Music use and exercise:

A mixed methods study of activity, autonomy and adherence

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Abstract

Regular exercise improves both physical and mental health but many people struggle to adhere to exercise programmes. Music is widely used by exercisers, and may aid adherence, but no evidence has yet substantiated this.

This thesis consists of four studies exploring exercise music's potential to assist adherence. In Study 1 (N = 282), online survey responses indicated that women were more likely to use exercise music and to synchronise movement to the beat than men, that running performance was superior among non-music users, and that music preference and personality are related. In Study 2, ten of the participants from Study 1 were interviewed, and interpretative phenomenological analysis revealed four main themes: *Taking control,* relating to managing the environment and internal challenges; *It's all about me*, concerning individualisation and sense of self; *Exercise music literacy*, involving the capacity to source and access desired exercise music; and *Embodiment,* connected with the interaction of body, music and hardware. Study 3 (*N* = 60) was a correlational study, exploring relationships between individual differences, gym media use and exercise frequency. Retrospective exercise data was collected from the gym's *Fitlinxx* computerised workout system, with participants supplying additional data for unrecorded exercise. Results indicated that men regularly listening to their own music exercised more frequently than those using other media. Study 4 (N = 99) was a longitudinal intervention study, comparing music and non-music pre-exercise interventions condition; the results indicated that listening to music prior to exercising to 'get in the mood' was associated with greater exercise frequency.

The thesis demonstrates a music-adherence relationship: use of music both during and before exercise was found to relate to frequency of exercise. This may relate to indications that certain kinds of music evoke an 'exercise mood.' Combined, these studies support the use of music to help facilitate exercise adherence, and extend knowledge of the who, why and how of music use in exercise.

[298 words]

Key words: music, exercise, adherence, motivation, mixed methods

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Chapter 1

Introduction

"Life seems to go on without effort when I am filled with music."

— George Eliot, The Mill on the Floss

1.1 Overview

It has been well documented that exercise can improve both physical and mental health. However, many people do not exercise enough, and struggle with motivation to begin and maintain regular exercise. Weinberg and Gould (2007) note that 50% of new exercisers stop regular exercise within six months, while in England, only 20.5% of men and 12.4% of women aged 16 and over exercise three or more times per week (Sport England, 2011).

Missed exercise sessions due to motivational challenges are also acknowledged by regular exercisers. On the website Fetch (www.fetcheveryone.com), where over 68,000 registered runners record and analyse training, communicate through blogs and forums, find races and maintain race portfolios, the acronym 'CBA' is regularly used. When typed into a blog or forum entry, it is automatically converted to a link, and clicking the link reveals a definition: "Can't Be Arsed. Often provided as a reason to skip a run."

Since there is an "impressive and convincing epidemiologic evidence" of exercise's benefits for physical health (Myers, 2008, p.314), and extensive support for its preventative and therapeutic effects on mental health (Donaghy, 2007; Stanton, Happell & Reaburn 2014), exercise adherence is desirable. Regular exercisers often use music during their exercise sessions, and it has been proposed that motivational music may help exercise adherence (Karageorghis, Terry & Lane, 1999). As yet, there is little evidence to support this. Karageorghis et al. proposed a conceptual framework for the study of music's motivational effects, including adherence as a possible outcome (1999: see Figure 1.1 and Section 1.3.2). They and their colleagues have since been prolific in researching music use to improve exercise and sport performance (see Section 1.3), but there are few references to adherence in their work; additionally, research has focused on lab-based studies, rather than looking at music use in exercise in everyday life. Indeed, while a number of researchers have looked at general (rather than exercise-related) iPod and MP3 use (Bull, 2005, 2007; Heye & Lamont, 2010; Skånland, 2013), published studies present few cases of participants using music autonomously in exercise. The literature has thus overlooked the autonomous individual exerciser. This presents two clear strands for investigation: firstly, how do everyday exercisers utilise music as a resource to enhance their workouts? Secondly, can music promote regular exercise and fewer missed sessions?

This thesis examines both these questions through four studies using different methods. In the first two studies, exercisers were asked about their music use in exercise in a survey, with data analysed quantitatively (Chapter 3), and a small sample of the survey respondents were interviewed in depth about their music use with the data analysed qualitatively (Chapter 4). Studies 3 and 4 investigated possible links between regular exercising and music use, firstly looking at music use during exercise with a correlational study (Chapter 5), and then comparing music with a non-musical pre-exercise intervention (Chapter 6).

In this chapter, I outline literature pertaining to the two main questions. Firstly, I consider music's broad potential to affect psychological wellbeing (Section 1.2), before looking at the existing research into music's application to exercise (Section 1.3) and theoretical models from music psychology that may offer useful ways to conceptualise exercise music use (Section 1.4).

From here, I move on to topics relating to health behaviours and adherence (Section 1.5). Finally, I summarise the questions raised (Section 1.6).

1.2 Music in everyday life

As outlined above, although there is a body of research on music use and listening in everyday life, little of this relates specifically to exercise. In this section, I consider the broader aspects of music use which might be particularly relevant in exercise contexts: music's power to motivate, its effect on emotion and mood, its influence on behaviour, and its relationship with individual differences such as personality traits.

1.2.1 Music as potential motivator

Research indicates music is used as a motivator in a range of everyday activities, including, but not limited to, exercise. Housework is an example: North, Hargreaves and Hargreaves (2004) noted that in 90% of episodes, participants in their experience sampling method study accompanied household chores with music. The most common reasons given were "I enjoyed it" (64.3%), "It helped to pass the time" (47.2%) and "Habit" (32.7%). Music was used in just under 21% of gym/exercising episodes (this excludes episodes when other-chosen music was playing): the most frequent reason was "It helped create the right atmosphere" (83.3%, although this equates to just five participants), with half (three participants) stating "It helped me to concentrate/think," "It helped to pass the time," "Habit," and "I enjoyed it." There are clear similarities between the stated reasons for listening during housework and listening during exercise.

Chamorro-Premuzic and Furnham speculated that "Extraverts…may use music to increase their arousal, especially during monotonous tasks such as cleaning, jogging and data-entry" (2007, p.177). Their findings suggested that those with high openness and intellectual engagement tended to use music more cognitively, while introverts and those with low emotional stability and low conscientiousness tended to manage their emotions using music. Their study looked at general everyday life, so it is not clear whether the findings would carry over to exercising contexts, but if so, then motivational music may need to reflect these differences.

Skånland (2013), in a qualitative study of MP3 player use in relation to affect, found firstly that participants felt more positively disposed towards less pleasant surroundings when they played music, and secondly that they used music to complement rather than change their mood. The study, again, was of general music use rather than in exercise contexts, so it is not clear whether the findings can be extrapolated. There may be scope, for example, to use music to make gyms feel less intimidating, but Skånland's results suggest music is used to reflect rather than generate mood, raising questions regarding its power to address low motivation.

Music is also associated with creating 'flow' states, and this may be beneficial in exercise contexts. The concept of flow, or 'optimal experience,' derives from work by Csikszentmihalyi (2002). He described various conditions that contribute to an individual's sense of flow, including being involved in a task requiring control, that can be completed, that relates to goals, that includes feedback and where concentration is possible. He noted that in flow states, an altered sense of time develops along with a temporary suspension of sense of self which subsequently emerges more strongly; the flow state involves "deep but effortless involvement" (p.49) with the activity. Csikszentmihalyi's discussions of music and movement include the suggestion that peak musical experiences require concentrated listening and analysis, while Gabrielsson (2010) described a more detached sense of absorption which overlaps with Csikszentmihalyi's description of flow: "The world around disappears: one dwells in one's own world, inaccessible to others. Time stands still…" (p. 558).

Csikszentmihalyi has recognised flow in physical activity, but focused on sport rather than exercise (2002). He suggested that the key components of flow experiences involve plentiful goals and subgoals, continually monitoring and challenging oneself, and measuring progress. Research into sport and flow has indicated that self-concept, use of psychological skills, challenge-skill balance, concentration, sense of control, clear goals and performance outcomes contributed to flow states (Jackson, Thomas, Marsh & Smethurst, 2001). Exercise can certainly include all these factors, but it is not clear whether flow is widely achievable outside a competitive context, nor whether music might have a role in this. Combining optimal stimulation level from music with enjoyment of bodily movement is likely to increase positive affect, and it is well-documented that endorphins produced in exercise also contribute (Noakes, 2001). It is not clear whether these factors alone are sufficient to overcome the struggles with motivation.

As will be discussed in Section 1.3, studies looking at music use in exercise have focused on performance outcomes rather than the broader possibilities of promoting adherence, improving affect and increasing exercise enjoyment. The studies above suggest that these additional outcomes may be achievable through the application of music.

1.2.2 Emotion and mood

The applications of music described in the previous section relate particularly to emotion and/or mood, and these terms need differentiating. Juslin and Sloboda (2010) defined emotion as:

> "a quite brief but intense affective reaction that usually involves a number of sub-components – subjective feeling, physiological arousal, expression, action tendency, and regulation – that are more or less 'synchronized.' Emotions focus on specific 'objects' and last minutes to a few hours (e.g. happiness, sadness)" (p.10).

There is some debate over what constitutes an emotion. Juslin and Sloboda contrasted mood and emotion, stating that mood lacks intentionality (i.e. is not focused on an object). This is consistent with the philosopher Robert Solomon's influential theory of emotion; his more recent work has acknowledged the relevance of physiological components of emotion (Solomon, 2007). For a study of music use in exercise, these elements may be particularly relevant because exertion raises heart rate, which is associated with emotional response. Griffiths' conceptualisation of emotions as 'affect-programs' (1990), involving multiple bodily changes including skeletal/muscular responses, expression, vocalisations and endocrine responses also aligns with Juslin and Sloboda's emotional sub-components in the definition above.

The response to music when exercising seems best conceptualised as a mood rather than an emotion: a mood does not need an intentional object if intrinsic qualities of the music – the sounds themselves – are affecting arousal level. Extrinsic associations, on the other hand, might incorporate intentionality; if a song is associated with a memory, this would be the emotion's object. The umbrella term of 'affect' might be more appropriate for mood, emotions and other similar psychological states, but intentionality may be a relevant concept for affect-related findings emerging in the studies here.

1.2.3 Music's effects on behaviour

The effects of music on behaviour have been widely studied, although exercise has rarely provided a specific focus. It is, nevertheless, important to consider whether some of the findings may apply in exercise contexts. Alternatively, there may be differences in behavioural response to music in exercise contexts, in which case questions would be raised as to why.

Research by North and Hargreaves and their colleagues indicates that music can influence behaviour in a variety of environments: playing classical music in a restaurant resulted in diners spending more money on their meal than when pop or no music was played (North, Shilcock & Hargreaves, 2003); playing French or German music in a wine aisle led to an increased purchase of French or German wine respectively (North, Hargreaves & McKendrick, 1999); and uplifting music played in the gym was found to lead to more altruistic behaviour when a favour was asked on exit than when music "selected to elicit an annoyed emotional state" was played (North, Tarrant & Hargreaves, 2004, p. 267): 'annoying' was not defined by the researchers in their paper, but a survey of participants' moods after listening confirmed their annoyed states.

The mechanisms behind the behaviours in these studies appear to be unconscious, yet vary according to context: for restaurants, either the music was preferred by customers, or classical music conferred an upmarket image on the venue, with preference or image perception somehow converted into a willingness to spend more money (North et al., 2003). Altruism, on the other hand, was assumed to arise through the music's influence on affect (North et al., 2004), while the French and German wine purchases seem to have been primed by association (North et al., 1999).

These examples demonstrate the interplay of different factors. Music's intrinsic features carry meaning for the listener through their understanding of musical styles and social contexts. Their response draws on this knowledge, possibly unconsciously. The examples demonstrate music's varied influences on behaviour, and those listed above may apply to exercise music. These findings indicate that in addition to music being perceived as 'fitting' a particular situation, behaviour is adjusted to 'fit' the combination of music and environment, and the environment is interpreted through its soundtrack. Music might be used to create an atmosphere perceived as appropriate for exercise, to influence affect in order to help an individual become more disposed towards exercising, or may have a particular association with exercising. This interplay of factors is examined in more detail in Section 1.4.

1.2.4 Individual differences in response to music

Various individual differences, including age and personality, may influence music response and its relationship with the exercise experience. In this section I consider individual differences pertaining to music response, returning to consider individual differences and adherence in Section 1.5.3.

Hargreaves and North (2010) noted inconsistent findings in research into the influence of sociodemographic factors such as social background and musical training, but that age is influential, with adolescent and early adulthood listening preferences influencing those in later life. They noted, however, that studies are rarely longitudinal, rather giving a ‘snapshot’ of different age cohorts simultaneously: older and younger participants, with very different lifetime experiences of music style and dissemination, are compared, rather than considering how responses might vary over an individual’s lifespan.

Rentfrow and Gosling (2003) investigated associations between personality and musical preference, identifying four ‘dimensions’ of music preference: Reflective and Complex, Intense and Rebellious, Upbeat and Conventional, and Energetic and Rhythmic. They found correlations between preferences and personality, with Openness particularly associated with liking Reflective and Complex music. Hargreaves and North (2010) noted an association between arousing music and ‘sensation seeking’ (which corresponds to Openness), observing that preferences tended to reflect personality (rather than compensate for it) by, for example, raising or lowering arousal levels. Extending this to situations where the exerciser can control their music, a desire to reflect rather than compensate for mood suggests that personality drives music choice more than a desire to manipulate mood.

Mood management, however, is described as the “most common motive for listening to music” (Juslin & Sloboda, 2010, p.3). This raises the question of whether exercisers choose music to reflect their personality and perhaps, through this, their sense of self while exercising, or to manage arousal levels, or whether both reasons apply. Similarly, when music is other-chosen, for example in exercise-to-music classes, it may be helping class members get ‘in the mood’ for exercise, or the pop and dance styles may be more appealing to extraverts (Rentfrow & Gosling, 2003), perhaps reflecting a preference for group rather than individual workouts. For the introvert, the class environment may hold less attraction because of the music being ‘extravert.’

Individual differences may be influencing a range of factors in exercise music, including response to the music itself, but also adherence behaviours, exercise intentions and the capacity to fulfil exercise plans. This is discussed in section 1.5.3.

1.3 Music in exercise

1.3.1 Sport, exercise and physical activity definitions

Before discussing exercise, it must be differentiated from the broad range of physical activity terminology. The literature has made a distinction between exercise and physical activity, based mainly on degree of structure and intention. Casperson, Powell and Christenson (1985) describe exercise as “planned, structured and repetitive bodily movement done to improve or maintain one or more components of physical fitness,” while physical activity is “any bodily movement produced by skeletal muscles that results in energy expenditure” (p.129). Exercise, therefore, is a form of physical activity. However, terminology regarding exercise and physical activity has been used inconsistently (Norton, Norton & Sadgrove, 2010). Norton et al. (2010) attempted to address this with definitions of five intensity levels, described in terms of (1) how long an activity can be sustained for and (2) the ability to talk during it; they still use the terms ‘exercise’ and ‘physical activity’ interchangeably in their paper.

Definitions of sport are few in the specialist literature. Weinberg and Gould’s undergraduate text on sport and exercise psychology (2007) discusses definitions, yet despite many references to ‘sport and exercise,’ assumes a pre-existing understanding of what the two terms include. At no point is this delineated, although they use the terms ‘athletes’ and ‘exercisers’ respectively to identify participants. There are implications of competency and competitiveness, yet differentiation is difficult: is the regular gym attendee who occasionally participates in organised running events, finishing at the back of the field, an athlete or an exerciser? Is the running event sport or exercise? The answer is unclear, demonstrating that the ‘common sense’ approach to terminology may still lead to anomalies.

‘Exercise’ may be used with qualifying terms: Spencer, Adams, Malone, Roy and Yost (2006) note that regular exercise “has been defined as 20 minutes or more of continuous physical activity performed at a vigorous pace 3 or more times a week” (p. 429). They observe that lifestyle physical activity – *ad hoc* physical activities such as walking up stairs rather than taking the lift, or playing with one’s children – has been added recently to expand the definition.

In this thesis, I use Casperson et al.’s (1985) definitions above, emphasising the planned, structured element of exercise. Professional sporting activities are not a focus of the research, although exercise may involve training for specific competitive sports for some participants, and competitive sport may be included in participants’ reports of their exercise activities.

1.3.2 Music in exercise: previous research

In this section, I discuss the exercise music literature, identifying some limitations, before discussing theories from music psychology that might be useful for conceptualising the mechanisms by which music response influences exercising behaviour. Research into music use in exercise has increased in recent years, stemming in part from the extensive work of Karageorghis and his colleagues. Karageorghis et al.’s (1999) model in Figure 1.1 was developed to conceptualise psychophysical responses to asynchronous music (music where the exerciser does not move in time with the beat) in submaximal exercise (exercising at an intensity below maximum capabilities).

The framework, which is speculative, suggests intrinsic factors (rhythmic response and musicality) and extrinsic factors (cultural impact and associations) contribute to motivation which leads to arousal control, a reduction in the rate of perceived exertion (RPE) and improved mood, and through these to adherence and use of music before exercise.

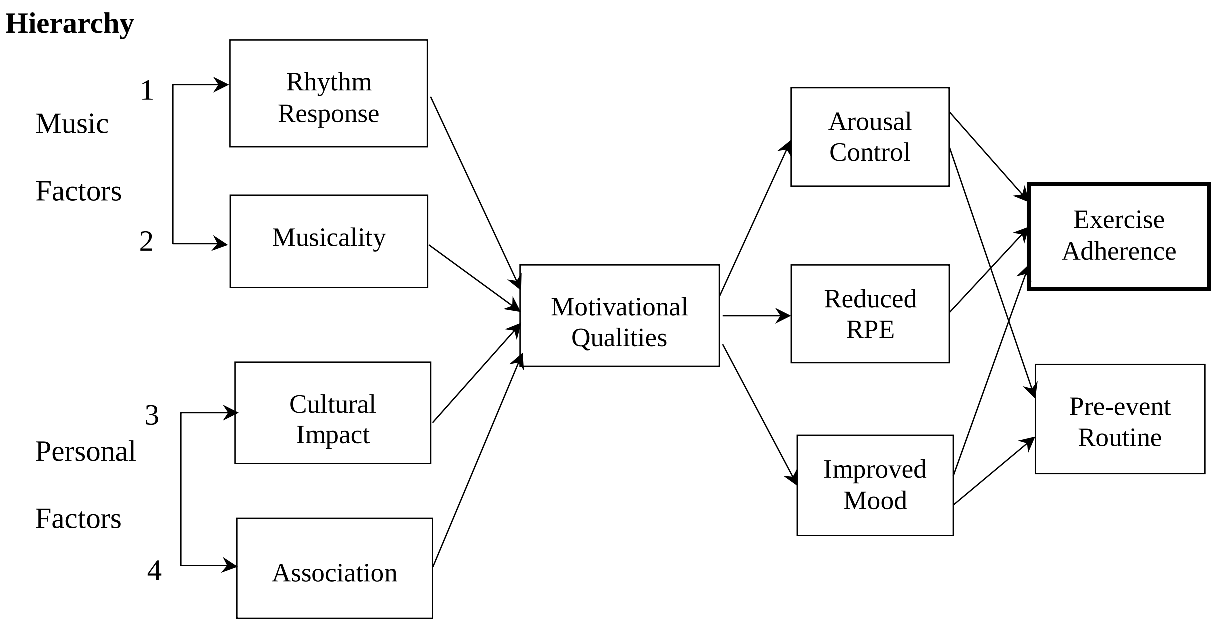

Figure 1.1: Revised conceptual framework for the prediction of responses to motivational asynchronous music in exercise and sport (Karageorghis, Terry & Lane, 1999, p. 721)

The four factors – Rhythm Response, Musicality, Cultural Impact and Association – on the left hand side of Figure 1.1 were derived by applying factor analysis to data collected from aerobics instructors regarding which musical parameters should be prioritised when selecting tracks for a class; participants for the confirmatory analysis were class attendees. The four factors are perhaps limiting. Musicality refers to melody and harmony, while rhythm response refers to “the rhythmical qualities of music which inspire bodily movement” (Karageorghis et al., 1999, p.717), cultural impact refers to cultural pervasiveness and association relates only to associations between the music and exercise. This excludes personal memories and associations, where certain pieces of music which ‘soundtrack’ memorable life events (for example, a particular song enjoyed with friends at university) and become permanently associated with them (Cady, Jackson Harris & Knappenberger, 2008).

The right-hand side of the framework presents three factors arising from motivational music which may influence exercise adherence. Arousal control and improved mood can be related to the broader concept of affect through Russell, Weiss and Mendelsohn's (1989) circumplex model, which measures affect through dimensions of arousal level and positive/negative valence: Russell et al. propose that stress is constituted by high arousal and negative valence, for example. Reduced RPE relates to an assertion that appropriate music can appear to reduce effort of exercise compared with no-music conditions, although support for this is mixed. Karageorghis and Priest's (2012) review of music, exercise and sport found a range of outcomes for music and lowering of RPE in the literature, suggesting the effect is not always consistent, although several studies found a clear relationship. Razon, Basevitch, Land, Thompson and Tenenbaum (2009), for example, found music reduced RPE for a grip strength task by providing a distraction, but increased workload decreased music's effect. This was consistent with other studies, where music had little effect on RPE in high intensity tasks; Karageorghis and Priest (2012) noted that most research on music and RPE has involved intense exercise activity. They criticised a number of the studies, most frequently for inappropriate, uncontrolled music choice and small sample size – weaknesses present in the Razon et al. study. Detail of the music is also lacking, other than an indication that participants listened to their preferred style from five broad genres.

Potteiger, Schroeder and Goff (2000) examined RPE, comparing self-selected music with 'fast upbeat music', classical music and no music, finding that all music conditions were comparable in a moderate intensity task. RPE was lower with music than without, although it is not clear whether participants were asked to choose exercise-appropriate tracks. The results are consistent with Dyrlund and Wininger's (2008) findings that RPE did not vary with most preferred and least preferred music, but may also reflect lack of cognitive demand from the music as a distractor. The limited effect of preference suggests music acts as a distractor whether negatively or positively regarded, but that its effect declines as activity intensity increases, resulting in higher perceived exertion.

Although Karageorghis et al. (1999) suggested that improved mood and reduced RPE may make exercise more enjoyable, leading to adherence, they did not explain arousal's role. If arousal, in combination with valence, is linked to affect (Russell et al., 1989), it becomes a constituent part of 'improved mood,' i.e. positive affect. Juslin and Sloboda's description of emotion involved "subjective feeling, physiological arousal, expression, action tendency, and regulation" (2010, p.10), implying elements of arousal control alongside a more nuanced range of elements, indicating a more complex response mechanism than Karageorghis et al.'s framework presents.

The suspense-resolution mechanism, fundamental to music's ability to elicit emotional responses (see Huron, 2006, for an extensive discussion), is utilised widely in popular music tracks. Priest and Karageorghis (2008), in findings from a qualitative study, mentioned how tension was built through musical devices leading participants to anticipate particularly motivating sections of music. These sections are termed segments, and can be defined in a number of ways. One participant described a motivating key change that defined a segment. In a subsequent paper, the authors suggested that the building of momentum in music, particularly through a "crescendo of drumming" (p.53), leads to a motivational effect (Karageorghis & Priest, 2012). There is no reference to segmentation or suspense-resolution mechanisms in the Karageorghis et al. (1999) model, and their description of segmentation presents a macrostructural element of the music, rather than referring to how a small phrase of the music can also create tensions.

In addition to the elements that appear to be missing from the framework in Figure 1.1, the model may be less relevant overall for those choosing music for solo exercise because the parameters were derived from data from aerobics instructors. In aerobics classes, tempo is critical for a class to execute sometimes complex choreographed steps, and broad appeal to attendees is a priority, rather than satisfying one individual's particular preferences.

Since Karageorghis et al.'s (1999) publication of their conceptual framework, there has been a substantial growth in research into exercise music, investigating many different variables. Aerobic activity such as treadmill use (Bharani, Sahu & Mathew, 2004; Edworthy & Waring, 2006; Karageorghis et al., 2009) has been examined alongside anaerobic activity such as sprinting (Simpson & Karageorghis, 2006), and music variables have included tempo (Karageorghis, Jones & Low, 2006; Waterhouse, Hudson & Edwards, 2010), volume and tempo in combination (Edworthy & Waring, 2006), motivational rating (Elliott, Carr & Savage, 2004) and style (Dyrlund & Wininger, 2008; Potteiger et al., 2000). However, the basis on which particular music tracks are chosen for research is often unclear, a point raised by Karageorghis and Terry (1997) in their review of the field.

Two of the studies mentioned above (Dyrlund & Wininger, 2008; Edworthy & Waring, 2006), provide examples where the basis for the specific tracks chosen by the researchers appears arbitrary and is not reported. Dyrlund and Wininger (2008) focused on style preference, looking at most preferred, least preferred and no music conditions out of classic rock, country, hip hop, rap, alternative and oldies, although they did not list the tracks used. Tempi were consistent, but other musical parameters such as melody, harmony and rhythm, all of which might influence outcomes, were not controlled for, and may not be style-specific. They found that in cases where participants paid attention to the music, it explained only 5% of the variance in exercise enjoyment, and RPE did not vary, and responses to least preferred music were not strongly negative. A condition with self-selected music would have provided an interesting comparison by including favourite tracks, and might better reflect common practices among those using devices such as iPods and MP3 players during exercise; however, control would not be enhanced.

Edworthy and Waring (2006), in contrast, looked at tempo and volume effects on treadmill speed, ratings of perceived exertion (RPE) and affect, finding tempo had an effect on speed, and moderated the effect of volume. As with Dyrlund and Wininger (2008), tracks were unspecified, although different tracks were used for the different tempi, which means the effect may have arisen through non-tempo-related music characteristics, such as harmony. No indications were given regarding whether the stimuli corresponded with participants' preferences.

Although there is a clear lack of control of variables in both studies, complete control of music stimuli is not viable for the variables under investigation because more than one parameter must change. Adjusting the tempo of a track also affects the rate of harmonic change, the rhythm, the possibility of synchronising moves, and the relationship with heart rate. Age may also have influenced results because of its relationship with fitness and music preference. Dyrlund and Wininger's participants were young adults (mean age = 20.69 years, *SD* = 4.41), while Edworthy and Waring's were aged between 18 and 63 (no mean was provided). Preferred music has a strong association with age (North, 2010) and ageing is also associated with appreciating a wider range of styles and with a deepening connection between music and personal meaning (Saarikallio, 2011). Younger participants' fitness levels may be higher than older participants (particularly if they are sports science undergraduates). This creates further difficulties in extrapolating results to other contexts.

Attempts to systematise music selection have led to the development of the Brunel Music Rating Inventory (BMRI: Karageorghis et al., 1999) and its more streamlined variant, the BMRI-2 (Karageorghis, Priest, Terry, Chatzisarantis & Lane, 2006), designed as tools for selecting motivational music for research and personal use. Karageorghis, Terry, Lane, Bishop and Priest (2011) describe exercisers' processes of selecting music as "intuitive rather than scientific" (2011, p.18) and suggest that the BMRI-2 (or a similar, unspecified rating system) should be used by exercise participants to select workout tracks. The 13-item BMRI is considered suited to professionals such as aerobics instructors for choosing music for classes (Karageorghis, Priest, et al., 2006), while the 6-item BMRI-2 is proposed for use by non-experts to evaluate motivational properties of music tracks, including the identification of appropriate tracks for use as stimuli (Karageorghis, Priest, et al., 2006).

Although the BMRI-2 formalises the music selection for empirical studies where researchers wish to select appropriate music tracks for their particular participant cohort, it presents several issues. Firstly, it reduces music to a few parameters for which non-experts can recognise the terms' meanings: melody, rhythm, tempo, style, instruments and beat. Harmony was excluded due to lack of understanding of the concept among participants during its development. This does not necessarily mean that non-experts fail to hear or respond cognitively to harmony, nor to the other parameters excluded from the BMRI-2 (particularly associations). Crust (2008), who used the original, more detailed BMRI to select motivational music for a study of endurance, argued that it may not correspond to factors such as liveliness which they found to be important influences in musical response. Additionally, all parameters are given equal weight, yet style may be almost superfluous because the other parameters contribute towards it, particularly for a style such as drum'n'bass, where distinctive rhythmic features are fundamental. Furthermore, the segmenting effect discussed previously, which creates motivating anticipation in the listener, is not assessed.

The 'real-world' relevance of studies with music selected using the BMRI-2 depends on whether exercisers are more motivated by their own choice of music, selected without using a scored inventory. Associated with the BMRI and BMRI-2 is the assumption that intuitive selection of music for exercise is inferior to using a reductionist rating system, but this is not substantiated. In everyday listening, DeNora (2000) has found that listeners are adept at selecting music to suit themselves and the occasion without assistance from 'experts':

> "Nearly everyone with whom we spoke, levels of musical training notwithstanding, exhibited considerable awareness about the music they 'needed' to hear in different situations and at different times…They drew upon elaborate repertoires of musical programming practice, and were sharply aware of how to mobilize music to arrive at, enhance and alter aspects of themselves and their self-concepts" (p.49).

At present, there is little literature on the process and consequences of self-selected music in exercise, nor any indication of whether these are similar to music selection and listening more generally. Greater understanding of music selection processes, usage and the role of music in exercise is needed, as well as knowledge regarding exercisers' goals and whether music is an aid to dissociation from exercise or a tool to help focus, and/or regularity of movement through synchronisation with an appropriate beats per minute (bpm).

De Nora's comments suggest that, rather than being intuitive in the sense of following 'gut instinct,' listeners can articulate the reasons behind their choices. This is supported by Greasley, Lamont and Sloboda (2013), who identified four main categories of preference rationale: music characteristics, responses (particularly cognitive and affective), use and personal identification with artists and styles. Their participants gave clear reasons for liking particular music, reflecting these categories, and these kinds of descriptions could provide much greater understanding of self-selection of exercise music.

Research studies using self-selected music stimuli in exercise are scarce, perhaps because of the difficulties in controlling conditions, yet if music is self-selected for a particular purpose, individual choices may generate more consistent responses than if all participants use identical musical stimuli. Among the few researchers who have utilised self-selected stimuli, Bharani et al. (2004) found it prolonged time to exhaustion in a treadmill task compared with a no-music control.

Other-selected music has produced inconsistent responses to motivational and oudeterous (neutral) music: Karageorghis et al. (2009) found participants listening to motivational music had greater endurance in a treadmill task than participants listening to oudeterous music, but Simpson and Karageorghis (2006) found no significant difference between motivational and oudeterous music in a 400m sprint protocol. The effect of music preference on physical activity outcomes may vary according to task, but may be limited if there is not a substantial difference in preference for one stimulus over another.

Self-selection may enable comparisons between disliked and favourite music, with an ecological validity based on forgetting to take a personal listening device to the gym and being subjected to disliked music played by the facility. There is certainly evidence of gym members sometimes disliking music played over gym public address systems (Hallett & Lamont, 2014; Priest & Karageorghis, 2008), and Priest and Karageorghis (2008) identified a risk of exercise sessions being cut short if music was disliked, but there is a lack of literature substantiating this or other effects.

The effect of liked and disliked music may relate to Herzberg's two-factor theory of motivation developed for workplace settings (1987). Herzberg argued that workers' needs can be categorised as relating either to satisfaction (motivators), or to dissatisfaction (hygiene factors). Desired music may be a motivator, achieving a sense of fulfilment in completing the workout and enriching the exercise experience, much as Herzberg notes that workers' psychological fulfilment is enhanced by work enrichment programmes. Disliked music, or absence of music for exercisers wanting to use it, may be hygiene factors causing dissatisfaction while exercising. Herzberg found that hygiene factors (rather than motivator presence) were associated with absenteeism, perhaps comparable to abandoning a workout.

Disliked music has, however, been associated with superior performance in a cognitive task compared with liked music (Perham and Sykora, 2012); the researchers suggested that this was because liked music was more likely to attract the attention of participants and distract them from the task. There is also evidence that positive emotions are associated with a broader scope of attention (Fredrickson & Branigan, 2005), which corresponds with reduced focus on a task. For exercise, where distraction may be sought from discomfort, or to alleviate boredom, it may be particularly important that accompanying music is liked.

Although self-selection allows the exerciser to choose the tracks that they believe will be most motivating for them, the examples above indicate that comparison of self- and other-selected music in exercise has not found a clear effect. This inconsistency extends to other contexts, such as driving. Cassidy and MacDonald (2009) found more favourable outcomes for self-selected music compared with silence, car sounds, and researcher-selected music (high and low intensities: all music conditions also included car sounds), in terms of enjoyment, efficiency and – in notable contrast to exercise contexts – lack of distraction. This contrasts with findings from Brodsky and Slor (2013), who proposed an optimal style of music to play while driving in a simulator. They found that driver-preferred music produced higher error rates, although it was enjoyed. Music structured to moderate arousal levels (no melody to sing to, no lyrics, and conservative use of instrumentation and harmony), resulted in fewer errors, although it was associated with significantly lower levels of positive affect and higher levels of negative affect. There seems highly unlikely that drivers would select less enjoyable music for their journey, and it is possible that enjoyment is prioritised over particular outcomes. These findings are consistent with Perham and Sykora's (2012) in their cognitive task, and may also apply to music chosen for exercise.

Music's role as a distractor in exercise differs from fine-motor/cognitive task contexts, since the emphasis is on physical outcomes and sensations of discomfort. It is possible that different cognitive arousal levels in exercise and tasks that are more cognitively demanding have a consequential effect for how music is attended to, and how optimum arousal levels are achieved. Brodsky and Slor's participants may have exceeded optimum arousal levels with self-selected music. For exercise, on the other hand, distraction may alleviate discomfort, therefore more arousing music may be sought.

Literature on pain perception and music supports this. Mitchell (2006) compared pain tolerance with self-selected music, relaxation music and white noise, finding that self-selected music facilitated significantly longer durations of pain tolerance than the other two conditions. Participants reported that self-selection provided them with a greater sense of control over their situation. This may be relevant because intense exercise can be perceived as painful or uncomfortable; Tenenbaum et al.'s study of intense exercise (2004) found that researcher-selected music had little quantitative effect on RPE or exertion sensations, but participants reported that they felt the music helped them tolerate the exercise, and believed music to be beneficial.

Finally, it should be noted that technology has an increasingly important role in self-selected exercise music. Since the advent of the Sony Walkman in the late 1970s, personal listening devices (PLDs)[1] have been used during exercise, from cassette and CD players, through minidisc players to MP3 players, including iPods (where the brand name is sometimes used as a generic term for digital music file players, much as 'Walkman' was applied as a generic term for cassette players). Literature in the social sciences includes references to the Walkman (Hosokawa, 1984), personal stereos (Bull, 2000), iPods (Bull 2005, 2007; Berry, 2006), and MP3 players (Heye & Lamont, 2010; Skånland, 2013; Sterne, 2006) reflecting a range of terminology. In some cases, a device's use reflects its particular specifications: participants in Bull's study (2000) discussed choosing which cassettes to take with them when they went out with their players, while MP3 and iPod users carry devices containing vast libraries of tracks.

It is clear that despite the growing body of research into the effects of music in exercise, much is still unknown regarding preferred strategies among individual exercisers for choosing it, making it difficult to extrapolate from studies of more general listening. The theoretical base used in the exercise-to-music literature would benefit from application of theories from music psychology. In the next section I move on to consider how these might be used.

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[1] 'Personal listening device,' abbreviated to PLD, is used in some papers looking at devices' effects on hearing (Peng, Tao & Huang, 2007), and this term will be used in this thesis. Fligor (2009, p.129) notes that PLDs are also referred to as personal music systems (PMS), although this overlooks the popularity of podcasts and audiobooks. Worthington, Siegel, Wilber et al. (2009) refer to 'mass-storage personal listening devices (PLDs),' although the suggestion of 'mass-storage' limits the description to MP3 players and similar devices. PLD is a useful term to cover all kinds of personal, portable sound-playing devices without having any particular association with one kind of player rather than another (personal stereo, for example, may be associated with cassette players as it was term used in the 1980s). More specific terminology will be used when applied by a research participant, or when an observation or finding is particular to a certain type of device (instant compilation and editing of playlists, for example, feasible on some MP3 players and iPods but not on portable CD or cassette players).

1.4 Theoretical frameworks from music psychology

Having considered music in everyday life, and examined existing music and exercise research, questioning some of its approaches, alternatives need to be explored. The rich and extensive literature in music psychology has largely been overlooked in the exercise music literature, which is largely generated by sports science departments. There is a considerable body of work to consider, so this section is by necessity highly selective, presenting key theoretical frameworks put forward by leading music psychologists that may be useful in studies of exercise music.

A useful starting point conceptualising responses to music is Hargreaves, MacDonald and Miell's reciprocal feedback model (2005), subsequently updated by Hargreaves (2012). These are combined in Figure 1.2.

The model presents three key areas – music, situations and contexts, and listener – and factors within each area that contribute towards physiological, cognitive and affective responses to music. It indicates extensive interaction between the areas and response: for example, interaction between music and situations and contexts leads to 'fit,' the perceived appropriateness of a particular kind of music to a situation. In exercise, fit might depend on type of activity (described as 'other ongoing activities' in the model) and whether exercise is carried out alone or in a group context (identified as 'presence/absence of others' in the model). Music factors might include style and familiarity. The listener is the third key area, and the model emphasises individual differences in preference, and their "constant evolution and change" (p.8).

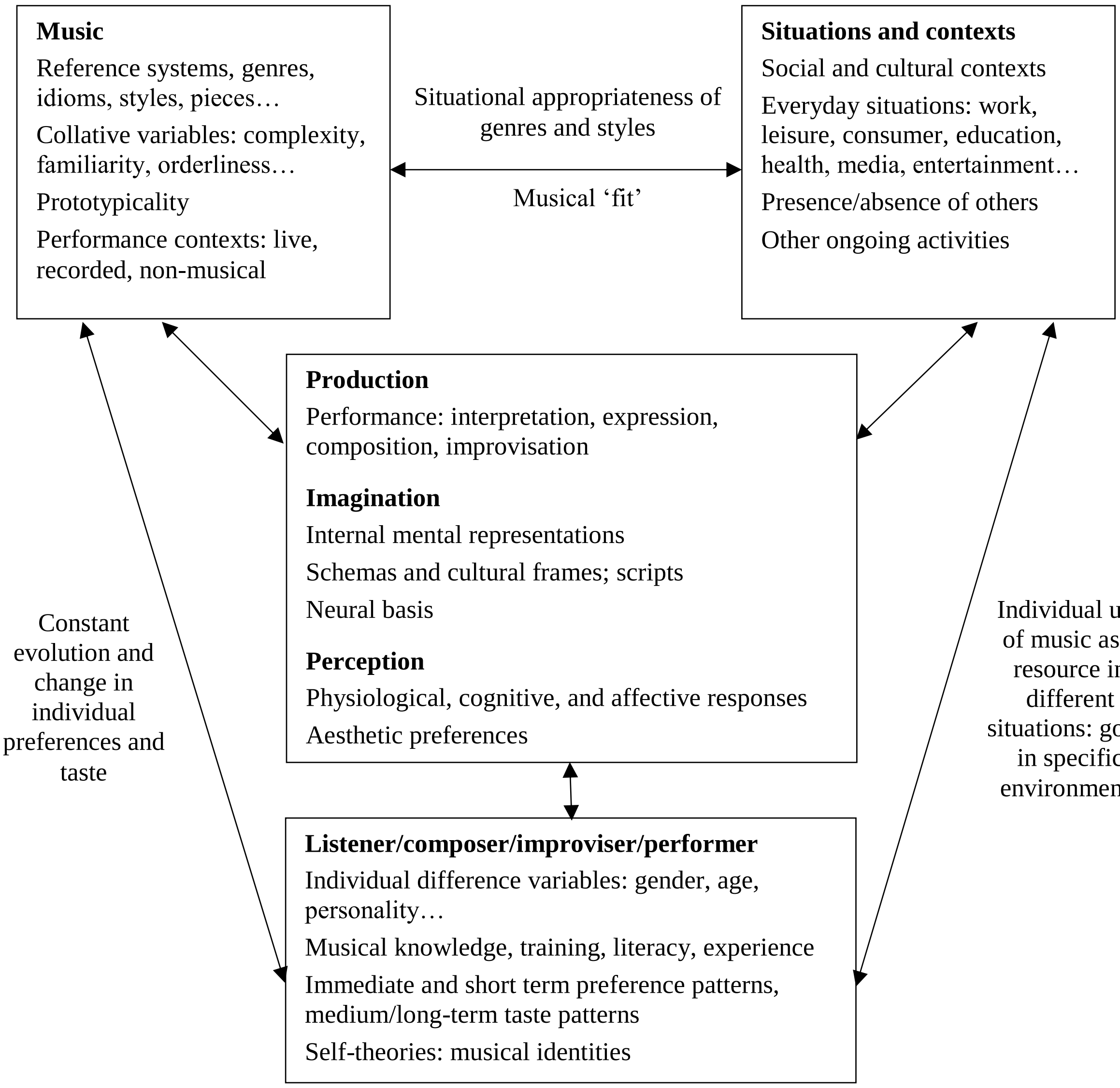


Figure 1.2: Reciprocal feedback model of musical response
(Hargreaves et al., 2005, p. 8; Hargreaves, 2012, p.554)

The reciprocal feedback model is useful because of its breadth, which invites exploration of its different elements, and connection with other theories. For example, the cognitive responses and neural basis which appear in the central section of the model correspond with Juslin's (2013) eight proposed mechanisms underpinning emotional response to music: brain stem reflex, rhythmic entrainment, evaluative conditioning, contagion, visual imagery, episodic memory, musical expectancy, and aesthetic judgement (abbreviated to the acronym BRECVEMA), each of which concerns a different evolutionary stage of development. Juslin's theory presents the mechanisms overlapping and interacting: for example, evaluative conditioning might be created by visual imagery triggering an episodic memory, resulting in positive or negative appraisal. The theory is speculative at present, therefore some caution must be exercised until there is more support for it through empirical evidence. Nevertheless, the concepts may be relevant to responses to music in the studies here.

To summarise BRECVEMA, brain stem reflex is a response to basic music attributes such as changes in tempo and volume, perhaps denoting a musical segment. Rhythmic entrainment concerns embodied response to rhythm, for example heart rate or movement matching bpm; Karageorghis, Jones, et al. (2006) suggest 120bpm to 140bpm as ideal for exercise, noting typical heart rates during moderate to intense activity levels show a similar range. Evaluative conditioning relates to a conditioned association between a piece of music and, for example, a particular event or autobiographical memory, or sporting activities (such as themes from the films 'Rocky' and 'Chariots of Fire'). Contagion refers to an emotional response arising through 'internal mimicry' linked to voice-like elements of music. Visual imagery concerns more abstract, emotional images, while episodic memory relates to more specific personal associations for the listener. Musical expectancy is a response to structural 'clues' regarding the music's direction, based on listener experience, and relates to the tension-resolution mechanisms discussed in Section 1.3.2. Finally, aesthetic judgment refers to the individual's assessment of a piece of music against their own criteria. These may be a useful extension to the reciprocal feedback model through their expansion of the model's domains of imagination and perception.

The reciprocal model is useful in considering how physiological, cognitive and affective responses to music might interact to create associations and mould preferences, but the focus is on interpretative response rather than consequential behaviour. However, adherence is a behaviour, as is enhanced physical performance when listening to music during exercise. The framework recognises physiological arousal, but not the behavioural application of this response. Indeed, the centre of the model would benefit from the addition of Behaviour as a fourth category. Further support for this comes from music therapy, where music listening has a role in producing behavioural change, moderated by change in affect (Thaut & Wheeler, 2010). Hanser (2010) describes the scope of iPods to create therapeutic playlists to invoke particular moods or states, and briefly mentions their application in exercise. If music is to help support exercise adherence, such extensions to the framework are needed.

Affective response in the reciprocal model appears to relate to Juslin’s three-part framework (2009) of musical (intrinsic) factors, individual factors (the listener’s personal background) and situational factors (the context in which the music is heard). Like Huron (2006), Juslin identifies suspense mechanisms within music as a way of triggering emotional response, particularly through violation of expectation. This may be applicable in generating positive affect during exercise.

Musical factors are central to the BMRI-2 (see section 1.3), and Juslin’s framework indicates the inadequacy of this focus because of the importance of individual factors and situational factors in emotional response to music. This might imply that emotional response is influencing individuals’ choice of exercise music, but although there is evidence for this in everyday listening, it is not clear whether exercise music choice is emotion-based, or relates to inducing a physiological response, or positive affect, or mood (rather than an emotion). In Greasley and Lamont’s (2009) study of engagement with music in everyday life, one participant reported listening to rock and metal while using a home exercise machine “to create a mood, to change an existing mood and for enjoyment…and had chosen the music to motivate her and get her adrenaline pumping” (pp.170-171). This indicates a complex process of music selected to serve multiple purposes.

Juslin’s (2009) individual factors concern individual differences such as personality, discussed in section 1.5.3. Socio-cultural background also influences music preference, acknowledged by Karageorghis, Priest, et al. (2006) who stated that, for music to motivate in the context of group exercise, “The music idiom, date of release and artist of the music in question must be allied to the age and sociocultural background of the exercise participants” (p. 907). However, Priest and Karageorghis (2008) found inconsistencies, including a participant who liked rap for exercising despite his lack of socio-cultural connection with the style.

Context may affect whether music choice is consistent with other everyday circumstances, or is more specifically tailored. Dibben and Williamson (2007), found that music listened to in the car was chosen in other contexts, but in Hallett and Lamont’s qualitative study of gym members’ use of music (2014), several participants reported listening to different music in the gym than in other everyday settings. This may indicate exercise contexts leading to differentiated music selection compared with other situations.

Juslin uses the term ‘situational factors’ to refer to, for example, occasion, acoustics and the presence of other people when listening to music. Pre-training music may be important to exercisers, as well as that played during training. Elite athletes may listen to music pre-competition, perhaps most famously the swimmer Michael Phelps, who reported that “It really just helps me sort of get in the zone and get focused” (Chappell, 2012, para.10). Bishop, Karageorghis and Loizou (2007) studied young tennis players’ pre-competition listening, finding that memories, associations and socio-cultural factors were more important in music selection than the intrinsic features of the music, and reported benefits included managing arousal levels and mood, and assisting pre-competition imagery (a visualisation technique practised in sport psychology: Weinberg & Gould, 2007). Competition outcomes were not described, but in a subsequent study (Bishop, Karageorghis & Kinrade, 2009), intensity of pre-activity music was found to relate positively to faster choice reaction times among tennis players.

There may be links with the ‘Mozart effect,’ an improvement in spatial task performance after listening to Mozart, identified by Rauscher, Shaw and Ky (1993); Rauscher (2009) attributes the results to “arousal or mood” (p.245) generated by pre-task listening rather than any particular qualities in Mozart’s music. Despite controversy over difficulties replicating the research (Chabris, 1999; Steele et al., 1999), Forde Thompson, Schellenberg and Husain (2001) found listening pre-task to a lively Mozart piece improved spatial task performance compared with silence, while a slow, sad Albinoni piece did not, suggesting that arousal and mood may assist performance.

There is, therefore, evidence that pre-task music can help control arousal and improve mood, leading to superior in-task performance. Motivation to adhere to an exercise plan is a quite different variable, although arousal and mood may be relevant. It would be desirable, therefore, to explore whether adherence to exercise can be improved by pre-exercise music listening.

The reciprocal feedback model includes, under 'Perception,' affective responses, and also refers to situations and contexts. These might be expanded using Sloboda's (2010) framework of ten themes relating to music listening, where everyday contexts are contrasted with non-everyday listening where attention is more focused (for example, at concerts): Table 1.1 summarises the themes, while the paragraphs following the table explore each theme, examining how exercise music might relate to them.

Table 1.1: Summary of emotions in hearing music (Sloboda, 2010, p.510)

Theme	Topic	Everyday	Non-everyday
Quality	1. Intensity	Low	High
	2. Memorability	Low	High
	3. Integration	Low	High
Content	4. Valence	Higher negativity	Lower negativity
	5. Reference	Self	Other
	6. Focus	External to music	Internal to music
	7. Level	Basic	Complex
Context	8. Elicitation	Mainly self-report	Broad range of methods
	9. Referent	Listener	Producer
	10. Attitude	Goal achievement	Aesthetic

Sloboda uses the term ‘quality factors’ for general aspects of emotions when listening, relating to musical characteristics, rather than involving value judgements. ‘Content’ is used to refer to emotions as the individual experiences them, and ‘context’ is the situation in which the music is experienced.

The first theme relates to intensity; Sloboda suggests that everyday experiences of music are associated with small emotional shifts, while the second theme is that these are generally not memorable. It is not clear whether either is the case with exercise, or whether exercise music has a greater effect than typical everyday listening. The third theme considers music experienced throughout the day, suggesting that it is fragmented, but also acknowledges that music may be ‘made’ non-everyday in the home by, for example, a film soundtrack experienced with dimmed lights and focused attention, as if in a cinema. Again, exercise music’s categorisation may depend on whether it is a background or a focus, and whether tracks are specifically selected for an activity or shuffled (played randomly by a device).

The fourth theme concerns levels of negative emotion created by unwanted or disliked music. If the individual can choose their music, negative emotions are unusual unless (as noted by Sloboda, 2010) music is chosen to complement a sad mood. In exercise contexts, music choice tends to be upbeat, promoting positive affect (Hallett & Lamont, 2014). The fifth theme concerns background knowledge, identifying this as less common in everyday than in non-everyday situations, where a programme note at a concert provides background information. This seems, again, to relate to other-chosen music, and may be relevant to gym background music or the music in an aerobics class, but perhaps less so to self-chosen exercise tracks. The sixth theme concerns the context of listening, describing emotional response to music in everyday situations as being driven by the accompanying activity. Exercise is one example, and perhaps particularly complex because of the influence of associated neurotransmitters, which can add to positive affect (Anderson, 2013). The seventh theme suggests emotions when listening to music in everyday contexts are basic, with complex emotions derived through non-musical associations, although this is presented as a characteristic of short extracts, such as advertising jingles, so may be less applicable to exercise.

The eighth theme concerns the methods that can be used to elicit data in either everyday or non-everyday situations, such as self-report (see section 2.5.3). The ninth theme arises through a focus on the listener rather than how the music 'should be' engaged with, and concerns difficulties for the researcher in eliciting self-reference to emotion rather than judgement of content. The tenth and final theme relates to the function of the music at the point it is listened to; Sloboda notes that with housework, this may be to finish the chore rather than generate an emotion while cleaning, and this is a question to address in the context of exercise: is enhanced performance or enhanced emotional state the main aim when choosing exercise music?

The framework may be limited by its dichotomising of everyday and non-everyday listening. Exercise music is neither one nor the other: frequent use and possible background function suggest the everyday category, while the potential to integrate activity and music to achieve a peak experience suggests non-everyday characteristics. These might vary between exercisers and between workouts, indicating a fluidity to the categorisation. Although the dichotomy seems an oversimplification, there may be some application to different kinds of exercise music use.

Sloboda's framework overlooks complexity in music qualities, and this needs considering. Berlyne (1971) catalogued several experiments examining preferences for different aesthetic stimuli, including visual patterns and musical passages, finding that although complex material was preferred to simple material, moderately complex stimuli were preferred to highly complex stimuli. He suggested that exercising both body and brain is enjoyable because it is necessary to maintain function; using music in exercise raises the question of balance between cognitive and physiological responses, again relating back to the reciprocal feedback model. Overall, there is an argument for taking the reciprocal feedback model as a framework which can be expanded through other models and theories, which add detail and provide a context for discussion of the findings that emerge in the studies in this thesis.

In addition to perception, the reciprocal feedback model emphasises the role of the listener's musical knowledge and training, short term preference and longer term taste, and musical identities. Together, these characteristics enable the individual to understand the musical environment and articulate their position within it, suggesting a social element to the process of music response, and emphasising the role of context. This leads to an important distinction between exercise contexts and the music played in them: while music in an exercise class or gym environment is other-selected, with the aim of broad appeal, individuals have scope to create highly tailored exercise playlists to use through PLDs. Bull (2005) notes increasing privatisation of music listening, and that the solitude of a music 'bubble' is empowering in an environment where social connection is avoided, for example when commuting. Exercising in a busy gym is perhaps comparable to being in a crowded station, although exercising alone outside with music is less likely to reflect the need for a bubble, while an exercise class requires engagement with the surroundings; situations clearly vary.

Musical 'fit' is a particularly relevant aspect of the reciprocal feedback model (see also Section 1.2.3), occurring when certain music is seen as appropriate for certain situations. Responses to music can vary according to perceived fit: North, Hargreaves and McKendrick (1999) found that when call centre hold music was of the expected kind of music for the situation, participants were willing to wait on the phone for longer. Lively, dance-oriented pop might be seen as particularly appropriate for exercise classes because it lends itself to aerobic-style choreography due to its 'danceability.' The typical bpm used in an aerobics class are typically towards the high end of the 120bpm to 140bpm considered ideal for exercise (Karageorghis, Priest, et al., 2006). It is not clear whether dance music is selected for other activities because it is perceived as having intrinsic musical features suited to exercising, or because it might correspond with heart rate (although this is highly varied between individuals and also dependent on intensity), or because it is expected and therefore perceived to 'fit.'

DeNora (2000), discussing music use in communal spaces, notably retail environments, describes it as "the aesthetic configuration of space… [which] … provides information; it offers cues about types and styles of acts" (p.130). A similar process may be taking place in communal exercise spaces, with music presented as 'fitting' then selected by exercisers for their individual workouts.

Finally, the reciprocal feedback model may need to acknowledge the importance of technology in accessing music. This relates both to the devices used to play music during exercise, and the methods used to find appropriate music and be able to transfer or stream music using such equipment. Recent developments in technology are of particular interest in understanding how exercisers use music because of the versatility of PLDs and the many options available for music consumption. There have been rapid changes in the way music is disseminated and accessed, and music practices have changed to incorporate developments; today's exercise music use is likely to reflect this.

The theories here offer several frameworks within which to consider exercise music. They draw attention to the variety of circumstances relating to music perception, and recognise the interplay of different factors. In the next section, I consider how perception might affect behaviour, looking at a range of research and exploring whether it might be applicable to exercise contexts.

1.5 Exercise behaviour and adherence

In the previous sections, I focused on music, its effects and its use in both general and exercise contexts. I noted the lack of knowledge regarding autonomous music use, and this is addressed in the first two studies in this thesis (see Chapters 3 and 4) where the aim was to increase understanding in this area. I now look at research and theories relating to health behaviours and adherences, which are particularly relevant to the second two studies (see Chapters 5 and 6) where relationships between music use and exercise behaviour are explored.

1.5.1 Conceptualising adherence in health behaviours

Health behaviours can be defined as "behaviours that are related to the health status of the individual" (Ogden, 2000, p.13), and can be compromising to health (such as smoking) or beneficial to health (such as smoking cessation). The term 'adherence' has largely superseded 'compliance,' used to denote the extent to which professional medical advice was followed; 'adherence' reflects a more active patient role, with their health beliefs and attitudes taken account of (Ogden, 2000), although the terms have often been used interchangeably (Brannon & Feist, 2000).

What constitutes adherence?

Adherence in health behaviour is defined by the World Health Organisation (2003, p.3) as "the extent to which a person's behaviour – taking medication, following a diet, and/or executing lifestyle changes, corresponds with agreed recommendations from a health care provider." The WHO notes historical application of the term to refer to medication regimes, extending this to a broader range of situations in the document *Adherence to long-term therapies*, including addressing "insufficient levels of physical activity" (2003, p.3). Central to this definition is the measurement of adherence levels against a benchmark of professional recommendation. Professional advice is also fundamental to Conraads et al.'s (2012) exercise-based definition: "exercise adherence is the extent to which a patient acts in accordance with the advised interval, exercise dose and exercise dosing regimen" (p. 452). This is useful as it extends the WHO's conceptualisation above to include measurements of adherence.

Conraads et al.'s (2012) paper was a position statement of the European Society of Cardiology on adherence to exercise during cardiac rehabilitation, so is written from a medical perspective, although the abstract states it is aimed at health professionals across the field, including psychologists. The authors suggest measuring adherence against an advised regime using three levels: those who adhere at least 80% of the time, those who adhere less than 20% of the time and those who fall in the 20% to 80% range, perhaps also cutting exercise sessions short or missing out certain exercises from their programme. This presents two important components of adherence: recommended quantities of exercise, and a recognition that adherence need not involve complete compliance with every prescribed session's content and duration.

Other research has used slightly different categories of exercise adherence. Edmunds, Ntoumanis and Duda (2007), for example, measured five levels in a study looking at a four-week exercise program: attrition at 1, 2 or 3 weeks, completion of 4 weeks while not adhering strictly to the programme, and completion of 4 weeks maintaining complete adherence. There is some overlap between these categories and Conraads et al.'s, although Edmunds et al.'s are perhaps less subjective, and specific to a four-week plan. Nevertheless, lack of standardisation presents difficulties when comparing study results. Notably, both papers assume professionally-prescribed exercise sessions; it is not clear whether exercisers who make their own exercise plans have similar targets.

The current official guidelines for exercise are based on WHO (2011) advice: NHS recommendations at the time of writing (2014) for 18-64 year olds are 150 minutes of moderate activity (e.g. cycling/fast walking) or 75 minutes of vigorous activity (e.g. singles tennis, running), or a combination of both, coupled with strength training of all major muscle groups at least 2 days a week. Sessions should be at least 10 minutes (NHS, 2011). In everyday life, decisions to exercise regularly may be independent, without advice on frequency or duration, rather than with professional guidance. As a result, measurement against official guidelines may not correspond to the individual's perceptions of their success (or not) in adhering.

Although the Health Survey for England (Health and Social Care Information Centre, 2011) refers to 2008 data showing that 39% of men and 29% of women reported levels of exercise that met guidelines, it is not clear how many respondents were unaware of recommended levels, or aware but unable to meet them. Knox, Esliger, Biddle and Sherar (2013) found that in 2011, only 18% of 2332 participants were aware of UK durational guidelines, with 12% aware of both duration and intensity guidelines. This does not necessarily mean that self-prescription results in low levels of exercise: a US study (Bennett, Wolin, Puleo, Mâsse & Atienza, 2009) found that many exercisers believed that guidelines recommended longer exercise durations than was actually the case. However, this presents questions over what constitutes adherence in self-prescribed exercise. Further difficulties arise when comparing older studies; Spencer et al. (2006) note a historical definition of exercise as vigorous physical activity carried out for at least 20 minutes, at least 3 times a week. Some exercisers may be subscribing to this definition, in addition to those self-prescribing exercise with goals fitting neither definition.

Guidelines for duration assume sessions of moderate or vigorous activity at a constant level, and a 35 year follow-up study of middle-aged men found the amount of physical activity had a proportionate effect on mortality rate (Byberg et al., 2009). However, there may be exceptions. Research into high intensity interval training (HIIT), where very intense activity for 10 to 20 seconds is alternated with brief rests in a session lasting 10 to 12 minutes, has shown physiological fitness benefits with under 30 minutes of exercise per week (Gibala, Little, MacDonald & Hawley, 2012; Metcalfe, Babraj, Fawkner & Vollaard, 2012; Dunham & Harms, 2012). Fogelholm's (2010) systematic review of studies of physical activity, fatness and fitness concluded that aerobic fitness, rather than activity level, was key to reducing health risks, emphasising outcomes ahead of behaviour. More research is needed into whether the lower time demands of HIIT lead to greater adherence than longer exercise sessions (Keteyian, 2012).

Percentage adherence could still be applied to HIIT programmes, as well as to self-made exercise plans. Rhodes, Courneya and their colleagues have looked at participants' exercise intentions and their relationship with adherence (Rhodes, Courneya, Blanchard & Plotnikoff, 2007; Rhodes, Courneya & Jones, 2004; Rhodes & Courneya, 2003). This presents evidence of how individual behaviours relate to intentions, with individuals able to set goals that they feel are realistic and achievable, hence potentially enhancing self-efficacy and consequently motivation (this is covered in more detail in section 1.5.2).

Identifying non-adherence

Beyond recommendations and self-prescriptions, and percentage of adherence to either, a third component of adherence needs to be taken into account. A period of no exercise must, at some point, constitute non-adherence, yet quantifying its duration presents a further challenge. If exercise programme adherence maintains or increases fitness, then non-adherence should relate to the point at which a noticeable level of fitness is lost in the process of detraining (Mujika & Padilla, 2000). Rate of detraining depends on the variable being measured, and research findings are inconsistent. Barboza, Rocha, Caperuto, Irigoyen and Rodrigues (2012), in a literature review of exercise training and detraining, suggest inconsistencies may also arise through variation in benchmark fitness levels of participants and their usual activity. Even where the same measurement is used, findings are inconsistent: glucose tolerance declined in 7-10 days in a study of highly trained athletes (Arciero, Smith & Calles-Escandon, 1998) but not after 2 months in young dancers (Chen et al., 2006). Mujika and Padilla (2001) compare a number of studies and conclude that a complete detraining effect, where all gains made from training are lost, takes 4 weeks. They suggest that "recently acquired endurance performance gains…can be readily maintained for at least 2 wk without training" (p.419), but beyond this, there is a lack of research looking at short-term detraining.

Periods without exercise do not necessarily indicate non-adherence. The marathon runner, having completed their race, may fail to meet standard recommendations for exercise the following week because of resting to aid recovery. The occasional week of little exercise due to a holiday, or a Christmas gym closure, should not be regarded as non-adherence. In Study 3, lapse data uses the threshold of 8 days of no exercise, which allows for a short lack of availability (e.g. holiday closures, time holidaying or working away from home) but recognises that bodily changes may begin a reversal of fitness gains after as little as a week.

To summarise, adherence measurement should include: target exercise frequency and duration (whether set by the exerciser or a professional); proportion of the target which is achieved; and the point at which exercise cessation is deemed to constitute non-adherence, with a need to recognise exceptional circumstances such as injury or brief, temporary changes in circumstances. As yet, it is not clear how these components occur in self-directed exercise programmes.

1.5.2 Models of health behaviour

There is a substantial body of research into health behaviour that has developed and applied various models and theories to try to explain how motivations lead to intentions and actions. In this section, I explore some of these and consider their possible relevance to a study of exercise music use.

Although regular exercise is recognised as a health behaviour because it provides various psychological and physiological health benefits, individuals' motives to exercise are not always health-related. Ingledew, Markland and Medley (1998) found that the most common motive to take up exercise was to improve appearance through weight-loss. Avoiding ill health had little influence on behaviour, and exercise was maintained primarily because it was enjoyed; pressure to be healthy reduced enjoyment and may be counterproductive. Despite many individuals taking up exercise to lose weight, research into the 'fat but fit' (individuals who are overweight or obese but have high levels of cardiovascular fitness from regular exercise) suggested that weight loss has little impact on the health outcomes of all but the morbidly obese (Campos, Saguy, Ernsberger, Oliver & Gaesser, 2006). The ‘health’ of health behaviour should therefore be taken to refer to the outcome of the behaviour rather than the individual’s reasons for carrying it out. For exercise, the health benefit of exercise relates to variables such as blood pressure and lung capacity rather than weight loss, unless the exerciser is at the extreme end of the obesity scale.

A number of theoretical models already exist for health behaviours. Armitage and Conner (2000) identify three types: motivational models; behaviour enaction models; and multi-stage models, and these categories provide a useful framework to consider the different approaches.

Motivational models

Motivational models focus on intention, positioning the corresponding behaviour as the usual outcome. Ajzen and Fishbein’s theories of reasoned action (TRA: Fishbein and Ajzen, 1975) and planned behaviour (TPB: Ajzen, 1991) are particularly widely-used in health behaviour studies. The TRA was important in presenting intention as dependent on moderating factors and is outlined in Figure 1.3. Central to the TRA is the suggestion that the beliefs and attitudes of an individual (described in the framework as beliefs about consequences, and attitude) and their associates (normative beliefs and subjective norms) regarding a behaviour contribute to the level of intention to perform the behaviour.

Another important factor in the TRA, shown in Figure 1.3, is the feedback loop indicating that the behaviour itself may affect future intentions and behaviours because of its impact on beliefs and attitudes. This is highly relevant to adherence; if outcomes of exercise, for example, are not as positive as expected, beliefs regarding its efficacy may be affected, leading to changes in intention and behaviour.

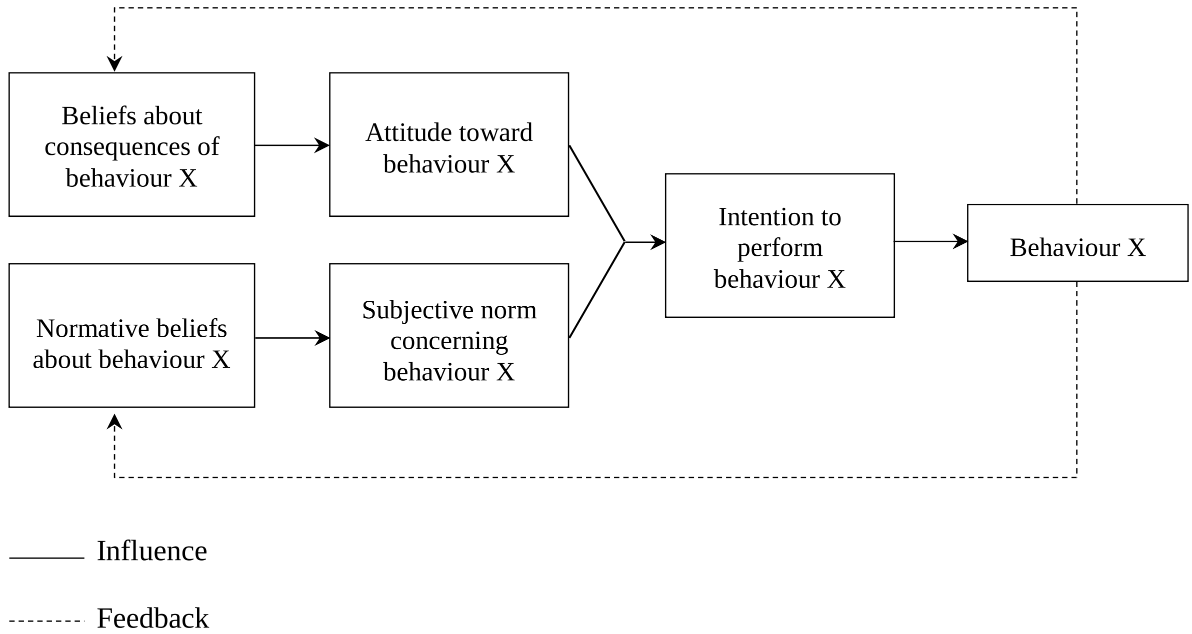


Figure 1.3: Schematic presentation of conceptual framework for the prediction of specific intentions and behaviours (TRA: Fishbein and Ajzen, 1975, p.16)

The model was subsequently developed into a methodology for practical application in research (Ajzen and Fishbein, 1980), but the feedback loop was not incorporated, nor into the subsequent TPB (Ajzen, 1991). The TPB (see Figure 1.4) introduces perceived behavioural control (PBC), which relates to barriers to health behaviours and the individual's perceived capacity to overcome them, recognising the influence of practicalities on intentions.

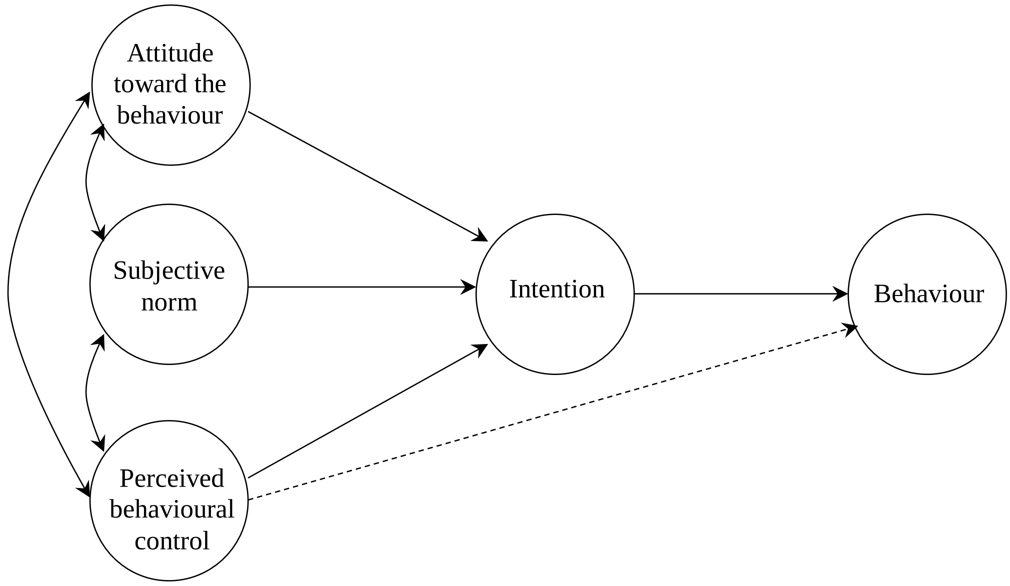


Figure 1.4: Theory of planned behaviour (Ajzen, 1991, p.182)

Despite the feedback loop's exclusion from the theory, previous experience with exercise may be an element of PBC, and research has incorporated measures; Norman and Smith's (1995) study which used the PBC to predict exercise found that previous exercise was the most significant factor in exercise behaviour. They applied the framework following principles in Ajzen and Fishbein (1980), firstly developing a questionnaire by asking a sample about their exercise beliefs, then administering it to a larger sample in the second part of the study. This demonstrates the flexibility of the approach to look at specific behaviours. Using the framework to develop questionnaires for data collection has identified pertinent factors in exercise research, as seen in Norman and Smith's study (1995). More recently, Miller and Miller (2010) applied the TPB in a study of attitudes to health clubs.

Despite their popularity among researchers, some health psychologists have argued that the TRA and TPB have serious limitations, largely relating to the a 'gap' identified between intention and behaviour (Godin, Conner & Sheeran, 2005; Ogden, 2000; Sniehotta, Scholz & Schwarzer, 2005; Sutton, 1998), meaning that although individuals may intend to carry out a behaviour, attempts to do so often fail. There is disagreement over what levels of intention conversion should be considered high or low. Ajzen and Fishbein initially stated that "barring unforeseen events, a person will usually act in accordance with his or her intention" (1980, p.5). By 2005, various meta-analyses of conversion of intention to behaviour led Ajzen and Fishbein (2005) to present figures of between 44% and 62% across a variety of health behaviours, arguing that this was a high rate of conversion. Sniehotta (2013) on the other hand, presented similar figures (an average of 50% in the short term) and stated that these were inadequate to support the TPB. These limitations have led to calls for its retirement (Ogden, 2014; Sniehotta, 2013).

In the long term, the 50% figure typically falls to 10 to 20% (Sniehotta, 2013), supporting Sniehotta's assessment. These longer-term figures are particularly relevant to exercise adherence, and the 'gap' is fundamental to the commercial gym business model, reliant on income from members who rarely use the facility but presumably, having taken out the membership, intended to do so.

Research suggests that attitudes to exercise, which the TPB suggests should influence intention, have little effect. Downs and Hausenblas (2005) carried out a meta-analysis of exercise studies using both the TRA and TPB, and found that attitude accounted for 21% of behaviour, substantially less than the 50% discussed above. Their findings supported previous studies by Hagger, Chatzisarantis and Biddle (2002), and Karoly (1998), which found that application of the models overemphasised social norms, which had little bearing on outcomes. Indeed, Karoly (1998) suggests that social goals can undermine efforts to exercise because of requirements to socialise in non-exercise settings or to work overtime for status and recognition. This indicates the complexity of influences on behaviour when there is conflict between various attitudes, intentions and everyday demands on the individual.

Although the TRA and TPB seem to offer little to the current study because of the weaknesses described above, the feedback loop identified in the initial version of the TRA may be relevant. The arguments regarding the conversion of intention to behaviour also indicate that this may be important in exercise contexts, where missing a workout is common even for those who exercise regularly. However, different models are needed to address this, and the next section on behaviour enaction models considers possible approaches.

Behaviour enaction models

Behaviour enaction models focus on strategies to bridge the intention-behaviour gap, addressing the weaknesses of motivational models. Their main concern, rather than factors contributing to motivation, is the action required to convert motivation into intended behaviour. Their theoretical approach, therefore, extends motivational models.

A widely used intervention applies Gollwitzer's (1993) implementation intentions theory. Implementation intentions interventions use formalised plans, where participants write down strategies using an "if…, then…" sentence structure. Results have been mixed: Arbour and Martin Ginis (2009) found that they were effective for six weeks of a walking intervention for sedentary women, but that behaviour subsequently decreased, possibly because of the onset of winter weather. Gollwitzer and Sheeran's (2006) meta-analysis found that across 94 studies, implementation intentions had a medium positive effect on goal attainment for health behaviours (d = .54, where .5 is a medium effect, .8 a large effect and .2 a small effect). However, there were very different outcomes for four studies looking at exercise and physical activity, ranging from d = .18 (unpublished study) to d = 1.25 for a study by Milne, Orbell and Sheeran (2002). This compared a motivational intervention used alone and combined with an implementation intentions intervention, with the latter very much more successful, but the study was only two weeks long so does not give an indication of longer-term efficacy. Prestwich, Lawton and Conner (2003) also compared multiple interventions, incorporating implementation intentions, a decisional balance sheet, and a combination of both interventions (d = .68). The implementation intentions intervention was more effective than the decision balance sheet when both were used alone, particularly for increasing exercise duration, although the study only lasted for four weeks.

Gollwitzer and Sheeran's (2006) meta-analysis demonstrated the difficulty of evaluating implementation intentions because of the variety of studies included, and the range of variables compared. Studies were often short, and there is limited evidence for the efficacy of implementation intentions in long-term adherence. However, its short term success and practicality for combined interventions means it may be a useful tool in converting motivation to behaviour.

Bagozzi's goal theory (1992; Bagozzi, Baumgartner & Pieters, 1998) emphasised the importance of emotions in the intention-behaviour gap, presenting a framework where appraisals of past processes involve remorse or anger if intentions are unfulfilled, and gratification and gratitude if they are fulfilled. Appraisals of current processes involve fear, worry and anxiety helping the individual avoid failure, or the hope of a favourable outcome leading to enactment and commitment to the goal (p.193). The framework is outlined in Figure 1.5.

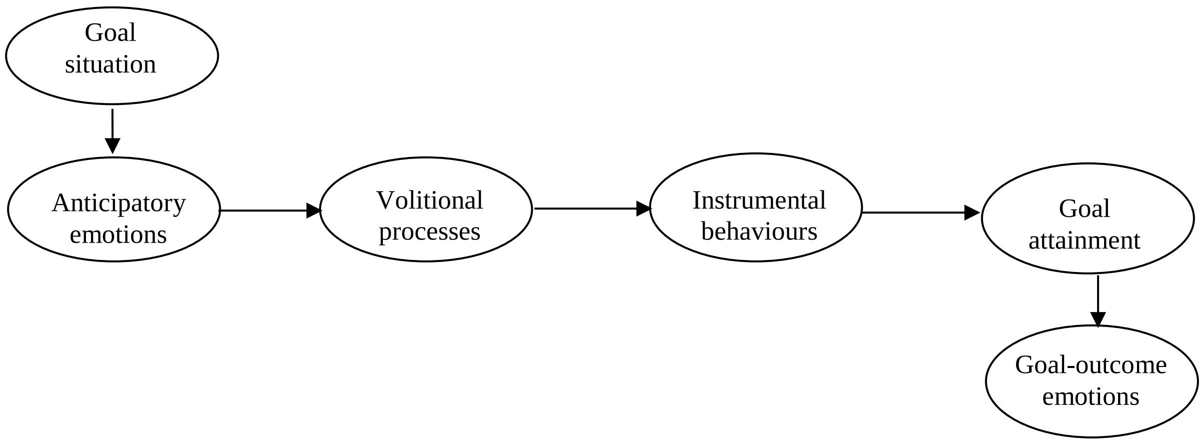


Figure 1.5: The role of emotion in goal-directed behaviour (Bagozzi et al., 1998, p.5)

Music may have a role to play here because of its influence on affect, and relationship with autobiographical memories. Associating previous outcomes, or imagining future outcomes, using an accompanying music track might assist focus on outcomes and promote positive affect. A further important aspect of the theory is its developers' suggestion of combining different models. Perugini and Bagozzi (2001) integrated the anticipatory emotions concept with the TPB, producing a model of goal behaviour (MGB) which they found was superior to the TPB. However, they were reluctant to suggest it as a replacement due to the established, well-tested status of the TPB. In more recent research, Bagozzi has looked at the MGB's application in marketing contexts, but has used it alongside the TPB, suggesting that synthesis of the theories and processes is a useful way to overcome shortcomings of individual models (Xie, Bagozzi & Østli, 2013), and noting weaknesses of both. The MGB is limited in its consideration of social factors; Xie et al. describe the introduction of social identity as a contributing factor to intention, indicating a model still under development. Confidence in the MGB as a research tool in its own right seems limited.

Self-efficacy, defined by Weinberg and Gould (2007) as "the perception of one's ability to perform a task successfully" (p.331), may also help bridge the intention-behaviour gap. Bandura (1977), who developed the theory, argued that four key factors lead to behaviour change occurring and being maintained: *Performance accomplishments* concern what Bandura described as 'personal mastery experiences,' meaning that the individual believes they can accomplish something because they have done so in the past. He suggests that repeating successful behaviour reduces the impact of past failures on behaviour. *Vicarious experience* involves the individual witnessing others achieving their aim; if the others are considered similar, the individual is more likely to believe themselves capable of success. *Verbal persuasion* places self-efficacy in a social context, acknowledging that others' suggestions can be influential, although Bandura (1991) presents social context's main function as providing benchmarks against which behaviour and achievements can be measures, with goals set accordingly. He notes that comparison with peers who struggle to achieve mastery can lead to competent individuals setting lower targets. *Physiological states* concern levels of arousal experienced by the individual, particularly regarding anxiety and apprehension. Research has indicated that self-efficacy is important for maintaining physical activity post-intervention (Baruth & Wilcox, 2014) and that self-efficacy coaching increases intervention adherence (Seghers, Van Hoecke, Schotte, Opdenacker & Boen, 2014).

Bandura (1991) emphasises the importance of the self in carrying out behaviour, in contrast to theories which focus on external influences. He argues that self-efficacy is fundamental to self-regulation in social contexts, noting that "When people attend closely to their performances they are inclined to set themselves goals of progressive improvement, even though they have not been encouraged to do so" (p.251). This is important for adherence because of the implication that exercisers may set goals themselves, rather than relying on professional advice.

There are parallels between self-efficacy theory and the TPB/TRA since both recognise the influence of social factors, although Bandura downplays their effects. The most significant difference is Bandura's emphasis on mastery as a reinforcer: this is absent from the TPB/TRA although it might be expected to influence perceived control. The TRA and self-efficacy theory are approximately contemporary to each other, reflecting the need at the time to find practical models for research into attitudes. Self-efficacy theory also has parallels with Ajzen's PBC (1991) but develops a far more comprehensive model of mechanisms involved, placing the self central to behaviour and behaviour change within the context of learning from others. In Edmunds et al.'s (2007) study (see Section 1.5.1) self-efficacy was correlated with adherence, with relatedness also improving through social engagement with other participants.

Bandura argued that long term change is largely achieved through self-efficacy, with extrinsic motivators or penalties moderately effective only during application, with no lasting effect. Consequently, achieving self-efficacy may be particularly difficult for the groups most at risk from failing to adopt healthy behaviours. Suggs, McIntyre and Cowdery (2010) found that among obese 25-35 year olds there was a widely-perceived need for extrinsic factors such as trainers or exercise buddies to provide motivation. Having recruited 30 participants for focus groups, only 13 attended, with the most common reason given for non-attendance being that the individual 'forgot'. This high attrition rate between recruitment and data collection may indicate difficulty with self-organisation within this group, with its own implications for interventions and adherence.

Miller and Miller (2010) considered attitudes rather than actual behaviour, but as with Suggs et al. (2010), various barriers to self-efficacy were evident. Miller and Miller identified widespread lack of confidence to exercise in public for both overweight and normal weight individuals, although it was more pronounced for overweight individuals. This potentially places a barrier between the individual and opportunities to gain mastery experiences that might increase self-efficacy.

Suggs et al. (2010) identified a group of participants who were particularly motivated to attend the focus groups, possibly reflecting individual differences between participants. Individual differences may influence behaviours in other contexts, and affect response to interventions. Reiss (2009a) identified six reasons behind low school achievement linked to individual differences in motivating factors. For the low achiever who is underchallenged, increasing challenge may address the problem, while taking the same approach with a low achiever who is intimidated by challenge may further disengage them.

Self-determination may also help bridge the intention-behaviour gap. Deci and Ryan (2000) proposed in their self-determination theory (SDT) that behaviour persists towards the anticipated outcome of a desired goal. They advocated developing both goal content and the processes required to reach a goal in the context of what they described as "innate psychological needs" (p.227), which they defined as competence, relatedness and autonomy. Goal pursuit takes place in accordance with personal priorities, which vary between individuals, reflecting individual differences and context. The authors identified three orientations – autonomy, control and impersonal – corresponding respectively to intrinsic motivation (and "well-integrated extrinsic motivation," p.241), extrinsic motivation and amotivation. They noted that autonomy and intrinsic motivation, where goals are self-determined or consistent with personal stance, led to greater success.

The TPB may offer syntheses with SDT in addressing the intention-behaviour gap. As has already been noted, subjective norms (related to the views of others) have been found to be of less consequence to exercise intentions than perceived behavioural control and attitude. Extending SDT to these situations suggests autonomy may relate to both intention and behaviour.

SDT has been applied in a number of studies of exercise behaviour. Edmunds et al. (2007) included professional support intervention at the outset of an exercise programme to help sedentary individuals lacking confidence in personal knowledge, develop autonomy regarding physical activity choices. When the professional advice was withdrawn, participants described a decrease in support which had a detrimental effect on their exercise behaviour. While autonomy was associated with superior outcomes to other motivational approaches by Deci and Ryan (2000), Edmunds et al.'s results indicate that it may need scaffolding if individuals feel insufficiently knowledgeable to make decisions.

Silva et al. (2010, 2011) investigated supported autonomy in a twelve-month study of 239 women, with thirty 2-hour sessions designed to promote autonomous motivation in exercise and weight control. They found the intervention group exercised more and lost more weight than the control group, and reported more autonomous self-direction (Silva et al., 2010). These results are important because they demonstrate the longer term efficacy of an SDT intervention. The study incorporated a two-year follow-up period during which there was no intervention, reported in a later paper (Silva et al., 2011). There was greater weight loss in the intervention group over the longer term, attributable to self-determined exercise behaviour. Overall, the longitudinal study did not take an individual differences approach: rather than measuring autonomy, the design sought to develop autonomy across the intervention group. This indicates that although there may individual differences in Deci and Ryan's three types of motivation (intrinsic/autonomous, extrinsic/control, and amotivation/impersonal: 2000), these can be addressed through interventions: however, the intervention strategy used by Silva et al. demanded substantial resources to deliver regular sessions. For many exercisers wishing to begin a programme, such interventions are not available.

Multi-stage models

Multi-stage models present a framework where individuals move through stages such as considering action, making plans, and taking action. Prochaska and DiClemente's transtheoretical model (TTM: 1982) was developed as a framework for smoking cessation, but has been applied in a range of contexts. It identifies five key stages: *precontemplation*, where the individual does not consider their behaviour problematic; *contemplation*, where problem behaviour is acknowledged; *preparation*, where information and practical solutions to behaviour change are sought; *action*, where the change is made; and *maintenance/relapse* (in relapse, the individual reverts to a pre-action stage).

There is evidence that the TTM is a useful construct for tailoring interventions. Spencer et al. (2006) reviewed TTM studies of exercise, finding support for interventions relating to the participant's stage (e.g. helping them move beyond contemplation to preparation). However, the TTM's development relates to abstention from risky behaviour, rather than take-up of positive behaviour such as exercise, which may limit its applicability. Adams and White (2003), in a research review, argued that the TTM is inadequate in exercise research because people can be at different stages for different activities. Although there was some support for basing interventions on the model in short-term studies, long-term studies were few and the results showed little benefit from applying the TTM.

The TTM also requires defining what constitutes action and maintenance. For smoking cessation, the individual has either smoked or not; there are not degrees of success as there are with exercise. Schwarzer (2008) notes that TTM stages may be better conceptualised as a continuum in some circumstances, and identifies inconsistencies between research defining contemplators as considering exercise in the next year in one study, and in the next six months in another. There are possible roles for music within this framework, despite these reservations. Preparing an exercise playlist, for example, might provide an incentive to carry out a first session perhaps also increasing enjoyment of exercise and assisting maintenance in the longer term.

Similarly, music might be relevant to Schwarzer's (2008) Health Action Process Approach or HAPA, shown in Figure 1.6, which also addresses the intention-behaviour gap. The HAPA is a two-stage model, with intentions formed in the motivational phase, behaviour carried out in the volitional phase and behaviour continuing in the action stage. Planning and self-efficacy are key components in addressing the intention-behaviour gap; planning resonates with Gollwitzer's (1993) goal intentions. The motivational phase focuses on the individual's attitudes and beliefs and their contribution to intention, rather than incorporating the normative beliefs of those around them.

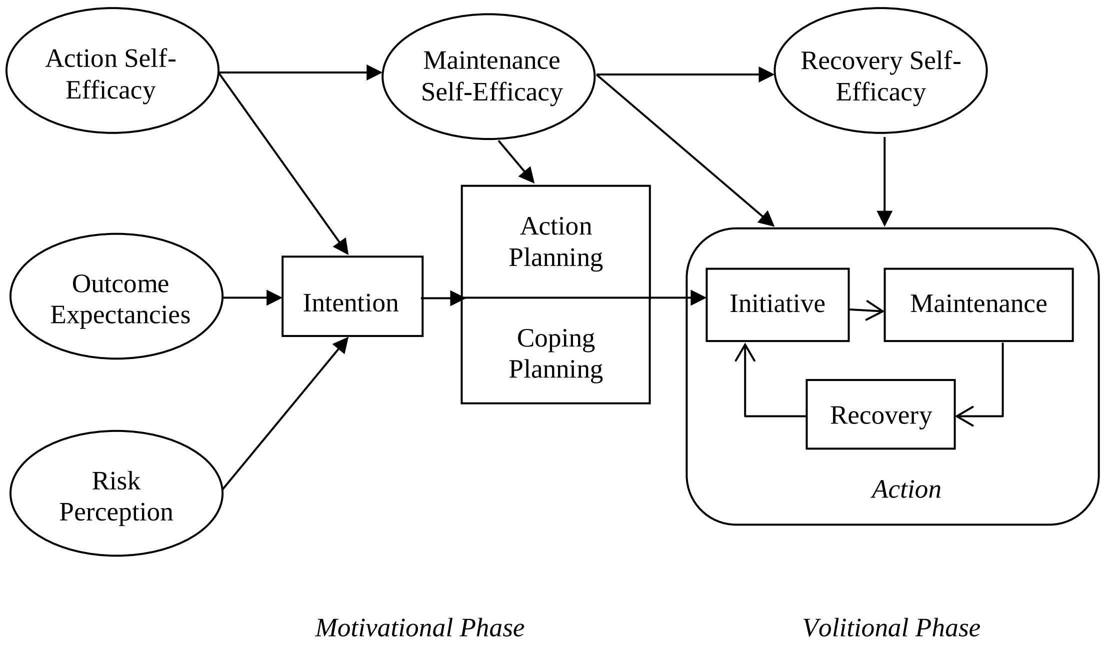


Figure 1.6: Generic diagram of the Health Action Process Approach (Schwarzer, 2008, p.6)

Self-efficacy is applied to each stage of the process. The HAPA draws on the idea that maintenance self-efficacy differs from recovery self-efficacy, the former being concerned with optimistic thoughts prior to embarking on the behaviour (possibly influenced by all of Bandura's factors), and recovery self-efficacy concerned with how the individual deals with setbacks after implementation, based on past experience (this is particularly related to performance accomplishments). Planning and self-efficacy are presented as a ‘bridge’ between intention and action, addressing the intention-behaviour gap. ‘Coping planning’ is a similar concept to implementation intentions, where plans are made to overcome barriers. The final circular action phase assumes ongoing maintenance, incorporating adherence into the model. The HAPA demonstrates synthesis of multiple models and theories into a wide-ranging framework that can address the complexities of health behaviours.

The model is less effective at recognising the importance of different influences on intention: Schwarzer noted that risk perception alone (such as acknowledgement of being at greater risk of developing a chronic health condition if exercise is avoided) is insufficient to form an intention. The motivational phase of the model, therefore, may need further development or synthesis with more detailed frameworks. The TPB may have a role here, as Xie et al. (2013) demonstrated its usefulness in synthesis of behavioural theories. Nevertheless, the HAPA has been used effectively to examine determinants of physical activity in different age groups: Caudroit, Stephan and Le Scanff (2011) found that older individuals were particularly influenced by concern over health risks, and that intention was a predictor of behaviour, while Barg et al. (2012), in their study of middle-aged women, found that action self-efficacy was the most significant predictor of intention and that risk perception was not an influence; intention was not an indicator of behaviour.

The models discussed here offer various ideas for conceptualising exercise behaviour, although each has limitations. The short-term nature of much of the research is a current weak point. Models have tended to focus on the initial behaviour change rather than maintenance over the long term, and have been tested in studies often lasting only a few weeks. Although beliefs, attitudes, social environments and self-efficacy are considered, other individual differences such as personality are not incorporated into models. In the next section, I examine aspects of individual difference that may be relevant to exercise adherence, outlining the literature on individual difference and exercise behaviour.

1.5.3 Individual differences

In the previous section, I suggested that health behaviour studies may need to make greater reference to individual differences than in previous research. While there may be some benefit to tailoring interventions according to an individual's stage of behaviour change, other individual differences may also be affecting their adherence. Furthermore, as described in Section 1.2.4, research indicates that individual differences have a relationship with music preference, suggesting that individual differences, music use and health behaviour may all be linked.

Personality

The 'Big Five' personality traits of Agreeableness, Conscientiousness, Extraversion, Openness and Emotional Stability (often measured as Neuroticism) have become well-established variables. Each collates a number of relevant traits: Extraversion, for example, includes sociable, fun-loving, friendly and talkative (McCrae & Costa, 1987), making it parsimonious. Gosling, Rentfrow and Swann's (2003) Ten-Item Personality Inventory (TIPI) provides a practical and validated short method of measurement.

Rhodes, Courneya and their colleagues have investigated personality traits in the context of exercise adherence, also incorporating the TPB framework. Their most consistent finding is that Extraversion appears to moderate the translation of intention into behaviour (Rhodes, Courneya & Hayduk, 2002; Rhodes & Courneya, 2003; Rhodes, Courneya & Jones, 2003), which they suggest is due to extraverts seeking stimulating environments, such as gyms, while introverts avoid them (Rhodes et al., 2002), although their participants were reporting on exercise carried out in any environment. They also found a relationship between Conscientiousness and bridging the intention-behaviour gap (Rhodes et al., 2002; Rhodes, Courneya, Blanchard & Plotnikoff, 2007) although this is less consistent: Rhodes et al. (2002) found a relationship between exercise behaviour and Conscientiousness, but this was not found in a subsequent study (Rhodes et al., 2003). The authors speculated that the effect in the latter study might be due to the student participants having high levels of Conscientiousness compared with the wider population, but the participants in the former study were also undergraduates. It is not clear why the two samples should differ on this measurement, nor why the authors suggest it may be affecting the results in only one of the studies.

This research incorporated the participants' own exercising aims, rather than those prescribed by professionals, and the field settings of the research achieved greater ecological validity than rigorously monitored and implemented intervention studies with prescribed exercise sessions. The self-report measurements are a possible weakness, although they provide a practical route to collecting multiple measurements across substantial samples (typically 300 participants in the studies above).

Ingledew, Markland and Sheppard (2004) also found support for the influence of Conscientiousness and Extraversion in a study of the relationship between personality and self-determination in exercise behaviour. They found that extraverts value exercise's provision of relatedness, while for conscientious exercisers, exercising delivers a desired feeling of competency. These studies all indicate that exercise behaviour and personality traits are related, suggesting that studies of exercise adherence need to recognise personality variables.

Research into adherence to health behaviours beyond exercise also suggests personality has a role. In a study of compliance with asthma medication regimes, Neuroticism explained 52% of compliance variance in men. Conscientiousness had a positive relationship although it did not impact on the regression analysis. There were no statistically significant findings for women in the study (Emilsson et al., 2011). Gorevski et al. (2013) found low Openness increased the likelihood of non-adherence to immunosuppressant medication regimes by 91% among kidney transplant patients, but not liver transplant patients. In this study, men and women were not compared, but around two thirds of each transplant group were male; significant findings seem to occur in studies with higher proportions of men, or where men are analysed separately.

A link between Neuroticism and non-adherence to a medication regime was found in a 6 year study of 771 participants aged over 72 (Jerant, Chapman, Duberstein, Robbins & Franks 2011). The study investigated gingko biloba's potential for dementia prevention, but since Neuroticism in older people is associated with cognitive decline, cognitive abilities may have been a confounding factor.

These studies indicate inconsistencies in adherence and personality relationships according to the behaviour investigated and sample demographics, even when conditions appear similar. There may be complex relationships behind the results; for example, one possibility for the differences between liver transplant and kidney transplant patients is the cause of the organ failure: conditions associated with kidney failure include diabetes and high blood pressure (NHS, 2012), while one common cause of liver failure is alcoholism (WebMD, 2012). These different medical histories may be associated with different health behaviour profiles and personalities, an idea supported by Friedman's study of long-term associations between personality and health (2000). Friedman analysed data collected over the lifetimes of individuals who were children in the 1920s, and found that sociability was overrated and Conscientiousness underrated regarding contribution to good health. Understanding of Neuroticism's role was "confused" (2000, p.1089). Friedman emphasised the role of the environment, suggesting that certain personality types were associated with joining groups where social norms adversely affect health outcomes. This underlying complexity of long-term behaviours may go some way to explain the inconsistencies in the literature.

Action-oriented and state-oriented traits

Individual differences also affect how individuals perceive their goals. Fuhrman and Kuhl (1998) identified action-oriented and state-oriented participants in a study of adherence to a healthy diet. State-oriented individuals tended to focus on the overall goal, sometimes becoming overwhelmed by task size and difficulty, while action-oriented individuals were more inclined to set goals, take action and achieve their aims initially, then struggle to maintain changes. There may be some similarities with exercise adherence, in that individuals need to make decisions on a frequent basis, but are likely to see gradual, long term results rather than an immediate impact.

Fuhrman and Kuhl advocate adjusting interventions to address state orientation by focusing on changing strategies over the longer term (1998). State-oriented individuals focus on punishing themselves for unhealthy behaviour as a way of self-regulation, but the short-term benefits of this are overridden by the medium- to long-term consequences of negative self-representation built by such strategies. Methods which avoid this are key to long-term success. Action-oriented individuals may also struggle with long-term adherence, particularly if initial goals and aims are simple, as momentum can be lost as goals are achieved. With both weight loss and exercise, maintaining in the longer term is important.

In both types of individual, SDT may be applicable, ensuring that basic innate needs (relatedness, competence and autonomy) are met and outcomes enhanced. Competency for state-oriented individuals may be a way of reversing punishing behaviours, while action-oriented individuals might be encouraged to address relatedness, using exercise to fulfil social needs. Self-talk may be related to both state and action orientations and the way in which the individual attempts to motivate themselves. Stone, Deci and Ryan (2009) identify carrot and stick (CAST) methods used in management to try to motivate employees, noting that they are incompatible with SDT approaches because they present extrinsic rewards or punishments. Studies of positive and negative (and neutral) self-talk in exercise (Gammage, Hardy & Hall, 2001; Hardy, 2006) relate it to self-encouragement and self-criticism; Fuhrman and Kuhl (1998) discuss the self-punishment of state-oriented individuals, rather than self-criticism, however; while both can be viewed as negative, criticism implies a more passive negativity than punishment.

There are possible associations with Dweck's (2000) self theories. Her work has focused on academic contexts, looking particularly at outcomes for students with different beliefs in intelligence. The fixed intelligence, or entity, framework occurs when students believe intelligence is a “fixed trait” (p.2). Other students believe that intelligence can be increased through effortful learning: this is the malleable intelligence, or incremental, framework. Dweck found that these beliefs affect application to academic tasks and goals, influencing engagement and willingness to risk error, and that students with malleable intelligence beliefs have more academic success. Negative self-assessment of performance, as found in state-oriented individuals, is also associated with the fixed intelligence self theory (Dweck & Molden, 2005), again suggesting possible theoretical synthesis.

Although self theory does not appear to have been tested in an exercise context, there has been research looking at its application in sport among teenagers (Biddle, Wang, Chatzisarantis & Spray, 2003), where it was found that enjoyment of sport was related to a malleable framework, where participants believed that their abilities would improve with effort.

Motives

Motives are described by Reiss (2009b) as the “wants, desires, strivings, and psychological needs” (p.20) underpinning motivation. The Reiss Profile is a psychometric test measuring motivational traits (Havercamp & Reiss, 2003), and is based on a framework of 16 motives corresponding to 16 basic desires, each with five core qualities: universality, psychological need, intrinsic motivation, intrinsic values and psychological significance. The 16 basic motives are shown Table 1.2

Table 1.2: The 16 Reiss Profile Motives (adapted from Reiss, 2004, p. 187)

Motive name	Motive	Intrinsic feeling
Power	Desire to influence	Efficacy
Curiosity	Desire for knowledge	Wonder
Independence	Desire to be autonomous	Freedom
Status	Desire for social standing	Self-importance
Social contact	Desire for peer companionship	Fun
Vengeance	Desire to get even	Vindication
Honour	Desire to obey a traditional moral code	Loyalty
Idealism	Desire to improve society	Compassion
Physical exercise	Desire to exercise muscles	Vitality
Romance	Desire for sex/courting	Lust
Family	Desire to raise own children	Love
Order	Desire to organise	Stability
Eating	Desire to eat	Satiation
Acceptance	Desire for approval	Self-confidence
Tranquillity	Desire to avoid anxiety/fear	Safe, relaxed
Saving	Desire to collect/frugality	Ownership

Reiss's use of terminology is inconsistent: he also refers to 16 basic desires, corresponding to the terms described as motive names (first column in Table 1.2), while the motives (second column in Table 1.2) might better be described as desires (the headings are from the original: Reiss 2004). He also uses the term strivings interchangeably with motives and desires, and refers to basic desires as intrinsic motives, or IMs (2004). I have used the term 'motive' in this thesis to avoid confusion.

Application of the Reiss Profile creates a motivational profile indicating how strong or weak each motive is for a particular individual, much like personality traits, and Reiss suggests motives are closely related to behaviour. For example, presenting a partner with a gift might relate to the motive of romance, power, status or (if the gift is chocolates that one hopes will be shared) eating. Money is not in itself a motivator, but a means to achieve ends such as status, or satisfy curiosity through paying for education. Reiss describes the motives as universal, but there are individual differences in the extent to which each applies, and Reiss and his colleagues' research investigates how these differences relate to behaviour. Additionally, behaviour that appears consistent may have different motivating factors; low achievement at school may be motivated by low needs for curiosity, order, power or honour, or a high need for vengeance or acceptance, the latter of which leads to fear of failure (Reiss, 2009a).

Reiss's physical activity motive is of particular interest to this study; it is defined as a physiological need to move muscles with a resulting feeling of vitality. However, physical activity may also relate to other motives: status in competitive sport, social contact in team games, power through enhanced strength and energy, or approval or romance for those exercising for aesthetic reasons. These may relate to attitudes and beliefs of the self, and social norms, included in models such as the TPB.

Reiss, Wiltz and Sherman (2001) used the motives framework in a study of athleticism, examining the number of sports students participated in and assessing whether a higher number correlated with particular motives. Unsurprisingly, the physical exercise motive was strong, along with high social contact, family life, vengeance (satisfied by competition), power (satisfied by achievement) and low curiosity. However, defining athleticism as the number of sports played is problematic and brings validity into question. An individual playing three different sports briefly and badly over the course of a week would be defined as being more athletic than someone training at a professional or semi-professional level whose activities revolved around a single sport. The results may indicate that sport helps satisfy social- and status-related motives for those with some competency in and liking for it.

Research has identified relationships between motives and personality traits. Olson and Webber (2004) found all the motives correlated with elements of the Big Five except for physical exercise. There were strong positive correlations between high scores across the motives generally and extraversion and neuroticism, and a negative correlation with agreeableness. Reiss also suggests that the motives may be useful in predicting behaviour, although he describes the evidence as "anecdotal" (2009b, p.36). Nevertheless, the various studies above have found significant relationships between motives and behaviour, and motives may be a useful addition to personality traits, already used in studies of adherence.

There are discrepancies with other theories. Deci and Ryan argue that competency and self-determination emerge when a goal process is intrinsically motivated: that is, “interesting and [which they] would do in the absence of operationally separable consequences” (2000, p.233). They note that extrinsic motivators, such as financial rewards, have a detrimental effect on intrinsic motivation, reducing enjoyment of an activity. Reiss, in contrast, argues that all motivators are intrinsic (2009b), and financial incentives therefore relate to intrinsic motives such as power and status. Additionally, relatedness and autonomy may correspond with motives, with relatedness linked to social and status needs, and autonomy to independence, although competence does not have obvious parallels.

In the context of exercise behaviour, the theories contradict each other. If societal pressure to be slim and fit influences exercise behaviour, Deci and Ryan would consider this extrinsic motivation, while Reiss would cite intrinsic motivations such as status. In practice, this apparent dichotomy may not be a problem: Hallett and Lamont (2014) found that regular exercisers cite psychological needs as motivating factors, such as relatedness through building friendships with other exercisers and autonomy through control of the exercise environment by using self-selected music. This suggests a synthesis of self-determination and motives, and the theories may be complementary. Fox notes that the “feeling good effect of exercise…seems to be substantiated by research” (1999, p.414), and such effects may fulfil Deci and Ryan’s competence needs through feeling better when exercising regularly compared with being sedentary. A possible factor in exercise maintenance, therefore, might be ensuring that intrinsic motivators become associated with exercising, leading to self-determined motivation driven by an individual’s motives profile.

Strengths

Strengths analysis is a method from positive psychology (see for example Linley, 2007; Linley et al., 2007; Seligman, 2011). Seligman's early work on learned helplessness presented a reversal of Bandura's self-efficacy mastery experiences, with repeated failure leading to passive behaviour where aims are abandoned (Seligman, 1990), perhaps relating to unsuccessful adherence. More recently, Seligman and Linley have taken a more individual differences-based approach through strengths analysis.

A strengths profile represents those areas in which an individual performs best, and there is evidence that strengths use contributes towards both wellbeing and organismic valuing (Govindji & Linley, 2007): the organismic valuing process is described as "an inner voice that guides us in the directions that are right and satisfying for us" (p.144). This suggests that by formulating exercise interventions appealing to an individual's personal strengths, exercise is more likely to be viewed positively, potentially increasing adherence.

Linley defines a strength as "a pre-existing capacity for a particular way of behaving, thinking, or feeling that is authentic and energising to the user, and enables optimal functioning, development and performance" (2007, p.4) and suggests strengths have evolutionary origins. Practical application is central to Linley's work (Linley, Nielsen, Gillett, & Biswas-Diener, 2010; Linley, Woolston & Biswas-Diener, 2009; Linley & Minhas, 2011) and the ideas have strong resonance within workplace coaching to maximise staff effectiveness. Rather than addressing weaknesses through training, Linley suggests delegating those tasks to a colleague with the relevant strengths.

Strategies for team working in business might theoretically transfer to sports teams; for the exerciser, seeking an individual rather than group outcome, delegation is clearly inappropriate. Instead, exercise preferences and habits need to reflect the individual's strengths, identifying suitable activities rather than trying to adhere to types of exercise associated with one's weaknesses.

Seligman (2011) also looks at utilising strengths, considering their use in well-being to achieve five “pillars”: Positive emotion, Engagement, Relationships, Meaning and Accomplishment (PERMA). To achieve these, he suggests applying a framework of 24 strengths in five categories (2011: see Table 1.3), inviting his audience to self-assess which are particularly pertinent to them as individuals.

Table 1.3: Seligman’s 24 strengths (2011)

Wisdom and knowledge	Courage	Humanity and love	Temperance	Transcendence
Curiosity/interest in the world	Valour and bravery	Kindness and generosity	Self control	Appreciation of beauty and excellence
Love of learning	Perseverance / industry/ diligence	Loving and allowing oneself to be loved	Prudence/ discretion/ caution	Gratitude
Judgement/ critical thinking/ open-mindedness	Integrity/ genuineness/ honesty	Citizenship/duty/ teamwork/loyalty	Humility and modesty	Hope/ optimism/ future-mindedness
Ingenuity/ originality/ practical intelligence/ street smarts		Fairness and equity		Spirituality/ sense of purpose/faith/ religiousness
Social intelligence/ personal intelligence/ emotional intelligence		Leadership		Forgiveness and mercy
Perspective				Playfulness and humour
				Zest/passion/ enthusiasm

The strength labels are rather vague. For example, Seligman differentiates between social and personal intelligence, then notes that both have been classified as emotional intelligence by Goleman (1996). His intelligences are presented as a category and two subcategories, yet 'emotional intelligence' seems an adequate and more parsimonious description, particularly given that it is already included under wisdom and knowledge. The vagueness calls the validity of the measure into question: what exactly is being measured when a variable is given multiple descriptors, each slightly different in meaning?

Strengths may relate to personality traits, and this is an area for further investigation, as recognised by Linley et al. (2007) although as yet, there has been little research. A recent study (Furnham & Ahmedoglu, 2014) used factor analysis on data collected from 280 participants using Seligman's 24-question short measure of strengths, reducing the 24 strengths to 5 'virtues,' which partly correspond to Seligman's five categories, although a number of strengths are grouped differently, making clear links between the Big Five and Seligman's framework difficult to assess. There were nevertheless significant positive correlations between extraversion and the virtues of transcendence (largely consistent with Seligman's category) and fortitude (Seligman's courage category plus playfulness), and between openness and the cognitive virtue (largely consistent with Seligman's wisdom and knowledge), indicating some correspondence between personality and strengths.

Past empirical studies of strengths may be affected by biased samples. Linley et al. analysed data from 17,056 UK respondents to the values in action inventory (VIA) questionnaire (2007), an online survey of self-reported strengths. The sample was not, however, reflective of the general population: 73% of the participants had a degree compared with 27% of the UK population (UK census information for 2011: UK Government, 2011). Strengths such as love of learning would be expected to reach higher levels than in a more representative sample, and other strengths may also reflect educational attainment. No studies of exercise adherence and strengths could be found, although, Seligman discusses exercise adherence anecdotally (2011) based on his personal success with online interaction and pedometer use. The lack of solid empirical research into strengths suggests research in the area is needed to support its application.

Self-regulation

The final individual difference to address here is self-regulation, or ‘willpower.’ Baumeister (2012) presents self-regulation as finite, arguing that individuals have a limited capacity to resist temptation (such as sitting and watching TV when an exercise session had been planned). This concept of ‘ego depletion’ (Baumeister, Gailliot, De Wall & Oaten, 2006) is important as research suggests that with regular use, the capacity for self-regulation can be increased.

These ideas have direct relevance to the intention-behaviour gap. Implementation intentions, for example, might be seen as an exercise in enhancing self-regulation, depending on the pattern of impact: if an implementation intention has a small effect on behaviour, which increases with time and usage, this may indicate reduced ego depletion.

Even with development through regular use, self-regulation may still be finite, and research suggests both personality and executive function may be moderating factors in converting exercise intention to behaviour. Rhodes and Courneya (2003) found a positive relationship between intention to exercise and the personality traits of extraversion, openness and conscientiousness, and these three traits were also associated with strenuous exercise behaviour. Research by Hall, Fong, Epp and Elias (2008) measured executive function through a Go/NoGo computer-based test, while intentions were measured by how much exercise participants planned to do the following week, and behaviour was measured through a self-report of the previous week’s exercise. Behavioural intention was a significant predictor of exercise across the sample, but more so for those with stronger executive function, suggesting it is related to self-regulatory abilities.

If an individual is more inclined to set goals because of certain personality traits, resulting in more goals, it might be expected that they would be more active in their practice of self-regulation and therefore have developed ‘stronger willpower.’ However, Sniehotta (2013) notes a consistent percentage of conversion of intentions into behaviours which is not affected by the number of intentions an individual has. Notably, the correlation between number of failed intentions and quality of life is positive, suggesting that having a large number of intentions may be more psychologically beneficial than actually achieving them. This implies that ego depletion may correlate with number of intentions.

While some failure might be anticipated and, according to Sniehotta, have little impact on quality of life, failed exercise intentions may have negative implications, particularly with regard to increased health risks. While Baumeister’s findings have interesting implications for the present study, the research is in its early stages and further work is needed to establish what interaction is taking place between mechanisms, contexts, and practices.

1.6 Summary of questions raised

Having considered a range of literature and theories relating to exercise, music psychology and the use of music in exercise, this section summarises the areas where research is needed, giving an overview of the current state of research before moving to explain how the studies in this thesis are constructed to address some of the gaps in knowledge.

Through much of this introduction, the absence of literature in certain areas has been evident and existing theories and frameworks have been questioned. The research in music and exercise has tended to take place in lab settings, with young, fit participants. The sports science context has led to a focus on music’s potential to enhance performance generally through speed and stamina, yet uses music that is not participant-selected, using reductionist selection techniques.

There are a number of theoretical frameworks exploring music, exercise, adherence and individual differences, but little synthesis. Consequently there is an absence of knowledge regarding how people use music in exercise, in addition to lack of empirical work on its potential to help adherence. If the question of if and how music might help with exercise adherence is to be answered, research is needed regarding how key areas interact. The studies here must explore basic assumptions relating to the research context as well as testing hypotheses.

The technicalities of music use need to be recognised because of rapid change in technology for music dissemination, influencing practices relating to obtaining and listening to music. Again, this is an area where little research has been done even in general listening, and certainly not specifically in exercise.

The concept of adherence has been shown to be problematic since it has three facets which are not consistently addressed: the target frequency and duration (which may be set by the exerciser rather than a health professional), the proportion of target that must be achieved to qualify for adherence, and the period of time without exercise that must elapse before non-adherence occurs. Much of the literature uses targets based on those promoted by bodies such as the World Health Organisation, assuming that professionals will be advising, but this is not necessarily the case, and individuals may set targets that contradict standard guidelines. Rather than benchmarking using an ideal, more knowledge is needed of what individuals do when left to make their own exercise plans. Actual behaviour can then be compared to intentions. Adherence needs to be defined in a way that has 'real world' relevance, and which must also involve activity at a level that has fitness benefits. The research here is undertaken recognising that concepts of adherence may need further refining according to findings regarding individuals' exercise practices.

Health behaviour models may be useful to consider research outcomes. A number of overlaps and similarities between models have been identified, and the possibility of synthesis has been suggested. This is particularly relevant to individual differences, which have often been overlooked but which studies have shown to be relevant to behaviour in exercise contexts. Health behaviour models have come under particular scrutiny because of their inadequacies. Extension through synthesising different models (see sections 1.5.2 and 1.5.3) means useful measures can be retained, and where a model is less satisfactory, added to more successful theory.

With exercise, the lack of longitudinal studies reveals a research focus on the action stage of taking up exercise, rather than the subsequent stage of adhering in the long term. Although research interest has shifted from intention towards the conversion of that intention into behaviour, maintenance is still somewhat overlooked. In practice, if maintenance involves dealing with setbacks, one might assume that initial barriers to exercise are not completely overcome, but recur, with the individual moving in continual cycles and minicycles, forwards and backwards through stages and decisions as exercise is planned, then missed, prioritised and deprioritised.

Individual differences in personality, strengths and motives may affect exercise adherence, and adherence may also be a skill that can be developed. It is not clear whether music in exercise is a background to which little attention is paid, or whether it has a far more integral role, possibly heightening emotional response in a way that is consistent with non-everyday emotional responses to music; there may be individual differences also affecting these factors.

Before this research can explore music interventions' capacity to help with exercise adherence, greater understanding is needed of exercise music use and behaviours. In Chapter 2, I consider appropriate methodology and research design to address the lack of knowledge regarding individuals' use of music in exercise, and to look at whether music can be used to help with adherence, introducing a series of studies that make up the thesis's practical research content.

Chapter 2

Methodology

In this chapter, I outline the aims of the research and consider appropriate theoretical approaches, examine methodological practicalities and detail the methods used in each of the four studies, explaining choices and presenting a rationale. Because the studies concern a very under-researched area, various exploratory approaches were used, and I discuss the justification for using less-established methods in some instances.

I begin by looking at the research aims, outlining eight key research questions relating to whether music can help facilitate exercise adherence. I then identify underpinning theoretical frameworks, along with interdisciplinary and mixed methods approaches used in the research. Following this, I cover the overall rationale and the details of each study's methods, followed by discussion of the practicalities of the research methods and the use of reflexivity within the project. Finally, I outline steps taken to ensure ethical standards were met.

2.1 Research aims

The main aim of this research project is to explore music's potential to help exercisers adhere to their exercise plans. It has been proposed that music can influence exercise adherence (Karageorghis et al., 1999: see Figure 1.1), but there has been an absence of research in this area. As discussed in Chapter 1, research has been focused in sports science environments, and has emphasised music chosen for rather than by exercisers. Of the more detailed qualitative studies, DeNora (2000) documented the application of music in an aerobics class, and Priest and Karageorghis (2008) focused on developing a gym music policy; they did not explore exercisers' use of their own music in depth, despite half their participants regularly using their own music while exercising. Experimental studies are the source of much of what is known about the effects of music on exercise, but few have utilised self-selected music stimuli. Overall, little is known about the autonomous music-using exerciser: that is, the exerciser who chooses their own music and, in many cases, the activities it accompanies. Yet for many exercisers, this is usual, and so adherence needs to be considered in this context.

Because of the lack of previous research in this area, there are a number of questions to explore regarding autonomous use of exercise music: it cannot be assumed experimental protocols, with researcher-selected music, represent optimal conditions or are superior to autonomous practices. Eight questions are outlined below: Sections 2.1.1 to 2.1.6 detail six questions relating to autonomous exercise music practices while the questions in Sections 2.1.7 and 2.1.8 look at how this knowledge might be used to address adherence.

2.1.1 What role do autonomous choices of music play in exercise?

Music's use in exercise has typically been described as motivational, but motivation is a broad term. Lab-based studies have focused on music's effects on physiological outputs such as strength, speed and stamina (see Section 1.3), but while these factors are important to the competing athlete (the focus of sports science), music may serve a different purpose for exercisers, possibly being chosen to alleviate boredom, or to enhance enjoyment, without reference to a performance goal. Additionally, it is not clear whether the content of the music has a particular purpose for autonomous exercisers, such as facilitating synchronous movement with a beat. The current research aims to investigate music's role in exercise from the perspective of exercisers.

2.1.2 What do people listen to, and how is it chosen?

There is little knowledge regarding the music exercisers listen to on PLDs, and whether choices are similar to music played in gyms and exercise to music classes. Style preferences in everyday listening relate to age (Holbrook & Schindler, 1989; North, 2010) and to individual differences (North, 2010; Rentfrow & Gosling, 2003), and both factors may be important in music selection. Exercisers' choices of styles of music and tracks may be influenced by exercise, by other factors, or by a combination of exercise-related and non-exercise aspects. This study will look at individual music preferences when self-selection is possible and investigate reasons underpinning the choices.

DeNora's comments (2000: see Section 1.3) indicate widespread awareness among listeners of musical 'needs' at a particular moment, and competency to find corresponding listening material. Very little is known about how exercisers select music for workouts, and what aspects of their exercise session their choices address: whether to work harder, to continue for longer, for distraction, or for some other reason. It may or may not be connected to a desire to adhere, perhaps helping complete a planned workout, or with music an incentive to begin an exercise session. It is not clear how exercisers identify suitable music, or whether they have difficulties finding tracks that 'work.' Different kinds of exercise may be addressed with different kinds of music: Hallett and Lamont's (2014) study of gym members found that heavier styles such as rap and metal were preferred for resistance training, with dance music preferred for cardio activities, but the processes underpinning these choices were not investigated. Understanding how selection takes place may help clarify how music might be used to increase adherence.

2.1.3 What role does technology play?

The ways in which music can be sourced and accessed have changed considerably in the last 15 years, particularly through the emergence of online options such as streaming, file-sharing, sites such as YouTube and downloads. It has become much easier to search for new music, for example through marketing algorithms on Amazon, or through the ‘Related artists’ function on Spotify, and acquisition is faster, with listeners accessing chosen music on demand, from home or any location with WIFI or mobile phone reception. The storage capacity of current portable devices is many times greater than cassette or CD players: rather than selecting a small number of tapes or CDs, listeners can access extensive music collections (a 64GB pocket device holds 6000+ tracks): cost per byte of music storage has also decreased since the advent of commercial MP3 players. Tailored playlists can be compiled quickly and easily, or tracks selected at random from delimited (e.g. by artist) or unlimited collections. Unlike cassette and CD players, current PLDs do not skip or distort when a device is moved vigorously, an important factor when exercising. The scope for interventions is enhanced by the internet, with programmes such as the NHS ‘Couch to 5k’ beginners’ running podcasts available for free download. These advances all contribute towards ease of using music in exercise and breadth of choice.

It is not known to what extent exercisers embrace technological developments and whether these affect their processes of acquiring and using music, although recent research by Krause and North (2014) suggests that listeners have a ‘music technology’ identity in general listening. The ever-increasing potential of technology means it may be a useful tool in facilitating exercise adherence.

2.1.4 Can pre-exercise music help adherence?

Music may assist adherence when played before exercise, as well as when played during exercise. As mentioned in Section 1.4, Bishop et al. (2007) found young tennis players used music to control arousal levels and help ensure an optimal level of performance, and Juslin and Sloboda (2010) suggest that one of the primary functions of music for listeners is emotional. This suggests that playing music prior to exercise may help generate a state conducive to feeling like moving, but there is little evidence of such use. This is a particular focus in Study 4 (Chapter 6).

2.1.5 Do individual differences affect how music is used in exercise?

As discussed in Section 1.5.3, research has already shown correlations between personality and adherence to exercise programmes, and between personality and music preference. Investigation of possible relationships between music, personality (and other individual differences) and adherence could prove fruitful and avoid 'one-size-fits-all' interventions if results suggest these are not appropriate.

2.1.6 When and why is music not listened to?

Not every exerciser chooses to use music while they train. Little is known about differences between users and non-users, nor why music is sometimes not listened to during exercise when the exerciser has the option to do so. More understanding is needed of whether music can be problematic in some exercise contexts, and/or for some exercisers.

2.1.7 Does music affect adherence?

Investigations into the questions above will help provide a context and suggest productive avenues for further investigation and possible interventions. It is unknown whether exercisers use music autonomously in exercise to help them adhere to their plans. If this is the case, insights into why and how this is taking place may indicate strategies for music-assisted adherence. Whether or not there are intentions to adhere with the help of music, there is scope to identify possible correlations between adherence and music use.

2.1.8 Can music be used to assist adherence? If so, how?

By considering the ways in which music is used, and assessing its possible role in adherence, strategies can be devised where music is harnessed to promote regular exercise. It is, of course, possible that evidence for music helping adherence will not be found, and that other interventions may be superior. Research is needed to establish whether or not music has a role in exercise adherence, and whether the suggestion from Karageorghis et al.'s (1999) model is supported.

2.2 Theoretical Approach

2.2.1 Overview

The reciprocal feedback model of musical response (Hargreaves, 2012; Hargreaves et al., 2005) in Figure 1.2 suggests a range of complex interactions, and in Chapter 1, I suggested additions to the model (Section 1.4). A study of music in exercise needs to acknowledge music context and social influences, indicating that a stance involving multiple disciplines is appropriate. Psychology's dominant cognitive paradigm, while potentially offering interesting findings, risks a reductionist approach demanding a level of control inappropriate for musical concepts (see Section 2.2.4 for further discussion); this contributes towards the unsatisfactory nature of the BMRI and BMRI-2 (Section 1.3). Furthermore, to explore experiences of using music in exercise, the study requires elements of phenomenology, suggesting a qualitative approach. Health-related research has increasingly drawn on mixed methods approaches (Evans, Coon & Ume, 2011), and this would seem appropriate here.

2.2.2 Theoretical framework

Evans et al. (2011) suggested that a theoretical framework connects epistemology (thoughts about knowledge) and the means by which knowledge is developed. However, they noted that in mixed methods research, theoretical frameworks are not commonly used, and in studies where they are, they are derived inconsistently. In Chapter 1, I considered various theoretical frameworks, some of which underpin the rationale and approaches used for this study. The key theoretical frameworks in question are listed below.

Karageorghis et al.'s conceptual framework

This framework (1999: see Figure 1.1) aimed to show response to motivational, asynchronous music in exercise and sport, incorporating intrinsic factors (musical characteristics) and extrinsic factors (such as cultural background) to predict responses to motivational asynchronous music in exercise and sport. The inclusion of adherence as a possible outcome was speculative, with the implication that it is a consequence of enjoying exercise, reduced perceived exertion and arousal control, all arising through music. The positive exercise experience then makes repetition of the activity more likely. There may, however, be other possible music/adherence mechanisms such as the anticipation of music listening, or pre-workout music listening to 'get in the mood' for physical activity.

The reciprocal feedback model of musical response

The reciprocal feedback model (Hargreaves, 2012; Hargreaves et al., 2005) in Figure 1.2 includes considerably more detail than Karageorghis et al.'s (1999) conceptual framework: Karageorghis et al. addressed a purely exercise/sport-related context while Hargreaves et al.'s model applies to more general music use, but the two overlap. The reciprocal feedback model presents various constructs that may be evident in the findings here, notably the situation for listening, the music's content, how the music is perceived and the individual's background. The reciprocal feedback, in addition to its high level of detail, covers areas not included by Karageorghis et al. such as musical knowledge and the presence or absence of others.

Adherence as a theoretical construct

No adequate frameworks for exercise adherence were found in the literature (see Section 1.4), but ideas of how exercise adherence might be defined were developed in Section 1.5.1 and will be returned to in the context of the current research findings (see Section 7.4). I have suggested that adherence definitions should combine (1) aims, (2) the proportion of aims met, and (3) the period of inactivity that must elapse before behaviour constitutes non-adherence.

The intention-behaviour gap

Bridging the intention-behaviour gap has been identified as a focus for behaviour change theories (see Section 1.5.2). This concept also relates to defining adherence, since intentions and outcome behaviour can be measured. It is important that intentions are not considered to indicate behaviour.

Implementation intentions

This promising theoretical strand, where intentions are formally stated regarding implementing behaviour, addresses the intention-behaviour gap. There is evidence that it is an effective intervention in behaviour change (see Section 1.5.2), therefore it offers an approach against which music interventions can be compared.

Individual differences

Various ways of cataloguing individual differences were discussed in Chapter 1 (see Section 1.5.3). There is support for the relevance of personality to exercise adherence, and motives and strengths measurements may also apply: Reiss' (2004) 16 motives include physical activity, while Seligman (2011) discusses exercise in the context of strengths. Further investigation is needed to see if these are useful in exploring exercise music use, motivation and adherence.

Arousal and flow

Achieving an optimal state of mind was discussed in Section 1.2.1 in relation to Csikszentmihalyi (2002) and Jackson et al.'s (2001) work on flow, and Berlyne's (1971) work on arousal through aesthetic stimuli and the enjoyment of bodily exercise. Despite these theories' inference that exercise to music should be enjoyable, widespread struggles with adherence indicate other, negative influences. Flow theory suggests that peak experiences can be achieved in physical activity without music, but if this is also possible with music, the question arises of whether music and flow can be combined to encourage adherence.

Phenomenology and interpretative phenomenological analysis

The phenomenological approach is grounded in the philosophy of Husserl, Heidegger, Merleau-Ponty and Sartre (see Smith, Flowers & Larkin, 2009 for more detail). As Smith et al. (2009) describe, Husserl's focus was on recognising the essence of experience, and being able to 'bracket' the self off in order to examine experience. Heidegger found Husserl's approach too theoretical and moved to develop a more practical phenomenology, focused on being-in-the-world ('Dasein'), with reflexivity (reflection on one's own position and influence) as an important tenet. Heidegger also emphasised the importance of hermeneutics: that is, recognising interpretation issues regarding how a participant makes meaning, and how the researcher then makes meaning from that, potentially uncovering deeper, unexpected meanings. Merleau-Ponty's main contribution was a focus on embodiment and the way experience is mediated by the body being situated between the world and the individual's thoughts; this is particularly relevant to exercise as a body-focused activity. Sartre, meanwhile, emphasised existential phenomenology, the conscious ongoing attempt to make meaning to create an ever-evolving sense of self.

The psychology of exercise music assumes interaction between physiology, psychology and audiology, and understanding this is fundamental to the research aims: Merleau-Ponty's concept of the individual as a 'body-subject,' with experiences mediated by the body, is clearly relevant. Existentialism is also important because of the need to understand experience's consequences: how does the experience of music in exercise stand in relation to a sense of self and how is meaning derived from it?

Phenomenology offers scope to explore thoroughly the experience of music use. While there is much research taking a positivist, experimental approach, there is little explanation for the results, nor documentation of how music is experienced. This is particularly important in autonomous contexts because so little is known regarding how listening is self-managed during exercise.

2.2.3 Combining disciplines

The term ‘interdisciplinarity’ is often used to describe research which does not fall within a single discipline. Moran (2010) describes references to building links between disciplines, to research falling into an “undisciplined space” between disciplines, or “even attempting to transcend disciplinary boundaries” (p.14). He favours a flexible definition, although he notes a difference between multidisciplinarity, lacking integration as in joint honours studies, and interdisciplinarity, which involves some element of transformation through interaction between disciplines.

Choi and Pak (2006) present a more clearly-defined model. They investigated a range of definitions of multidisciplinarity, interdisciplinarity and transdisciplinarity, concluding, like Moran, that differentiation between the approaches related to integration. Multidisciplinarity, they suggested, involves individual specialists each approaching an issue from their discipline to present information to a team leader, as might happen in a GP exercise referral: a GP identifies a medical issue which exercise might alleviate and a fitness instructor creates a programme excluding activities that the GP suggests are unsuitable. These professional activities are carried out separately, without either party being aware of the expertise underpinning the other’s activities. Were the GP and instructor to work together to produce an exercise programme informed by both medical and exercise knowledge, this would reflect interdisciplinarity, which Choi and Pak (2006) describe as a “synthesis of two or more disciplines, establishing a new level of discourse and integration of knowledge” (p. 355). Transdisciplinarity takes this a step further, with experts sharing roles and developing knowledge, so that the instructor’s medical knowledge increases and the GP’s understanding of exercise and gym use increases, allowing parties to work beyond their specific disciplines.

Choi and Pak’s definitions above are applied in the context of research teams. For the doctoral researcher working non-collaboratively (beyond supervisor guidance), this implies that any research combing the approaches of two or more disciplines demands a transdisciplinary stance. The researcher must have an appropriate level of understanding of any discipline on which he or she wishes to draw, to the extent that it can be applied to the research and its design.

There is often overlap between academic disciplines: for example, Hollway (2007) discusses ‘psychological social psychology’ (PSP) and ‘sociological social psychology’ (SSP), with PSP taking a predominantly experimental approach to examine the effects of social stimuli on individuals, while SSP uses primarily observation and surveys, with a greater focus on individual-social reciprocity. This study draws on the disciplines of music psychology, exercise psychology, health psychology, musicology, philosophy and sociology, and is also informed by vocational fitness instruction training.

There is debate regarding the desirability of combining methods within a research project. Despite the overlap in the area of interest between PSP and SSP, Hollway notes a lack of interaction between the two strands, although her source dates from 1978. Brewer and Hunter (2006) state their 1989 call for “combining different styles or methods in the same research project” (p.xi) has been answered. Hollway (2007), on the other hand, is highly critical of experimental methods, while Brewer and Hunter’s position is that all methods have weaknesses, but can be combined effectively to compensate for this. In the next section, I consider multi- or mixed method research as an approach for the current project.

2.2.4 Mixed methods

Combining qualitative and quantitative approaches is sometimes deemed problematic because it attempts to reconcile constructivist and positivist epistemologies which are perceived as incompatible (for example, in Hollway et al., 2007). However, although qualitative and quantitative approaches may initially appear dichotomous, there are many exceptions (Bergman, 2008), deconstructing the opposition in which they are often placed.

Concerns over psychology becoming overly reductionist, and relying too heavily on biological explanations, have a long history. Jessor (1958) questions the hierarchy of disciplines that places physics at the top, arguing that reducing disciplines to commonalities threatens the development of each, and that unification should not privilege any discipline. Webster (1973) expresses concern regarding the reduction of sociology to psychology because of psychology's inability to explain social phenomena, reflected by unexplained variance in empirical psychological studies. These observations are still relevant to psychology today, as seen in the previous section. More recently, Tryon (2012a,b) has argued that reductionism involves trying to explain psychological function in biological terms, but that this cannot explain behaviour and that material and mental causes need to be taken into account. The overall argument here is that psychology is too fragmented.

Jessor (1958), Webster (1973) and Tryon (2012a, b) reflect over fifty years of argument that reductionism can impede understanding of behaviour. Within a mixed framework, multiple approaches to collecting data help ensure the weaknesses of one method are addressed through the strengths of another (Furr, 2009). Furr's summary of ways to collect behavioural data (e.g. formal measures, self-reports and observation) outlines such issues. He finds weaknesses within individual methods, such as participants behaving atypically when being observed due to self-presentation concerns, biased observation, self-report accuracy, and the practical demands often made on researchers' time. By careful selection and combination of methods, more breadth can be achieved. Brewer and Hunter's (2006) position corresponds with this.

Parker (2005) also endorses mixed methods:

> "Radical research can be quantitative, but the methodological questions about standpoint, knowledge, subjectivity and history are as relevant to statistics and other quantitative approaches as they are for the qualitative study of action and experience in psychology" (p.10).

Nevertheless, he is critical of quantitative methods “because psychologists often do quantitative research so badly” (p.9), noting subjective elements of quantitative approaches. This issue is perhaps more associated with qualitative research than quantitative, but Parker is not alone in relating it to quantitative methods: Hollway et al. (2007) take a similar position. It is vital to recognise limitations in qualitative and quantitative research as not only the result of intrinsic methods, but also of extrinsic factors such as social, cultural, historical and geographical context.

While highly-controlled experimental designs can isolate variables for exploration, Karoly (1998) notes that "self-regulation cannot occur in a psychosocial or cultural vacuum" (p. 744), indicating that the laboratory environment may create a situation that is so unnatural that participants' responses have little applicability elsewhere. This arises because of the complexity of social constructs and the way in which the individual interacts with the social environment, and is a particular issue with musical stimuli. Researchers can generate simple stimuli to investigate differences in response to, for example, a melody in a major key compared to a melody in a minor key, without varying other parameters, but this may bear little relation to the way melody is normally heard, in the context of harmony, rhythm and with possible non-musical associations. Bramley, Dibben and Rowe (2012) looked at the effect of music tempo on gambling responses, using an instrumental piece in an electronic style played at two different tempi. This varies not only the bpm, but also the melody, rhythmic patterns and rate of harmonic change. In terms of controlling the tempo variable while maintaining ecological validity in terms of musical style, this showed considerable procedural rigour, yet in real-life situations, listeners will generally select familiar music for their activities when given the choice (hence DeNora’s (2000) observations of competency in choosing appropriate music), and so non-musical associations may also be triggered: researcher-generated stimuli are unlikely to achieve the same effect. Bramley and her colleagues have extended their work by exploring self-selected gambling music through quantitative and qualitative studies (Bramley, Dibben & Rowe, 2013). These studies represent a mixed methods approach to understanding the use and effect of music on behaviour in a particular context – gambling – while the aim with the current study was to do likewise in exercise.

The studies in this thesis utilise mixed methods as an appropriate way to explore an under-researched area. Bartholomew and Brown (2012) note that mixed methods is particularly appropriate in culture-specific psychological research because it does not impose “Western norms” (p.177). There is a similar danger in approaching a study of use of music in exercise, where assumptions may be made about individual’s exercise music use, influencing research design. Throughout the studies, qualitative data was collected, even when the focus of the data collection was quantitative, so that participants could express thoughts that they felt should be considered. Feedback in addition to standard survey tick-box responses was actively sought to generate a more comprehensive understanding of the individual experiences alongside common trends.

Green et al. (2014) note that mixed methods have various approaches to integrating qualitative and quantitative data, and that either can inform the other; they also note the importance of comparing findings from the different approaches, using qualitative data to explore exceptions to statistical trends found in the quantitative data, and also to help design subsequent quantitative studies. The structure of the project in this thesis involved both quantitative and qualitative findings informing the design of the final quantitative study.

The first two studies looked at how exercisers utilise music in their workouts. Study 1 used an online survey which collected data about participants’ use of music and exercise practices, alongside information on their music training and some measures of individual difference. They were also asked about whether they made exercise plans, whether they stuck to them, and if not, their reasons for missing workouts. Study 2 explored these factors in more detail through interviews with a small sample of the participants from Study 1, using interpretative phenomenological analysis to explore personal experiences and meanings in exercise music. Studies 1 and 2 were integrated, and all interviews in Study 2 involved some questions regarding the responses in Study 1.

Study 3 explored exercise frequency, media use and individual differences among members of a local authority gym, using a questionnaire to explore the latter two variables, while exercise frequency was measured using retrospective data from the gym's computerised system for gym exercise and questionnaire items for non-gym exercise.

Study 4's quantitative exploration of pre-exercise interventions was supported by data in Study 1, which indicated that (1) some exercisers listen to music prior to exercising or taking part in competition (also explored by Bishop et al., 2007), and (2) that some exercisers reported not doing so because it had not occurred to them. These observations suggest that some exercisers have found a benefit to pre-activity music listening, and that this might also be the case for those who have not considered it before. The relationship between music choice and emotion can be causal in either direction (Konečni, 2010) and music can be used in therapeutic settings to motivate behaviour change (Thaut & Wheeler, 2010), suggesting a possible role for pre-exercise music in adherence.

The overall methodological approach taken for this project emphasises ecological validity, looking at activities in participants' usual exercise settings through both quantitative and qualitative methods, and the application of these is covered in Section 2.5.2. Ecological validity of music stimuli is also vital to generate relevant results (Demorest, 1995), and so the study will examine both self-selected music (e.g. when using PLDs) and other-selected music (e.g. when attending exercise classes) to understand experiences and preferences in depth.

2.2.5 Interpretative phenomenological analysis

Interpretative phenomenological analysis (IPA) provides an analytical method for qualitative data corresponding to the philosophical tenets of phenomenology: Smith and Eatough (2012) describe its "central concern" as "the analysis of how individuals make sense of their lived experiences" (p.441). The approach allows investigation of the 'what-it-is-like'ness of music use in exercise, considering individual experiences of choosing music and listening to it during a workout. This potentially takes understanding beyond the 'what' – what music, what activities, what outcomes– to focus on the 'how' and 'why' of individual lived experience, adding an individual perspective to the results from survey data and studies of behavioural outcomes. In this section, I discuss the theoretical arguments regarding IPA. The process which I use in the research, following Smith, Flowers and Larkin (2009), is detailed in Section 4.3.4.

The interpretative strand of phenomenological analysis has been widely scrutinised and there are several areas of disagreement. The first controversial element of Smith and his colleagues' IPA, which Smith developed (Willig, 2008), is its incorporation of cognition. Smith and Eatough (2012) contrast hot cognition, defined as "the process of trying to make sense of issues in one's life which are current, important and emotive" (Glossary, Breakwell, Smith & Wright, 2012, p. 551) and referring to the individual's most immediate concerns, with cool cognition, which involves longer term reflection. Willig (2008) challenges the centrality of cognition because of its reliance on a Cartesian dualism with a distinction between subject and object. This presents the individual separated from the world around them, which some critical social psychologists (see Hollway, 2007, for example) have questioned, although Murray and Holmes (2013) suggest that IPA has tried to overcome dualism.

Smith et al. (2009) argue that cognition is central to sense-making because mental activity takes place in a context of "life goals, relationships, personal and professional projects, and with the factors that facilitate or inhibit them" (p.188). Smith's colleagues, Larkin, Eatough and Osborn (2011), state that phenomenology and cognition must work together because cognition has to be seen as embodied and situated. There is, for these theorists, considerable difficulty taking cognition out of the process, and given IPA's use within the discipline of psychology, to dispense with cognition would be to let go a substantial element of the wider concerns.

A second debate is centred on the concept of *epoché*, or 'bracketing off.' Langdridge (2007) defines this as "the process by which we *attempt* to abstain from our presuppositions" (p.17:

my italics), and it involves a process of the researcher trying to stand back from their work and view it objectively – a practice which theorists have often questioned. From a philosophical perspective, Husserl advocated the process, while Heidegger, Merleau-Ponty and Sartre were more sceptical (Langdridge, 2007). Willig (2008) notes that epoché is more a tenet of descriptive phenomenological analysis than of IPA, and Smith et al. (2009) question whether effective epoché is at all possible in IPA. Instead, they focus on hermeneutics, the levels of interpretation involved with participants making sense of experience and researchers making sense of participants; this acknowledges the role of the researcher, but advocates acknowledgement rather than detachment. Smith and Osborn (2008) describe this as involving a double hermeneutic:

> "The participants are trying to make sense of their world; the researcher is trying to make sense of the participants trying to make sense of their world" (p.53).

Given this recognition of the complexity of understanding utterances, it should be noted that as the researcher disseminates their findings, audiences may create further layers of meaning and add further hermeneutics.

More important, arguably, than epoché is the recognition of the difficulty in achieving it because of the reporting. An important part of the IPA approach, therefore, is to consider what these influences are and how they may have affected the research. This is the process of reflexivity, which Willig (2008) describes below, also recognising epoché as somewhat futile:

> "*Reflexivity* requires an awareness of the researcher's contribution to the construction of meanings throughout the research process, and an acknowledgement of the impossibility of remaining 'outside of' one's subject matter while conducting research" (p.10).

The need for reflexivity goes beyond IPA; the researcher's background inevitably contributes to how any research is carried out, in terms of methods, populations and research focus and questions. I return to this in the Discussion (Chapter 7), particularly in Section 7.7.2.

IPA is an important part of this thesis because of the scope to look at participants' individual experiences, taking knowledge beyond statistical trends and using a systematic approach to identify key experiential themes. Additionally, principles associated with IPA such as reflexivity provide a useful tool to evaluate all the research, including the studies using quantitative approaches.

2.2.6 Summary of theoretical approach

The study draws on a number of theoretical frameworks and models that appear to have relevance to the research question. While Evans et al. (2011) note a lack of consistency in mixed methods frameworks, and the combination here is without precedent, this study has a need for transdisciplinarity. The varied disciplines from which the frameworks are taken therefore reflect the needs of the research, and by grounding this project in previous work, the aim is to produce a project reflecting a synthesis of these disciplines.

2.3 Rationale

The key research question – can music boost exercise adherence? – can be divided into three main areas to be covered in the thesis, concerning firstly how music is used by exercisers, secondly how various factors may be influencing adherence and thirdly how any findings from studies of these two areas might be used to devise musical interventions that could help exercise adherence. These research questions were outlined in Section 2.1 and an overview of the project is shown in Figure

2.1. Three of the four studies use quantitative methods to analyse relationships between variables and hence identify those which are particularly significant, showing trends in larger populations. The designs of the quantitative studies allow substantial numbers of participants to be recruited and a large amount of data to be collected that can be represented numerically. The remaining study (Study 2) is qualitative.

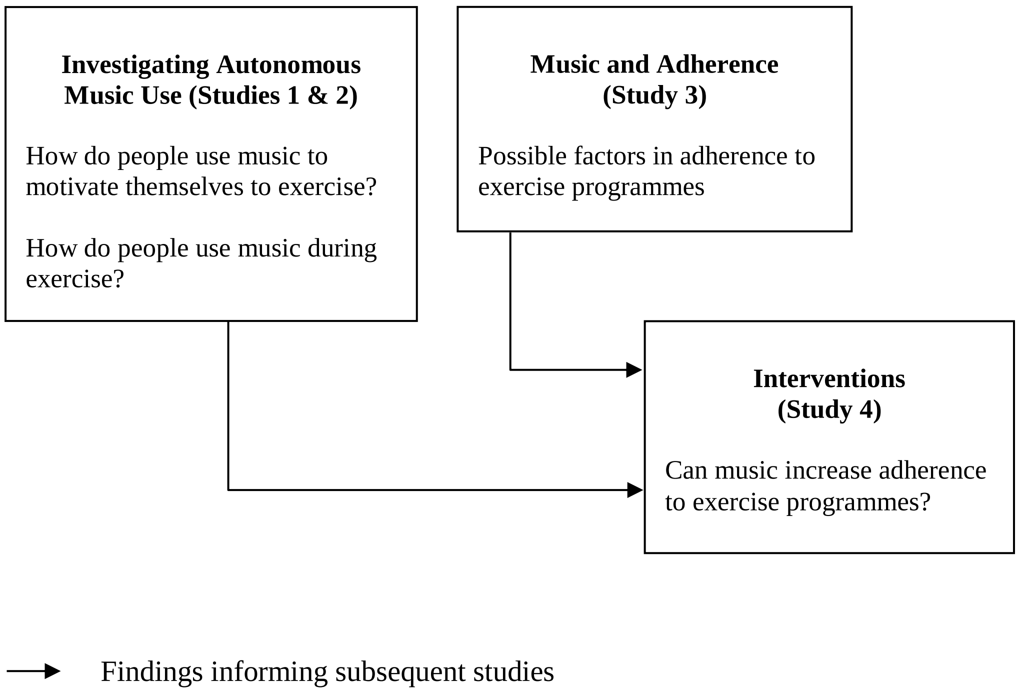


Figure 2.1: Outline of research studies

In addition to quantitative methods, the question ‘how’ is a central theme. The surveys used to collect quantitative data also incorporated qualitative elements, which could subsequently be coded to provide quantitative data via coding (such as preferred musical style, taking into account all styles mentioned by participants, rather than participants choosing from a researcher-constructed checklist). Quantitative data can also be used as a starting point for further exploration through qualitative methods such as in-depth interviews.

The various theories outlined in Section 2.2 draw on a number of different disciplines, and the methodological approach reflects the transdisciplinarity of the research aims. Mixed methods are used in the study as complementary techniques. Quantitative methods are used to identify statistical relationships between variables across relatively large samples (the smallest study here had 60 participants). Qualitative methods are used to explore those findings at a more individual level, looking at possible explanatory phenomena.

The Karageorghis et al. (1999) framework and the reciprocal feedback model (Hargreaves, 2005, 2012) present models which might find support through quantitative methods measuring relationships between variables, or through qualitative methods exploring the subjective meanings of these relationships. Individual differences are normally measured through self-report questionnaires and analysed quantitatively, and these measures will be used in the studies here. Implementation intentions and the intention-behaviour gap can both be considered quantitatively in intervention studies, and investigated qualitatively to find out how people motivate themselves, and to what they attribute difficulties in converting intention to behaviour.

There are roles for qualitative and quantitative methods, and also for various methods of data collection. For qualitative data collection, surveys and interviews will be used. For quantitative data, methods will include self-report surveys and retrospective data from a computerised gym workout system.

2.4 The Studies

As previously mentioned, the four studies form two ‘blocks’ of investigation, with Studies 1 and 2 examining the music and exercise practices of exercisers, and Studies 3 and 4 investigating whether music could be a factor in helping exercisers adhere to their plans.

2.4.1 Study 1

The first study consisted of an online survey, with almost 300 participants, 10 of which were subsequently interviewed for Study 2. The aim of Study 1 was to explore activities, motivations and music use among exercisers to see trends across the sample. For analysis, I used correlations along with chi-square tests of independence, *t*-tests and ANOVAs. The chi-square tests were necessary for categorical data, such as music style. Because the design of the survey invited free responses for some questions (for example, describing the music listened to during an activity), some variables needed coding prior to analysis. This is discussed in detail in Chapter 3.

2.4.2 Study 2

To understand possible reasons behind statistical findings in Study 1, a qualitative approach was needed. Study 2 used IPA with data collected in interviews with 10 of the survey participants from Study 1. Because of the focus on experience at both an individual and group level, IPA offered a particularly appropriate way to analyse the data. Smith et al.'s (2009) approach was suitable because of its engagement with cognition, an important element of psychology, and their method formed the basis of the analysis in Study 2, facilitating deeper insight into individual experiences of exercise and music so that trends could be related to individual phenomenologies. The study is covered in Chapter 4.

2.4.3 Study 3

While music may offer benefits for exercisers during their workouts, it is of little consequence if individuals are failing to take part in physical activity in the first place, therefore greater understanding of factors underlying exercise behaviour is required. Study 3 took a sample of 60 gym members and through a self-report survey, collected data on media use in the gym, personality, motives and strengths. Retrospective attendance data was collected from Fitlinxx, a computerised gym workout system installed at the facility where participants were members. This was accessed using a five-digit code provided by the participants, and the Fitlinxx data was supplemented with self-reports of additional, unlogged activity. The aim of the study was to explore possible factors relating to exercise frequency. The study is covered in Chapter 5.

Data collection involved looking through detailed exercise history, and information was recorded regarding the type of workout done and on what day, using a manual record sheet. Although there was a large volume of data on the system, accessing it was time consuming and it was not possible to print out tailored reports. Activities were listed, but, the length of time spent in the gym was not normally recorded.

While the system held a large amount of useful data that was invaluable in the analysis, it had to be used in the context of 'real world' use, and questions regarding other activities and the extent to which these were logged were included in the questionnaire. Some participants logged all activity on the system, including non-gym workouts and physical activity such as gardening, while others took part in other activities but did not record them. Familiarity with the system from having worked at the facility was vital to the research design: had this not been the case, the issue might not have been anticipated and the accuracy of the frequency data compromised. The design had to be considered in the context of what information could reasonably be procured both from the Fitlinxx system and via survey data.

The analysis of Study 3 data involved correlations and regression analysis to establish relationships between individual differences, media use and frequency of exercise. Preparation of the raw data included verifying the reliability of the motives measurements and taking the retrospective exercise data and converting it into scalar variables. These processes are discussed in detail in Chapter 5.

2.4.4 Study 4

The final study was designed to compare the effects of a musical and non-musical pre-exercise intervention on adherence, with a control group also included. Those returning to exercise after a break or lapse, or who had not exercised before, participated for a year in order to incorporate the 9 month drop-out period (Weinberg and Gould, 2007). Those already regularly exercising participated for six months. Short online surveys were used at monthly intervals to collect exercise data. Weight, resting heart rate and cardiovascular fitness data was collected quarterly.

Participants were allocated randomly to one of three conditions: the first group played music prior to exercising, the second group used a non-music intervention (implementation intentions) as a pre-exercise motivational tool, and the third group had no intervention. The surveys were tailored to each group. Control groups are particularly important in intervention studies because taking part in research can itself affect behaviour, and recording exercise (as all participants were required to do) might have helped participants adhere. Participant feedback indicated that this was indeed the case, with participants commenting that taking part helped them to exercise regularly.

The analytical approach was mainly quantitative, looking at statistical outcomes for exercisers over the period of the study. This involved comparison of different groups, using *t*-tests and ANOVAs, and their non-parametric equivalents, as well as correlational analysis. Adherence outcomes were compared against initial plans, and changes in fitness measurements over the period were analysed.

2.5 Methodological Practicalities

2.5.1 Precedents

As discussed in Chapter 1, there is a substantial body of lab-based research looking at musical response in exercise across a sample. While this might correspond to exercising with other-selected music in exercise classes, or listening to music over gym PA systems, choosing one's own music to play on a PLD allows the exerciser to select whatever tracks they personally find most motivating. Although some research has incorporated self-selected music stimuli, participants' choices were not disclosed (Bharani et al., 2004; Potteiger et al., 2000). The focus of this study of self-selected music in exercise does not have a direct precedent.

Other elements of the research here reflect previously-used methods. Rhodes and Courneya and their colleagues' research measured adherence in relation to self-chosen targets, and their personality questionnaires were well-validated measures. In the studies here, the TIPI (Gosling et al., 2003) has been used rather than longer questionnaires because it is established as reliable, and because brevity is important to minimise inconvenience to participants. Measurements for motives and strengths are less well-established, although both Reiss (2009b) and Seligman (2011) included self-assessment tools in their books. The detailed Reiss Profile requires licensing and training for those wishing to use it. This was not financially viable for the current study: however, the available simplified measures were worthy of investigation, and significant findings may support future use of the detailed Reiss Profile. Additionally, the published self-assessment tool had 96 questions, rather than the 128 in the unpublished Reiss Profile, making it more practical.

A similar situation was encountered with measuring strengths; however, while the Reiss self-assessment tool uses six items for each motive, the Seligman self-assessment tool has only two items per strength, with 48 questions in all. Large inventories are problematic because participants may be reluctant to complete time-consuming tasks, or may omit responses. This is less problematic in the TIPI, where five personality traits are measured through just 10 self-assessment questions.

No precedent was identified for the data collected from a computerised gym workout system in Study 3. Fitlinxx, the system in question, is one of several different brands of computerised workout system. Members log in with an access code on entering the gym, enter their code into cardiovascular and weights machines, and their exercise is logged. Retrospective data for gym attendance is accessed by searching through Fitlinxx records. The advantage of using retrospective data was that participation could not affect behaviour that had already taken place: when data is collected after a study commences, participants may exercise because of wishing to please a researcher, or through worries of being judged for infrequent attendance. Retrospective data avoided effects on behaviour.

2.5.2 Field-based research

Because this study explored how exercisers use music, and how they might apply it to assist adherence to preferred activities, it was important for the research to be field-based, reflecting individuals' usual exercise practices. Johnson (1975) stated that field research is typically referred to as 'qualitative,' but in the research here, quantitative methods were also used with data collected from the field; for example, Study 3 used exercise records from the participants' gym, a regular exercise venue for them. Johnson was writing as a sociologist, using field research for observational studies. The development of the internet since the time at which he was writing expands the potential for field research, facilitating data collection without the researcher needing to be physically present.

2.5.3 Self-reported data

Much of the data collected during this research was self-reported. This includes responses to individual differences instruments (validated and reliable in the case of the TIPI, but with less such evidence for measures of motives and strengths), responses to other survey questions such as self-measured fitness tests and reported time taken to walk or run 5 kilometres (3.1 miles), and the provision of qualitative data through open survey questions and interviews.

Self-reported data carries with it issues of verification; nevertheless, in a study such as this, which is partly exploratory, it can indicate worthwhile directions to pursue in studies where variables are measured more reliably. There is also the problem of response bias (Creswell, 2009): questions not responded to may be those for which answers would be particularly pertinent to the results, but participants do not wish to disclose the information. This must be balanced with Fricker and Schonlau’s (2002) observation that self-administered surveys can reduce behavioural biases because the desire for social acceptability in face-to-face interviews is removed, indicating an advantage for self-report. However, Jalal, Taylor and Hinton (2014) attributed reports of more sleep paralysis online than in interview to over-reporting online rather than under-reporting in face-to-face situations, indicating that in interviews, the definition of sleep paralysis could be clarified. There is, therefore, a risk with the studies here that self-reported data incorporates misunderstandings among participants with less knowledge of fitness concepts and terminology. Care must therefore be taken to avoid technical language.

Research has also looked at differences between self-reported and measured activity in health-related contexts, but reasons given for differences have tended to be speculative. Bond et al. (2010) found a substantial difference between patients’ reports of physical activity after bariatric surgery: 55% claimed to be achieving target activity levels, while an accelerometer indicated only 5% were doing so. The authors suggested various possible reasons, including perceptions of the level of intensity required, gadget malfunction, a sense of having more energy than prior to surgery and the small sample size. There is also the question of whether bariatric patients' self-report patterns were similar to, for example, regular exercisers.

Hedman et al.'s (2010) study of social phobia compared online and paper-and-pencil self-reports, finding little difference in responses for various measurements other than the Quality of Life Inventory: they suggest that, given the large amount of data collected through a range of inventories, at least one discrepancy would be expected. Herring et al. (2013) attributed differences between self-reports of sleep and actigraph measurements to the practical difficulty in self-estimating sleep duration: 39% of participants overestimated by more than an hour, and 23% underestimated by more than an hour.

Some biases in self-report data may be down to procedures. For example, Health Survey England, a collection of health data that has been compiled regularly since 1991 (http://www.hscic.gov.uk/article/3741/Health-Survey-for-England-Health-social-care-and-lifestyles), assesses exercise activity by asking participants in an interview how many times they exercised over the previous four weeks, raising issues of data accuracy because of the demands made on memory. In this thesis, data collection has avoided reliance on memory: in Study 3, a substantial amount of exercise data had already been computer-recorded, while for each survey in Study 4, participants were emailed in advance and asked to keep a diary of their activity over the coming week, giving clear indications of the required information and inviting them to note it down during the course of the week. The surveys also collected qualitative data, where individual expression of opinion or practices is fundamental to understanding experience. Additionally, online survey methods meant that the studies were open to a wide range of participants, including those from overseas, since a researcher did not have to be present to record activity or behaviour. Surveys offer an economical, efficient way to collect data and the scope to increase the participant pool geographically.

Although some questions explored were without precedent, established protocols were used where possible to minimise subjectivity: for example, participants in Study 4 measured their fitness levels with a validated test (Bailey, Shephard & Mirwa, 1976). This can still be subject to misreporting, either through participants carrying out the protocols incorrectly or reporting inflated figures to please researchers or through concern that they might not have performed adequately. However, the measure is more objective than using a Likert scale ranging from very fit to very unfit, where it is unclear what fitness attributes relate to different scale points.

2.5.4 Recruitment

Since much of the research on exercise music has been carried out with young participants, particularly sports science undergraduates, where high fitness levels would be expected, it was important to find participants from a wider age range to reflect the characteristics of the general population, who would not typically have sports science undergraduates' specialist knowledge and training. Additionally, it was important to be able to collect data relating to real-life settings, in order to reflect typical exercise practices rather than protocols developed for laboratory exercise research.

Recruitment of participants poses a challenge for many research projects. The method used for the studies here was snowballing, publicising the research through a variety of channels including leaflets, posters, word of mouth, my own website, a local parkrun (weekly 5k time-trials, held at a large number of UK venues, www.parkrun.com), www.fetcheveryone.com (an online running community of which I have been a member since 2007), and through Twitter and Facebook. Some of these channels overlap (Hanley parkrun has an active Twitter and Facebook presence, for example).

A large element of recruitment involved online channels. They were practical for building large samples because of the ease of communicating information about the research, and because the information could be shared by recipients in its original form, rather than misrepresented through word of mouth.

A disadvantage of snowballing is that participants come from researchers' circles of contact, and those contacts' contacts, which can lead to homogeneity in terms of demographic background, interests and other bases on which social relationships are formed. Participants were also likely to be active online, which may again suggest certain demographic profiles, since use is lower among older people and the less affluent. In 2013, fewer than 40% of over-65s used a computer every day, compared with 70% across the adult population. Of the 4 million households without internet access, equipment costs and access costs were barriers to 13% and 12% respectively (Office for National Statistics, 2013).

Educational attainment in these studies was higher than in the general population: in Study 1, for example, three times as many participants had undergraduate degrees than would be expected in a random UK population sample. Nevertheless, a wide range of ages and fitness levels took part in the studies, ranging in age from 18 to 77, from those who might be described as beginners to marathon runners and participants who had competed at international level.

2.5.5 Online tools

Online research tools offer considerable potential because of their convenience and low cost. As a relatively new option for research, the implications are still very much under consideration. James and Busher (2009) note that online responses tend to be thought through more than interview answers because the psychological discomfort of silence, which can influence an interview, is avoided. The book focuses on gathering qualitative data in online communities, so covers ethical concerns regarding 'lurking' which are not relevant to the design of the studies here, where informed consent was given prior to participants providing data.

Fricker and Schonlau (2002) debate cost savings, noting the time taken to programme surveys and to enter data from email responses. However, software such as SmartSurvey presents a straightforward way to set up a survey and to export resulting data to statistics software, leading to cost savings, particularly compared with traditional mail survey methods. Lefever, Dal and Matthíasdóttir (2007) note difficulties recruiting participants because of unwillingness among those invited to participate, and lack of control over responses to open invitations, although this is not limited to online research methods. Neither of these papers considers social media as a means of recruitment, and the popularity of social networking sites such as Facebook has seen substantial growth relatively recently. Online research tools are a dynamic resource, and publications regarding their use are likely to become obsolete rapidly because of technological development. Technology provides the opportunity for new research approaches, but these may depend on researchers ensuring they are familiar with the options because of the time taken to build an audience using social media.

The research here made extensive use of online technology for recruitment and data collection. Social media was used for recruitment, alongside offline activity such as approaching gym members and runners at Hanley parkrun with information about the research. Online surveys were used in Studies 1, 3 and 4. In the Study 3, hard copies were provided, although few participants took this option. In subsequent studies, the surveys had to be completed online. The surveys were created using SmartSurvey, an online provider to which Keele University subscribes, with links provided via social media and on posters and flyers. Overall, online tools provided an effective way to find participants, and to manage data collection, helping to increase the powering of the studies.

2.6 Reflexivity

> "Production of social scientific knowledge about the world is itself a social activity" (Woolgar and Ashmore, 1988).

In the discussion of phenomenology (Section 2.2.2) and IPA (Section 2.2.5), I suggested that reflexivity was a more useful aspect of IPA than epoché, which it has been argued is unachievable. Reflexivity is a process of acknowledging the situated nature of one's research, and Willig (2008) identified two types: personal, reflecting the influence of the researcher's own stance, social identity and background; and epistemological, relating to the effect of methods on outcomes. Epistemological reflexivity is expected in quantitative and qualitative research reports, while personal reflexivity is associated with qualitative approaches.

Personal reflexivity is generally accepted as an important element of qualitative research; I have argued in its favour, and done so in a mixed methods context. It therefore follows that personal reflexivity should be extended to the quantitative studies. It is relevant to the design stages, where my knowledge of the research context influenced structure and content of surveys. Recruitment of participants again followed particular avenues that were found to be most successful, and these choices of recruitment venue and my own understandings of the people and systems involved undoubtedly influenced how I discussed the research and invited people to take part. My processing of the data and decisions made on categorisation again demonstrates the application of arbitrary processes that relate to my experiences and understanding of music, exercise and adherence.

Woolgar and Ashmore (1988) noted that reflexivity is often regarded as a problem, yet this itself is contextual, representing positivist evaluation from a perspective that advocates maximising control. Control *can* be maximised, but can never be complete for the reasons discussed previously. Reflexivity, therefore, will form an important element of reflection on the project and its findings.

Reflexivity has been used previously in mixed methods research by Walker, Read and Priest (2013). The initial part of their study was quantitative, collecting baseline data. The authors suggested that widespread lack of [personal] reflexivity in quantitative approaches (the epistemological-personal distinction is not mentioned) was firstly because it was not seen to add anything to data perceived as 'factual,' and secondly because it may have given the impression of inadequate controls. Nevertheless, they acknowledged that few researchers would argue that quantitative research is completely objective, suggesting its benefits are to safeguard against bias, and to add transparency, but that it is most useful to provide a broader view of the research process.

Shaw (2010) also argues in favour of reflexivity to make research more transparent. In contrast to Willig's two-part reflexivity, she refers to Woolgar's continuum of reflexivity ranging from a radical approach where no account has superior value, to an introspection which tries to be "accurate" (p.21) with object and representation kept distinct. This suggests various styles and degrees of engagement, from a critical, personal reflexivity to epoché, although it is questionable whether accuracy is attainable.

Bishop and Shepherd (2011) discussed the implications for reflexivity during qualitative data collection, recognising that participants' awareness of similarities between their personal narratives and the researcher's may affect disclosure. They identified failure to explore some avenues because of a researcher assumption that the similarities between their self-narratives and their participants' gave them privileged understanding; in post-interview reflection, they questioned this, leading to a particularly detailed and critical reflexivity.

A range of approaches to reflexivity are presented here. Willig's recognition of epistemological and personal reflexivity (2008) is a particularly useful model because it provides a framework to consider both qualitative and quantitative reflexivity and address any issues regarding transparency. Reflexivity will therefore be used throughout the study to reflect on research processes and the influence of my background along with methodological choices, bearing in mind that epistemological approaches may be influenced by personal biases, so the two types should not be seen as dichotomous. I consider reflexivity and how it might have affected the studies in Sections 4.5.1 and 7.7.

2.7 Ethics

Ethical approval was obtained from Keele University Ethics Committee for all studies prior to data collection being carried out, with survey materials being approved by the Committee prior to circulation, and the ethical guidelines of the BPS (British Psychological Society, 2009) were followed. All participants provided informed consent prior to taking part, and were advised that they could withdraw at any time. Anonymity has been preserved through the use of pseudonyms where participants have been directly quoted. Copies of the approval letters from the committee can be found at the end of the Appendices in Appendix J: Ethical approval letters.

2.8 Summary

In this chapter, I have considered research aims and questions, discussed theoretical frameworks and looked at the overall rationale for the studies here. I have outlined the individual studies, considered practicalities related to them and discussed the importance of reflexivity. I identified a number of issues arising through lack of precedents, access to measurement tools and the influence of technology on both the research process and the object of the research – that is, the practice of listening to music during exercise. The next four chapters (Chapters 3 to 6) discuss each study individually, and this is followed by a general discussion of the findings of all the studies in Chapter 7.

Chapter 3

Study 1: A survey study of music use in exercise

3.1 Introduction

The first two studies of this thesis examine people's music and exercise practices. Study 1 relates these to demographics, individual differences and fitness-related performance, building a detailed picture of trends across the exercising population. Despite an established body of research testing effects of different aspects of music on exercise performance – including genre, tempo, volume, and music compared with no-music controls (see Section 1.4) – there was little research on exercisers' selection and use of music in autonomous situations before the current study. It was not clear, therefore, whether music selection and application in laboratory-based research corresponded to exercisers' choices and applications in their own workouts. There is a small body of research examining how personal listening devices (PLDs: see Section 1.3) are used in everyday life, including Bull's (2000, 2005, 2007) studies of Walkman and iPod use in urban spaces and Heye and Lamont's (2010) study of PLD use while travelling. However, although participants in these studies occasionally mentioned exercise music choices, the research did not specifically address PLD use in exercise. Study 1, covered in this chapter, seeks to address the gap in knowledge regarding individual use of music in exercise by uncovering trends across a large sample. This is followed in Chapter 4 by Study 2, where a subset of participants from Study 1 were interviewed in depth.

3.2 Methodological strategy

Study 1 is the first part of a strategy combining two contrasting, complementary approaches to generate a broad understanding of music selection and use in exercise. A quantitative approach with statistical analysis offered scope to find correlations between activities, preferred styles and individual differences with a view to identifying trends and characteristics across a population. However, although such a study is likely to provide useful indications of common practices, alone it would provide limited understanding of the range of experiences at an individual level. The topic is therefore examined through two studies, firstly with a large scale survey to collect predominantly quantitative data for statistical analysis (Study 1). In-depth interviews with some of the participants analysed qualitatively (Study 2: see Chapter 4) provide an indication of the practices and experiences underlying the trends identified in Study 1. Combination of the two methods offered a way of generating understanding of typical music and PLD use in exercise while also recognising how one individual's experiences while using music and PLDs in exercise might be very different from another's. The current chapter documents Study 1. Study 2 is covered in Chapter 4, at the end of which links between the two studies will be discussed (see Section 4.5.2).

3.3 Method

3.3.1 Design

I created an online survey looking at a range of variables relating to music use in exercise, covering activities, music preference, formal music training, sporting performance, exercise planning and adherence, and personality traits. The aim was to explore relationships between the variables, and both quantitative data, and qualitative data which was subsequently coded, were collected.

Exercisers, whether music users or not, were invited online and by direct approach to take part in the research by accessing and completing the survey. Analysis was carried out to indicate trends and frequencies across the participant sample, with qualitative data such as music choice coded prior to analysis.

3.3.2 Participants

Participants (*N* = 282: 159 females, 117 males, six undisclosed) ranged in age from 18 to 65, with a mean age of 37.68 years: details of the age of participants by gender are shown in Table 3.1. Most of the participants (*n* = 259) were from the UK, with three from the Republic of Ireland, five from other European countries, 14 from the US and one from Australia. Data from participants not disclosing their gender has been included in analysis of all participants, but analysis by gender has only been carried out for disclosing participants. The characteristics of the participant sample are covered in more detail in the descriptive statistics in the results section.

Table 3.1: Age of participants

		Age		
Gender	*N*	Range	*M*	*SD*
All participants	282	18-65	37.68	10.16
Female	159	18-65	36.89	9.66
Male	117	20-62	38.15	10.35

3.3.3 Materials

The survey questions can be found in Appendix A. Data was collected for variables covering age, gender and educational background, formal music training, personality, preferred sporting/exercising activities, sporting performance, whether music was used during exercise, music preferences for exercise, and exercise plans and adherence. Personality traits were measured using the TIPI (Gosling et al., 2003) a short questionnaire where participants rate ten pairs of traits as they seem them applying to themselves, such as “critical, quarrelsome” or “sympathetic, warm,” using a Likert scale. The ten word pairs represent one positive and one negative measure for each of the Big Five personality traits of Agreeableness, Conscientiousness, Extraversion, Openness and Emotional Stability (Costa and McCrae, 1988: note that the term Neuroticism is used by Costa and McCrae, while Gosling et al. prefer Emotional Stability). The ratings range from 1 (“disagree strongly”) to 7 (“agree strongly”). Negative items are then reverse-scored, the totals for each trait added together and divided by 2.

Sporting performance levels were assessed by asking participants the time they took to cover a 5 kilometre distance (‘5k,’ equivalent to 3.1 miles) by running, walking or a mixture of the two. This protocol was used because 5k is a common event distance: parkruns held across the UK have around 50,000 participants weekly, and the Cancer Research UK Race for Life, a popular first event for new runners (also often walked), is 5k. The NHS’s C25K (couch to 5k: see Section 2.1.3) podcasts are popular with beginners. Additionally, 5k paces have been used in previous research (for example Meardon, Hamill & Derrick, 2011; Warren et al., 2011), and the distance is considered an achievable goal for those starting a running programme (Warren et al., 2011). It was therefore reasonable to expect participants to be able to complete 5k, and likely to have a time they could report, particularly given the recruitment of many participants through a running website and at a parkrun (see Section 2.5.4); non-runners reported times indicating a walking speed, and the field could be left blank for those unsure of their speed. Times were adjusted for age and gender to generate a 5k Performance variable relating to world-class performances by runners of the same age and gender, using formulae in Glover and Glover (1999). Because the calculation required gender information, the variable could not be calculated for the six non-disclosing participants.

For each sport or exercise activity that participants described participating in regularly, they were asked whether they used music during it, whether they were able to choose the music and, if so, what they selected and why. Those participants who preferred not to use music during exercise were asked why, and all participants were asked whether they listened to music before or after a workout or competition.

Questions on barriers to exercise were included to see whether listening to music prior to an activity related to likelihood of undertaking a planned activity, and also to assist intervention design (see Study 4, covered in Chapter 6). DeNora (1999) reported participants using music to 'get in the mood' for non-exercise activity, while Bishop et al. (2007) studied the use of music firstly prior to competition, finding it was applied to manage arousal levels, and secondly prior to performance tasks (Bishop et al., 2009) finding it improved performance. Myers and Roth (1997) identified a 'time-effort' subset of barriers to exercise that included factors possibly relating to arousal levels, such as 'too tired,' 'too boring' and 'too lazy.' Although these studies did not identify music use as a strategy to overcome barriers, similarities regarding arousal and preparation indicate a potential link.

Participants were also asked whether they had ever obtained music designed for synchronised exercise (such as Audiofuel or Podrunner tracks). At the end of the survey, participants were invited to provide a contact email if they were willing to take part in a one-to-one interview for the second part of the study.

3.3.4 Procedure

Participants were recruited through social media (Facebook and Twitter, with friends and followers sharing and retweeting my posts), through my website (www.tunesandtreadmills.co.uk) and through flyers and posters at events and venues including Hanley parkrun (a regular Saturday morning 5k run/walk) and gyms. Altogether, 283 participants completed the survey, but one was excluded since, despite indicating being aged over 18 in the informed consent section, the age given in the survey was 17.

The publicity materials provided a link to an online survey (delivered via SmartSurvey software) where a range of quantitative and qualitative data was collected. Participants were required to tick boxes indicating informed consent and that they were aged over 18 in order to progress to the survey. Information about the research and its purpose was available via a link from the front page of the survey. The survey was designed so that there were various pathways through the questions so that participants were not inconvenienced by being asked questions not relevant to them (participants indicating that they did not use music during exercise bypassed questions on choice of exercise music, for example). Around half the respondents provided a contact email address, indicating willingness to participate in follow-up interviews.

3.3.5 Analysis

The characteristics of the sample and any unusual patterns of distribution were identified using descriptive statistics. Relationships were then explored using several different statistical analysis techniques: as much of the data was categorical, chi-square tests of independence were used to explore possible differences between categories. Cell counts should be 5 or more in 80% of cells to avoid violating assumptions (Pallant, 2010), and violations are noted in the results. Effect sizes in the chi-square test for 2x2 tables use Cohen's criteria (1988) of *phi* = .10 for a small effect, .30 for a medium effect and .50 for a large effect. For larger tables, Cramer's *V* is reported so that degrees of freedom are taken into account: effect sizes follow guidance in Pallant (2010) to take the smaller of (n_{row} categories -1) or (n_{column} categories -1), with values shown in Table 3.2.

Table 3.2: Cramer's *V* effect values

C-1 or R-1 (select smaller value)	*V*: small effect	*V*: medium effect	*V*: large effect
1	.01	.30	.50
2	.07	.21	.35
3	.06	.17	.29

For scale data, *t*-tests were used in cases of two categories (all analyses were two-tailed unless otherwise stated), and one-way between groups ANOVAs to compare groups where there were more than two categories. The age-graded performance scores for completing 5k were percentages of various world record speeds, and were therefore proportional data, so were analysed using non-parametric tests.

Where respondents were free to answer in their own words, responses were coded and categorised. This applied particularly to ‘exercuses’ (reasons not to exercise: terminology from Exercise Works! 2012) and musical preferences. Music choices were initially coded by style into the 14 categories used by Rentfrow and Gosling (2003), with additional categories added for podcasts and specifically-designed synchronous running music such as Podrunner (www.djsteveboy.com/podrunner.html) or Audiofuel (www.audiofuel.co.uk). Where multiple tracks were listed, the most common style was used for coding, with the first-mentioned style used if there was not a clear overriding style. If an artist was difficult to categorise (for example, Rihanna might be considered pop, R’n’B, dance, hiphop or reggae), the first style listed on their Wikipedia entry was used; since genre and style categorisation is subjective, and no academic sources were available for this level of description, Wikipedia’s community-authorship and comprehensive artist coverage meant it could be used consistently to provide a consensus of opinion. The styles were then collapsed to four ‘types’ of music, again following Rentfrow and Gosling (2003), with podcasts allocated to Reflective and Complex, and Podrunner and Audiofuel allocated to Energetic and Rhythmic because of their dance-based style. This allowed a more straightforward comparison of ‘types’ of music which had been previously validated, avoiding difficulties of analysis where some preference groups were very small. The allocation is summarised in Table 3.3.

Table 3.3: Styles grouped by umbrella headings

Umbrella heading	Styles included
Reflective and Complex	Classical, jazz, blues, folk and podcasts/spoken word
Intense and Rebellious	Alternative, rock and heavy metal
Upbeat and Conventional	Country, pop, religious and soundtracks
Energetic and Rhythmic	Rap/hiphop, soul/funk, electronica/dance, Audiofuel/Podrunner

Across the data, numbers of categories for analyses were reduced following the principle of parsimony, distributing participants more equally across categories for comparison since some categories were found to include very small numbers of participants following data collection. There were limited precedents available for describing synchronisation; Hallett and Lamont (2014) found of sixteen gym users, only one synchronised and this was accidental, yet Podrunner and Audiofuel are produced for synchronous exercise, and synchronisation is fundamental to many exercise classes. Categories therefore needed to include purposeful synchronisers, non-synchronisers and accidental synchronisers. Two levels of purposeful synchronisation were included so that frequent and moderate synchronisers could be differentiated; since only 16 of the 178 participants responding to this question frequently synchronised, they were combined with the moderate group of 44, to produce categories of 60 synchronisers, 70 accidental synchronisers and 48 non-synchronisers.

Duration of music training was initially assessed through five categories: no training, up to 2 years training, 2-5 years training, 6-10 years training and over 10 years training. In a longitudinal study following 157 students from 1997, Evans, McPherson and Davidson (2013) found children aged 7 to 9 were more likely to withdraw from instrumental tuition in the first two years of lessons than in the third, so this group reflects a basic level of training, corresponding to an initial phase of high withdrawal rates. Evans et al. found another increase in withdrawal from lessons in the 4th and 5th year of tuition. Beyond this, the groups reflect continued music study through secondary school (11-16 years), with the 10 year threshold indicating likely instrumental study in Further and possibly Higher Education (16-18 years and 18+ respectively). For analysis, due to numbers of respondents, the categories were collapsed to compare no training, moderate training (up to 5 years) and high levels of training (6 years or more), with the first two categories similarly-sized (n = 106 and n = 113 respectively) and the latter category somewhat smaller (n = 63).

To analyse relationships between 5k Performance and music use, t-tests were used, with manual calculations of effect size (Pallant, 2010) added to SPSS output. Effect size was assessed using Cohen's guidelines (1988) of .01 for a small effect, .06 for a moderate effect and .14 for a large effect. To explore the relationship between 5k Performance and preferred music type, and 5k Performance and propensity to synchronise, one-way between group ANOVAs were used.

3.4 Results

In Section 3.4.1, relationships between educational background, particularly formal music training, and use of music in exercise are examined. Analysis of preferences and propensity to synchronise is included, relating these factors to musical training, and reasons behind choosing not to exercise with music are presented. In Section 3.4.2, the focus is on preferred sport and exercise activities and the level at which the participants were able to perform, examining relationships between performance and music use. In Section 3.4.3 personality traits of the participants are analysed, and their relationship with music use explored. In the final section (3.4.4), participants' descriptions of their plans, adherence and their 'exercuses' – reasons given not to exercise – are related to their music use, and the extent of music use before competition and exercise sessions is examined.

3.4.1 Musical background and practices

Education and musical training

The sample's educational level was higher than that of in the general population, with the majority (81.9%) educated to graduate level or beyond, compared to 27.0% of the UK population (2011 Census). Levels of education are shown in Table 3.4.

Table 3.4: Highest level of education

	All participants		Women		Men	
Education level	*N*	%	*n*	%	*n*	%
Not given	1	0.4	-	-	1	0.9
Secondary (11-16)	14	5.0	7	4.4	7	6.0
6th Form (17-18)	36	12.8	14	8.8	20	17.1
Undergraduate	120	42.6	63	39.6	54	46.2
Postgraduate	105	37.2	72	45.3	32	27.4
Higher Professional (e.g. doctors, lawyers)	5	1.8	3	1.9	2	1.7
Vocational (e.g. apprenticeship)	1	0.4	-	-	1	0.9
Total (rounded)	282	100	159	100	117	100

30 (10.6%) participants reported vocational qualifications in addition to other higher education, and 49 participants (17.4%) had professional as well as academic qualifications.

The majority of participants (62%) had had music lessons. There are no exact comparison figures available. Recently published data from the Goldsmiths Musical Sophistication Index (Müllensiefen et al., 2014) includes a musical training measure, but this collates variables such as amount of practising with years of formal training. Hughes (2010) found that 27.2% of UK adults profess to play a musical instrument but this may include self-taught individuals while excluding those with formal training who believe they lack competence.

Levels of musical training varied by gender: approximately three quarters of the female participants had had instrumental tuition compared with half of the men. Only 12 (20.7%) of the 58 men with formal training had continued beyond 5 years, whereas the figure for women was 51 out of 115 (44.3%). The frequencies for musical training are shown in Table 3.5.

Table 3.5: Musical training (5 levels)

	All participants		Women		Men	
Amount of training	*N*	%	*n*	%	*N*	%
No training	106	37.6	44	27.7	59	50.4
< 2yrs	51	18.1	24	15.1	25	21.4
2-5yrs	62	22.0	40	25.2	21	17.9
6-10yrs	33	11.7	26	16.4	7	6.0
10+yrs	30	10.6	25	15.7	5	4.3
Total	282	100	159	100	117	100

For analysis, three levels were used: the < 2 years and 2-5 years categories were combined, as were the 6-10 years and 10+ years categories. This increased the numbers of participants in each category to ensure analysis could be carried out effectively, and demarcated the groups as having no training, moderate training (up to 5 years) and extensive training (more than 5 years). The results are shown in Table 3.6, and represented graphically in Figure 3.1, demonstrating clear gender differences, with women on average having more training than men. Men were more likely to have had no musical training than women.

Table 3.6: Musical training (3 levels)

	All participants		Women		Men	
Amount of Training	*N*	%	*n*	%	*n*	%
No training	106	37.6	44	27.7	59	50.4
Up to 5 years	113	40.1	64	40.3	46	39.3
Over 5 years	63	22.3	51	32.1	12	10.3
Total	282	100	159	100	117	100

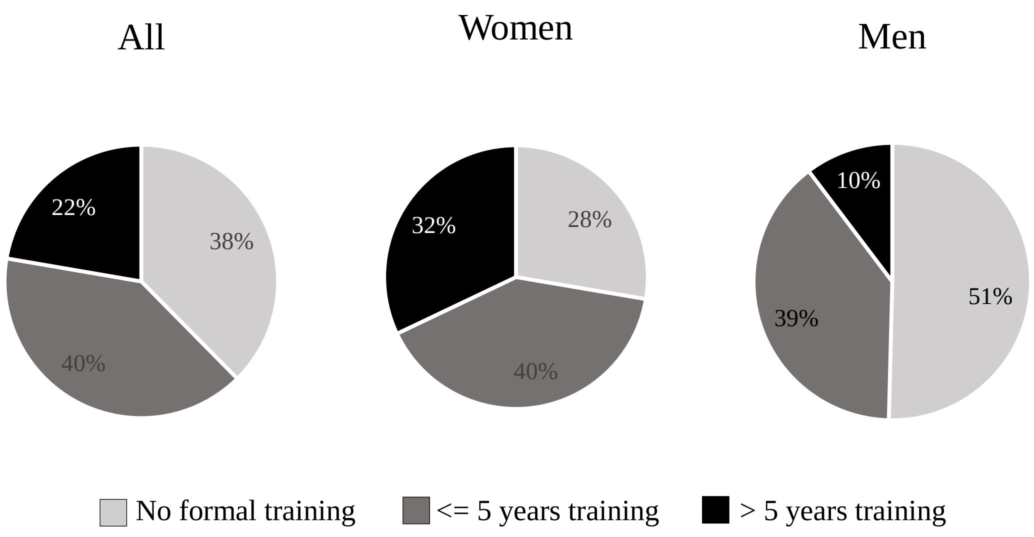


Figure 3.1: Formal music training (3 levels) – comparison of women and men

Of the 176 participants who had had instrumental tuition, 96 reported taking music exams such as the Associated Board of the Royal Schools of Music (ABRSM) grades in the UK. Of those who stated the grade reached, 50 had achieved grade 5 or above, with 17 achieving grade 8 and 3 having passed Diploma level exams (beyond grade 8). The distribution is shown in Table 3.7.

Table 3.7: Highest grade achieved in music exams

	All participants		Women		Men	
Grade achieved	*N*	%	*n*	%	*n*	%
None	183	64.9	85	53.5	92	78.6
1-5	52	18.4	37	23.3	15	12.8
6-7	15	5.3	14	8.8	1	0.9
8	17	6.0	15	9.4	2	1.7
Diploma	3	1.1	3	1.9	-	-
No response	12	4.3	5	3.1	7	6.0
Total	282	100	159	100	117	100

A small number of participants (34: 12.0%) had studied music as an academic subject post-16, with just over half continuing music study at university. As with instrumental training, the figures were higher for women than for men. A chi-square test of independence was used to explore gender differences in level of formal music training. Results were significant: χ^2 (2, n = 103) = 23.42, p < .001, V = .29 (small effect), with women having more years of musical training than men. Only 27.7% of women reported no musical training compared with 50.4% of men.

Music use

Over three quarters of participants used music to some extent during their exercise sessions (running was the most preferred activity, followed by cycling, walking, gym workouts and swimming: see Section 3.4.2). Women were more likely to use music than men (83.0% compared with 70.1%). The breakdown of music use is shown in Table 3.8.

Table 3.8: Music users

	All participants		Women		Men	
Uses music	*N*	%	*n*	%	*n*	%
Yes	219	77.7	132	83.0	82	70.1
No	63	22.3	27	17.0	35	29.9
Total	282	100	159	100	116	100

Various differences between men and women were noted in the descriptive statistics. Gender differences in music use were analysed using a chi-square test of independence. Phi was used instead of V because the analysis was 2x2 in this instance. Results were significant: χ^2 (1, n = 276) = 6.47, p = .011, *Phi* = -.15 (small effect), with women more likely than men to listen to music during exercise.

The influence of music training on exercise music use

Chi-square tests were used to explore relationships between music training (three levels) and exercise music (two levels: yes, no). There was a small, statistically significant effect: χ^2 (2, n = 282) = 6.28, p = .043, V = .15, indicating that those with more formal music training were more likely to listen to music while exercising. When analysed by gender, men showed a small, almost-significant result: χ^2 (2, n = 117) = 5.79, p = .055, V = .22, but there were no significant findings for women: χ^2 (2, n = 159) = .762, p = .683, V = .07. Comparisons of users and non-users by years of musical training can be seen in Figure 3.2.

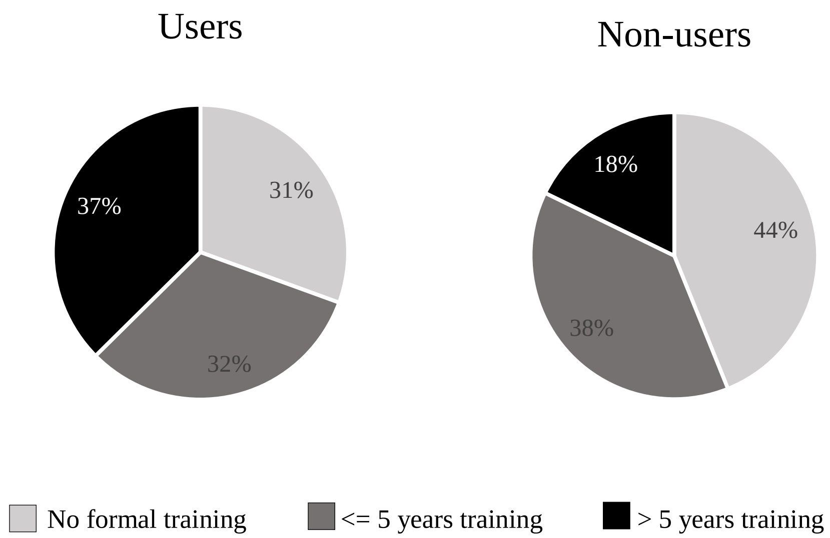


Figure 3.2: Years of formal music training and propensity to use music during exercise

Period of using music in exercise

Participants who used music while exercising were asked for how long they had been doing so. Comparisons found some inconsistencies: 33 participants reported using music during exercise for longer than they had been exercising. For three participants, the difference was a year, perhaps indicating participants were approximating. For most participants where there was a discrepancy, however, this was substantial: the largest was 24 years (*n* = 2). This suggests that the question had either been misunderstood, or that participants were perhaps recalling exercising to music in childhood, but had only begun exercising regularly more recently. Data from participants showing a discrepancy was excluded from analysis. The results are shown in Table 3.9, with the length of time in years.

Table 3.9: Length of time in years for which music had been used in exercise

	Years					
	All participants *N* = 178		Women *n* = 105		Men *n* = 70	
	Exercise	Music use	Exercise	Music use	Exercise	Music use
Maximum	40.00	33.00	33.00	33.00	40.00	30.00
Minimum	0.25	0.13	0.25	0.13	0.25	0.25
Mean	8.04	5.74	7.51	5.88	8.54	5.39
SD	7.93	5.76	7.22	5.86	8.92	5.61

Music preferences

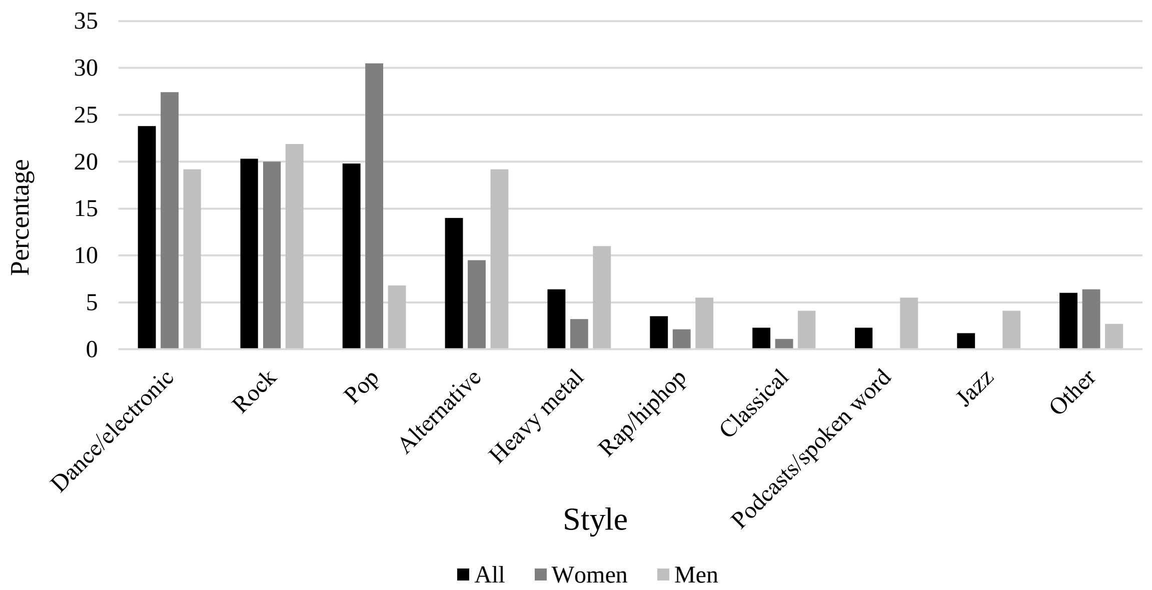
There were 172 records for the first activity where music was self-selected. Only 20 participants described music choice for a second activity and just five for a third. Music preferences were therefore analysed for only the first, most frequent activity described where music was self-selected. Participants described their selections in their own words: these were coded using the most frequently mentioned style if several tracks were mentioned, or the first-mentioned style if two or more different styles were referenced. Running was most often named as the first activity (*n* = 129) followed by gym workouts (*n* = 28): for a full list, see Table 3.16. Preferences are summarised in Table 3.10.

The bar chart in Figure 3.3 shows the variations in music preference for the more popular styles. When women's and men's preferences were compared, the clearest difference was between women's preference for pop over alternative music, while the reverse was the case for men.

Table 3.10: Style of self-selected music in Activity 1

	All participants		Women		Men	
Style	*N*	%	*n*	%	*n*	%
Dance/electronic	41	23.8	26	27.4	14	19.2
Rock	35	20.3	19	20.0	16	21.9
Pop	34	19.8	29	30.5	5	6.8
Alternative	24	14.0	9	9.5	14	19.2
Heavy metal	11	6.4	3	3.2	8	11.0
Rap/hiphop	6	3.5	2	2.1	4	5.5
Classical	4	2.3	1	1.1	3	4.1
Podcasts/spoken word	4	2.3	-	-	4	5.5
Jazz	3	1.7	-	-	3	4.1
Country	2	1.2	2	2.1	-	-
Soundtracks	2	1.2	-	-	2	2.7
Soul/funk	2	1.2	1	1.1	-	-
Audiofuel/Podrunner	2	1.2	2	2.1	-	-
Blues	1	0.6	-	-	-	-
Religious	1	0.6	1	1.1	-	-
Total	172	100	95	100	73	100

Categories from Rentfrow and Gosling (2003) with Podcast/Spoken word and Audiofuel/Podrunner categories added.



Other (< 4% for All, Women and Men): soundtracks, soul/funk, Audiofuel/Podrunner, blues, religious music

Figure 3.3: Style preferences: comparison of women and men.

Further analysis was carried out on music type, using Rentfrow and Gosling's four categories (see Table 3.3). Preference frequencies for each category are shown in Table 3.11. Some participants referred to music spanning two (n = 80) or three (n = 20) of the four categories: in these cases, the dominant type of music was used for analysis, and if this was unclear, the assumption was applied that the first-mentioned style, track or artists was most important, and the corresponding category was used. The figures show that across the participants self-selecting music for their most frequent activity, Intense and Rebellious music was the most popular, followed by Energetic and Rhythmic music.

Table 3.11: Music type for Activity 1 where music was self-selected

	All participants		Women		Men	
Music type	*N*	%	*n*	%	*n*	%
Reflective and Complex	12	7.0	1	1.1	10	13.7
Intense and Rebellious	70	40.7	31	32.6	38	52.1
Upbeat and Conventional	39	22.7	32	33.7	7	9.6
Energetic and Rhythmic	51	29.7	31	32.6	18	24.7
Total	172	100	95	100	73	100

There were, nevertheless, clear gender differences, shown visually in Figure 3.4. Women's preferences were evenly spread across Intense and Rebellious music, Upbeat and Conventional music, and Energetic and Rhythmic music, while men preferred Intense and Rebellious music ahead of other categories.

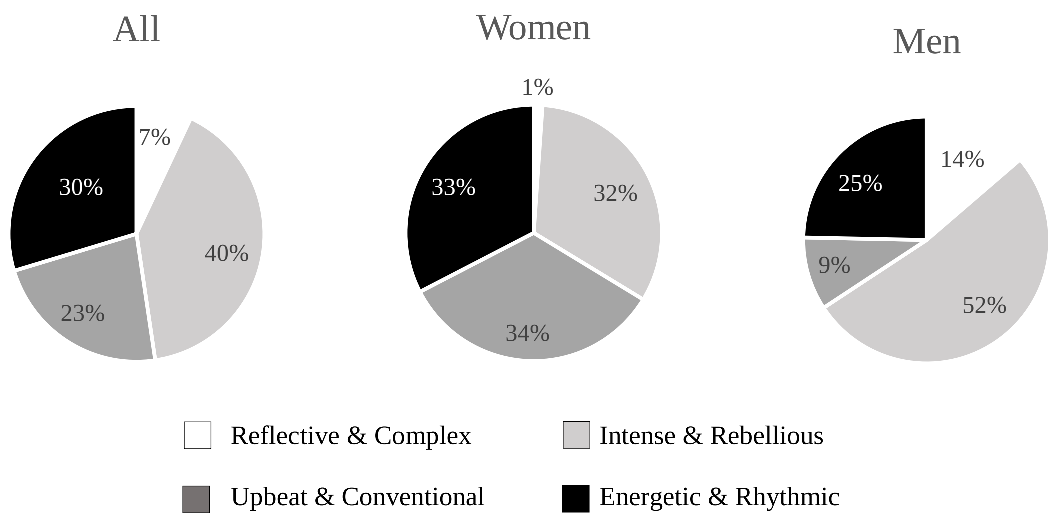


Figure 3.4: Preferred category of exercise music: comparing women and men

Comparisons were made using the three categories of formal music training and the four categories of self-selected music type in the first choice activity: using four categories rather than 15 styles helped to ensure cell counts were adequate. There were no significant differences across all participants: χ^2 (6, n = 172) = 4.90, p = .557, V = .12 (25% cell-count violation). For women, cell-count violation was 25%: χ^2 (6, n = 95) = 2.09, p = .911, V = .11, while for men it was 58%: χ^2 (6, n = 73) = 5.59, p = .470, V = .20. All effect sizes were small.

Participants were asked what the most important factor was to ensure music was suited to their exercise. The intrinsic qualities of tempo and style were most frequently cited (tempo was more important to women and style more important to men), but in third place were memories and associations, extrinsic qualities. These were considered more important than rhythm, melody, mood or cultural fit. Participants could provide other reasons: some of these fell under the headings provided, while others were more individual: among women, other descriptions for criteria included ‘Favourite tracks that make me smile’ and ‘Music I can worship God to,’ while men’s responses included ‘I hit shuffle on the iPod’ and ‘I honestly don't know.’ Table 3.12 shows the response frequencies.

Table 3.12: Most important factor when selecting music

	All participants		Women		Men	
Factor	*N*	%	*n*	%	*n*	%
Speed/tempo/ bpm	58	32.6	41	42.3	16	21.1
Style/genre	51	28.7	23	23.7	27	35.5
Memories/ associations	24	13.5	12	12.4	12	15.8
Rhythm	16	9.0	10	10.3	6	7.9
Melody	6	3.4	3	3.1	3	3.9
Mood	5	2.8	3	3.1	2	2.6
Cultural fit	1	0.6	1	1.0	-	-
Other	17	9.6	4	4.1	10	13.2
Total	178	100	97	100	76	100

The data provided some insight into music use in gyms, where self-selected and other-selected music is available. For the first activity, 23 participants indicated they exercised at the gym (those who did not indicate whether machines or weights were used at home or in a gym were excluded). Sixteen used their own music (69.6%) while seven listened to the music played by the gym (30.4%). Six of the seven rated the music as appropriate/sometimes appropriate, describing it variously as motivating and upbeat. The participant who said the gym's music was not appropriate also described it as 'high bmp [sic] and upbeat.'

Synchronisation

Participants were asked whether they selected tracks to synchronise their activity with i.e. to move in time to the beat. Around a third synchronised always or often, while the largest group – almost 40% – were sometimes aware of synchronising accidentally. A substantial group reported not synchronising. This data excludes exercise to music classes where activity is usually synchronised to music, and where the first-named activity was a class, data was excluded from analysis. To analyse synchronising, two categories, 'always or almost always' and 'often,' were combined, resulting in three levels of synchronising, differentiating purposeful synchronisers, accidental synchronisers and non-synchronisers (see Table 3.13).

Table 3.13: Synchronising

	All participants		Women		Men	
Synchronisation	*N*	%	*n*	%	*n*	%
Purposeful	60	33.7	37	38.2	20	26.3
Accidental	70	39.3	44	45.4	25	32.9
Non-synchronisers	48	27.0	16	16.5	31	40.8
Total	178	100	97	100	76	100

These results appear graphically in Figure 3.5, showing women's greater propensity than men's to synchronise.

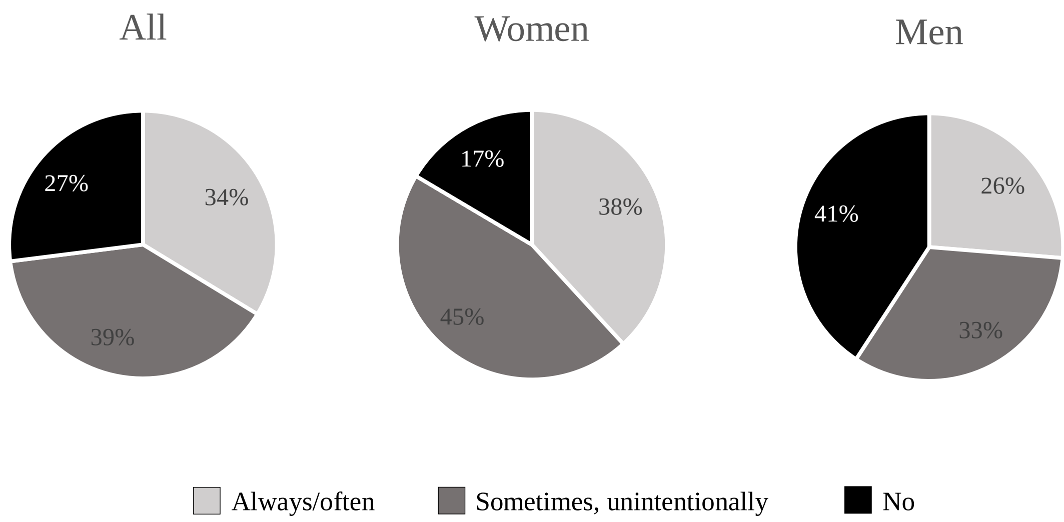


Figure 3.5: Women's and men's propensity to synchronise

Differences between women's and men's propensity to synchronise exercise movement to the music's beat were analysed using a chi-square test, with three levels of synchronisation on the first-described activity where self-selected music was used. Results were significant: χ^2 (2, n = 173) = 14.42 , p = .002, V = .27 (small effect), with women more likely to synchronise either purposefully or accidentally than men. Only 16.5% of women reported not synchronising compared with 40.8% of men.

Differences in levels of formal music training and propensity to synchronise were also analysed with chi-square tests. Three categories of music training were used (none, up to 5 years, more than 5 years), and three levels of synchronising (purposeful, accidental, and non-synchronising). Differences were not significant: χ^2 (4, n = 178) = 4.06, p = .398, V = .11. When analysed by gender, cell-count assumptions were violated (33% for men, 22% for women), and there were no significant findings: for women, χ^2 (4, n = 97) = 6.40, p = .171, V = .18 and for men, χ^2 (4, n = 76) = .903 , p = .924, V = .11. Since women were more likely to synchronise than men, the lack of effect of musical training in this analysis indicates that gender differences in synchronisation are not attributable to formal music training.

Non-use of music

Participants who did not use music at all during exercise were asked to give reasons why. They were able to give multiple reasons; the most frequent concerned safety, followed by a desire to focus on the activity. The frequencies of different reasons given not to use music in exercise are shown in Table 3.14.

Reasons with no respondents are also included: notably, none of the participants stated a dislike of music, suggesting that the exercise context provided the reasons not to listen to music, rather than the music itself (although one participant’s preferred style – Irish folk music – was too fast to use in exercise). The own-words responses to ‘other reasons’ were coded and incorporated into the results.

Table 3.14: Reasons for not using exercise music

	All participants		Women		Men	
Reason	*N* = 63	%	*n* = 27	%	*n* = 35	%
Safety	37	58.7	17	63.0	20	57.1
To focus on the activity	32	50.8	10	37.0	22	62.9
Prefer quiet	18	28.6	7	25.9	10	28.6
To chat	14	22.2	5	18.5	9	25.7
To connect with the environment	7	11.1	3	11.1	4	11.4
To listen to audiobooks/podcasts	5	7.9	1	3.7	4	11.4
Headphone hassles	3	4.8	2	7.4	1	2.9
Thinking time	2	3.2	1	3.7	1	2.9
Activity unsuited to music	2	3.2	2	7.4	-	-
It’s antisocial	1	1.6	1	3.7	-	-
Makes time drag	1	1.6	-	-	1	2.9
Hearing impaired	1	1.6	-	-	1	2.9
Preferred music unsuited to exercising	1	1.6	-	-	1	2.9
Race regulations	1	1.6	1	3.7	-	-
Sings to self	1	1.6	-	-	1	2.9
To watch TV	-	-	-	-	-	-
To read	-	-	-	-	-	-
Dislike music	-	-	-	-	-	-

3.4.2 Sport and exercise activities

Participants’ histories of sports participation ranged from beginner to nearly fifty years, with an average of 7.73 years (*SD* = 8.68). Women reported shorter durations (*M* = 6.77 years, *SD* = 7.83) than men (*M* = 8.60, *SD* = 9.04. Several participants reported zero years/months of participation, or did not respond: all had, however, checked at least one sporting activity in which they took part, suggesting that those reporting zero time had begun very recently.

Preferred activities are shown in Table 3.15. Participants were free to describe activities as they wished, but some responses were grouped: e.g. jogging was included with running, tennis and squash were grouped as racquet sports, while classes such as step and aerobics were all grouped under exercise-to-music classes. Many participants took part in multiple activities. Running was the most popular, followed by cycling and walking.

Table 3.15: Preferred activities

	All participants		Women		Men	
Activity	*N* = 282	%	*n* = 159	%	*n* = 117	%
Running	216	76.6	115	72.3	96	82.1
Cycling	121	42.9	57	35.8	61	52.1
Walking	106	37.6	75	47.2	30	25.6
Gym (cardiovascular)	100	35.5	62	39.0	35	29.9
Resistance	93	33.0	47	29.6	44	37.6
Swimming	87	30.9	57	35.8	29	24.8
Exercise-to-music class	50	17.7	42	26.4	6	5.1
Team sports	40	14.2	13	8.2	27	23.1
Yoga	33	11.7	28	17.6	5	4.3
Pilates	24	8.5	20	12.6	3	2.6
Skiing	24	8.5	10	6.3	14	12.0
Martial arts	9	3.2	6	3.8	3	2.6
Climbing	8	2.8	4	2.5	4	3.4
Skating	8	2.8	6	3.8	2	1.7
Circuits	5	1.8	4	2.5	1	0.9
Racquet sports	5	1.8	3	1.9	2	1.7
Dancing	4	1.4	4	2.5	-	-
Rowing	3	1.1	2	1.3	1	0.9
Golf	2	0.8	-	-	2	1.7
Other*	9	3.2	4	2.5	4	3.4

** One participant for each of adventure racing, aquafit, archery, cheerleading/gymnastics, gardening, horse riding, hula hoop, scuba diving and snowboarding.*

Participants were able to describe their music use in up to five activities, and were asked to start with the one they carried out most often with music. Most participants' first-named activity where music was used was running/jogging, as shown in Table 3.16, far outnumbering the next activity, gym workouts.

Table 3.16: First-named activity where music was used

	All participants		Women		Men	
Activity	*N* = 282	%	*n* = 159	%	*n* = 117	%
Running/jogging	129	45.7	68	42.8	57	48.7
Gym (unspecified or cardio)	28	9.9	23	14.5	5	4.3
Exercise to music classes	22	7.8	21	13.2	1	0.9
Weights	14	5.0	4	2.5	10	8.5
Walking	8	2.8	5	3.1	3	2.6
Cycling	7	2.5	2	1.3	4	3.4
Dancing	3	1.1	3	1.9	-	-
Circuits	2	0.7	2	1.3	-	-
Unspecified routine/exercise	2	0.7	1	0.6	1	0.9
Pilates	1	0.4	-	-	1	0.9
Yoga	1	0.4	1	0.6	-	-
Exercise DVD	1	0.4	1	0.6	-	-
Skiing	1	0.4	1	0.6	0	0
Did not use music	63	22.3	27	17.0	35	29.9

Gym and sports club membership

Over 70% of the participants had membership of a sports club, a gym, or both. Women were more likely to be gym members than sports club members, while the reverse was found for men. Table 3.17 shows membership figures.

Table 3.17: Gym and sports club membership

	All participants		Women		Men	
Membership	*N*	%	*n*	%	*n*	%
Sports club only	72	25.81	33	21.15	38	32.48
Gym only	71	25.45	50	32.05	20	17.09
Sports club and gym	57	20.43	26	16.67	28	23.93
No memberships	79	28.32	47	30.13	31	26.50
Total	279	100	156	100	117	100

Performance level

Participants' physical performance levels were gauged by asking them for the time in which they could cover 5km (3.1 miles), either running, walking or a combination of the two. The results are shown in Table 3.18.

Table 3.18: 5k times

	All participants		Women		Men	
Time (minutes)	*N*	%	*n*	%	*n*	%
< = 20	50	17.7	10	6.3	40	34.2
21-25	89	31.6	42	26.4	45	38.5
26-30	53	18.8	41	25.8	9	7.7
31-40	29	10.3	27	17.0	1	0.9
41+	8	2.9	6	3.7	2	1.8
Unknown/ not given	53	18.7	33	20.8	20	17.1
Total	282	100	159	100	117	100

Men's times were, unsurprisingly, faster than women's. A time under 20 minutes is achievable by faster club runners, while under 30 minutes is achievable for most people with appropriate training. The distance would be completed in around an hour at a steady walking pace hour.

After data collection was completed, figures became available allowing comparison of participants' times against nearly 600,000 5k race and parkrun performances in the UK in the first six months of 2013 (Carter, 2013). The data is shown in Table 3.19.

Participants' performances in this study were faster on average than those in the large samples, with 67.46% of women and 81.44% of men achieving times in the top 50%, and 7.94% of women and 8.25% of men in the study achieving times in the top 1%. This indicates that the average performance in the Study 1 sample was higher than the running community average.

Table 3.19: 5k times compared with UK average 2013*

% achieving time across UK Jan-Jun 2013	*Women*				*Men*			
	UK average*		Study 1		UK average*		Study 1	
	From (mm:ss)	To (mm:ss)	*n*	%	From (mm:ss)	To (mm:ss)	*n*	%
1	00:00	20:11	10	7.94	00:00	17:19	8	8.25
5	20:12	22:34	8	6.35	17:20	18:52	8	8.25
10	22:34	23:59	6	4.76	18:53	19:50	6	6.19
20	24:00	25:47	28	22.22	19:51	21:13	28	28.87
30	25:48	27:10	23	18.25	21:14	22:21	19	19.59
40	27:11	28:22	7	5.56	22:22	23:24	6	6.19
50	28:23	29:30	3	2.38	23:25	24:26	4	4.12
60	29:31	30:45	8	6.35	24:27	25:34	6	6.19
70	30:45	32:12	13	10.32	25:35	26:54	4	4.12
80	32:13	34:04	4	3.17	26:55	28:41	3	3.09
90	34:05	37:00	3	2.38	28:42	31:40	2	2.06
	37:00	65:00	13	10.32	31:40	60:00	3	3.09

**UK average, compiled from Run Britain data on all parkruns and UKA licensed 5k races in the first half of 2013, with 213,660 performances by women, and 376,427 by men. Times provided for up to 37 minutes for women, and 31:40 for men. The 16 slower participants are accommodated in the bottom line.*

The 5k times of those who ticked running as one of their exercise activities were compared against the rest of the participants: 229 participants provided the time in which they could complete a 5k walk/run, and 210 of these listed running among the activities they took part in. Table 3.20 compares the average times given by the whole sample (53 participants did not provide a 5k time), and by those who specifically identified as runners (6 runners did not provide a 5k time), who were slightly faster overall.

Table 3.20: 5k average times in minutes:seconds

	Total N = 229			Women n = 126			Men n = 97		
Group	*M*	*SD*	*N*	*M*	*SD*	*n*	*M*	*SD*	*n*
Whole sample	25:40	7.31	229	28:16	7.38	126	22:13	5.82	97
Runners	24:40	5.31	210	27:08	5.35	113	21:27	3.19	92
Non-runners	36:47	14.37	19	38:04	13.56	13	36:24	17.75	5

While 5k times give some indication of performance levels, these decline with age and are slower among women than among men, limiting analysis. A 5k Performance figure was therefore calculated for all provided 5k times following tables of values in Glover and Glover (1999), which express the individual's 5k speed as a percentage of world class 5k speed for the same age and gender, providing more meaningful comparisons for a mixed sample. A 5k Performance above 90% reflects an athlete of international standard, 80% of national standard and 70% of regional standard. Table 3.21 shows the medians.

Table 3.21: 5k Performance medians

	Total		Women		Men	
Group	Median	*N*	Median	*n*	Median	*n*
Whole sample	60.22	223	57.58	126	64.78	97
Runners	60.55	205	58.17	113	64.87	92
Non-runners	42.04	18	40.83	13	43.24	5

Although the highest 5k Performance figure, 91.92%, was that of a female runner, the distribution showed that the women had lower scores on average than the men, and this was the same for those who included running among their regular activities. Because the calculations are based on world-class performances, where younger athletes tend to follow more rigorous training schedules than veterans, 5k Performance scores improve slightly with age; correlation analysis of age and 5k Performance showed this was the case with the sample here ($r = .28$, $N = 223$ $p < .001$), particularly for men ($r = .40$, $n = 97$, $p < .001$, compared with $r = .20$, $n = 126$, $p = .022$ for women). Non-parametric tests were used to compare 5k performance between different groups because the performance scores were percentages, calculated from a variety of different world record performances; different denominators can affect means through weighting.

Relationships between performance and music use

Despite adjusting 5k times for age and gender, there were still significant differences between men and women, increasing the risk of Type 1 errors. Analysis was therefore carried out by gender to avoid confounding effects, using non-parametric tests since percentages are proportional data. The details of the analyses are in the sections below.

Music use and 5k Performance

When 5k Performances of music users and non-users were compared, the results were significant for women, with non-users achieving higher age-gradings (*Md* = 62.59, *n* = 20) than music users (*Md* = 55.61, n = 106): *U* = 496.50, *z* = -3.76, $p < .001$, *r* = .33 (medium effect). For men, non-users also achieved higher age gradings (*Md* = 66.01, *n* = 32) than music users (*Md* = 64.02, *n* = 65); the difference was marginal (*p* = .077). Table 3.22 shows the 5k Performance medians.

Table 3.22: 5k Performance medians for music users and non-users

	Women *n* = 126		Men *n* = 97	
Music use	*N*	Median	*n*	Median
Users	106	55.61	65	64.02
Non-users	20	62.59	32	66.01

Music preference and 5k Performance

The impact of music preference on 5k Performance was tested, grouping participants according to preferred music type (Reflective and Complex, Intense and Rebellious, Upbeat and Conventional, and Energetic and Rhythmic). For women, the highest 5k Performance score was for Reflective and

Complex music, although only one participant was represented. This was followed by Energetic and Rhythmic music, then Intense and Rebellious music, with the lowest scores for Upbeat and Conventional music; for men, the pattern was similar, but with those using Intense and Rebellious music achieving higher performance scores than those preferring Energetic and Rhythmic music. The medians are shown in Table 3.23. The 5k Performance did not differ significantly by music preference: p = .693 (women), and p = .772 (men).

Table 3.23: 5k Performance medians for music preference

	Women n = 81		Men n = 59	
	n	Median	*N*	Median
Reflective, complex	1	59.10	7	64.51
Intense, rebellious	27	55.85	30	64.02
Energetic, rhythmic	26	56.51	17	61.78
Upbeat, conventional	27	53.31	5	61.03

Synchronising and 5k Performance

The relationship between synchronising behaviour and 5k Performance was explored, grouping participants according to whether they purposely synchronised, accidentally synchronised or did not synchronise. The median 5k Performances are shown in Table 3.24. For men and women, increased synchronising was associated with decreased 5k Performance, but the differences between groups were not significant: p = .283 (women) and p = .266 (men).

Table 3.24: 5k Performance medians for levels of synchronising

	Women n = 82		Men n = 62	
Synchronisation	*n*	Median	*N*	Median
Purposeful	33	53.31	18	61.74
Accidental	36	55.61	19	64.02
Non-synchronisers	13	57.19	25	64.51

Music training and 5k Performance

To test the relationship between music training and 5k Performance, participants were grouped according to whether they had received no formal musical training, up to 5 years of training, or over 5 years of training. The medians are shown in Table 3.25, showing the middle group achieving the highest performance scores, followed by those who had no lessons, with those having over 5 years of lessons achieving the lowest performance scores, for both women and men. The differences between the groups were not significant: p = .458 (women), p = .911 (men).

Table 3.25: 5k Performance medians for levels of music training

	Women n = 126		Men n = 97	
Music training	n	Median	n	Median
No lessons	35	56.29	53	63.67
Up to 5 years	50	59.29	38	65.06
Over 5 years	41	55.37	6	63.32

Competitions

Around half of the participants had competed in some kind of event; eight had competed at national or international level, and 23 at county level. This suggests participation in the many amateur events open to all performance standards. Competitive history is summarised in Table 3.26.

Table 3.26: Competitions

	All participants		Women		Men	
Competed	N	%	n	%	n	%
Never competed	137	48.8	84	52.8	50	43.1
Competed (no specific level)	113	40.2	63	39.6	48	41.4
County level	23	8.2	8	5.0	14	12.1
National level	4	1.4	2	1.3	2	1.7
International level	4	1.4	2	1.3	2	1.7
Total	281	100	159	100	116	100

Social support

The majority of participants (56.5%) reported sometimes exercising with a 'buddy,' and over a third reported receiving consistent support for their activities from family and friends, although almost one in five exercised without others' support. Patterns of interactions are summarised in Table 3.27.

Table 3.27: Exercise buddies and family support

	All participants		Women		Men	
	N	%	*n*	%	*n*	%
Sometimes exercise with a 'buddy'	157[a]	56.5	85[b]	54.5	68[c]	58.6
Exercise alone	121[a]	43.5	71[b]	45.5	48[c]	41.4
Have the support of family/friends	196	69.5	112	70.4	79	67.5
Support from others varies	31	11.0	28	17.6	26	22.2
Do not have others' support	55	19.5	19	11.9	12	10.3
Total	282	100	159	100	116	100

Where not all participants responded: [a]n = 278, [b]n = 156, [c]n = 116. Percentages exclude non-responders.

3.4.3 Personality

The sample scored below the TIPI norms on all five traits, across the sample and within gender groupings. The scores are shown in Table 3.28 for participants who completed all 10 of the TIPI items. The 'TIPI norms' across 1814 participants tested by Gosling et al. (2003) are also included, in italic type, for comparison.

Table 3.28: Comparison of trait scores in the sample to trait score norms

	All *N* = 267		Women *n* = 154		Men *n* = 108	
	M	*SD*	*M*	*SD*	*M*	*SD*
Agreeableness	4.89	1.19	5.11	1.21	4.61	1.09
Norm Agreeableness	*5.23*	*1.11*	*5.32*	*1.11*	*5.06*	*1.10*
Conscientiousness	5.27	1.19	5.35	1.19	5.14	1.17
Norm Conscientiousness	*5.40*	*1.32*	*5.51*	*1.11*	*5.19*	*1.15*
Extraversion	4.14	1.65	4.20	1.62	4.06	1.66
Norm Extraversion	*4.44*	*1.45*	*4.54*	*1.47*	*4.25*	*1.41*
Openness	5.23	1.11	5.26	1.12	5.20	1.04
Norm Openness	*5.38*	*1.07*	*5.40*	*1.06*	*5.34*	*1.09*
Stability	4.64	1.40	4.49	1.41	4.83	1.39
Norm Stability	*4.83*	*1.07*	*4.66*	*1.45*	*5.13*	*1.31*

Norms for N = 1814 from Gosling et al., 2003, p.526.

Personality and exercise music

Data collected for personality enabled levels of Agreeableness, Conscientiousness, Extraversion, Openness and Stability to be calculated for each participant. For music use, *t*-tests were used to compare music users to non-users, with one-way ANOVAs used to analyse possible relationships between music preference and personality, and between synchronising and personality.

Music use and personality

Across the sample, there were no significant differences between the personality traits of music users and non-users. Analysing the women and men separately, again the results were not significant, although for women, significance was borderline for Extraversion and music use: t (157) = -1.82, p = .071. Users (M = 4.13, SD = 1.58) were less extraverted than non-users (M = 4.74, SD = 1.69). The effect was small (mean difference = -.62, 95%CI: -1.28 to .05, η^2 = .021). The findings for Extraversion for men were not significant t (113) = 1.07, p = .286, although in contrast to women, male music users (M = 4.18, SD = 1.72) were more extraverted than non-users (M = 3.82, SD = 1.58).

Music preference and personality

Personality traits were analysed across the four music type preferences (Reflective and Complex; Intense and Rebellious; Upbeat and Conventional; and Energetic and Rhythmic) using one-way between-group ANOVAs. The only statistically significant finding across the sample was a small effect for Openness (F (3, 165) = 2.80, p = .042, η^2 = .048). None of the post-hoc comparisons were significant: the most notable difference (p = .101) was between the group preferring Upbeat and Conventional music (M = 5.10, *SD* = .96) and the group preferring Intense and Rebellious music (*M* = 5.55, *SD* = 1.04), with those preferring Intense and Rebellious music showing higher levels of Openness than those preferring Upbeat and Conventional music. Analysis was also carried out by gender, but no significant differences were found.

Synchronising and personality

The personality trait scores of purposeful, accidental and non-synchronisers were compared. Openness was found to be a significant factor across the sample with a medium-sized effect: (F (2, 172) = 5.542, p = .005, η^2 = .061). Post hoc comparisons showed a significant difference between purposeful synchronisers (*M* = 5.66, *SD* = .94) and non-synchronisers (*M* = 5.03, *SD* = .96), Tukey: p = .003, with purposeful synchronisers having higher levels of Openness.

Analysis by gender showed a medium effect for men regarding Extraversion and propensity to synchronise: F (2, 71) = 5.56, p = .006, η^2 = .13. Post hoc comparisons showed that the significant effect arose through purposeful synchronisers being more Extraverted (*M* = 5.08, *SD* = 1.57) than accidental synchronisers (*M* = 3.44, *SD* = 1.66), p = .004 (Tukey). For women, there were significant differences between the synchronisation levels for Openness, with a medium-sized effect: (F (2, 94) = 3.515, p = .034, η^2 = .070). Post hoc comparisons revealed this was due to higher levels of Openness among purposeful synchronisers (*M* = 5.64, *SD* = 1.06) compared with non-synchronisers (*M* = 4.84, *SD* = .89), p = .025 (Tukey).

3.4.4 Planning, adherence and ‘exercuses’

Nearly three quarters of participants reported making exercise plans, with women more likely than men to do so (74.1% compared with 69.8%: see Table 3.29).

Table 3.29: Propensity to make exercise plans

	All participants		Women		Men	
Plans made	*N*	%	*n*	%	*n*	%
Yes	204	72.9	117	74.1	81	69.8
Sometimes	57	20.4	32	20.3	25	21.6
No	19	6.8	9	5.7	10	8.6
Total	280	100	158	100	116	100

However, rather fewer reported adhering to their plans (see Table 3.30), and men were more consistent here than women with 59.8% always adhering to plans compared with 53.3% of women.

Table 3.30: Adhering to plans

	All participants		Women		Men	
Plans adhered to	*N*	%	*n*	%	*n*	%
Yes	150	57.0	80	53.3	64	59.8
Sometimes	109	41.4	67	44.7	42	39.3
No	4	1.5	3	2.0	1	0.9
Total	263	100	150	100	107	100

Those who regularly made plans managed to adhere to them more often than not (64.1% for women, 65.4% for men: see Table 3.31).

Table 3.31: Adhering to plans: all-the-time planners

	All participants		Women		Men	
Plans adhered to	*N*	%	*n*	%	*n*	%
Yes	134	65.7	75	64.1	53	65.4
Sometimes	69	33.8	41	35.0	28	34.6
No	1	0.5	1	0.9	-	-
Total	204	100	117	100	81	100

Of those who were less consistent at making plans ('some-of-the-time planners'), only 12.5% of women managed to adhere to them with men faring better at 40.0% (see Table 3.32).

Table 3.32: Adhering to plans: some-of-the-time planners

	All participants		Women		Men	
Plans adhered to	*N*	%	*n*	%	*n*	%
Yes	14	24.6	4	12.5	10	40.0
Sometimes	40	70.2	26	81.3	14	56.0
No	3	5.3	2	6.3	1	4.0
Total	57	100	32	100	25	100

Participants were able to use their own words to give reasons for not adhering to plans. These were coded to produce 'exercuses.' Table 3.33 summarises the reasons given first, showing that working late was the most common reason to miss a workout (39.5%), particularly for women. This was followed by tiredness and time limitations. Childcare was more frequently cited as a reason not to exercise by women than men (9% compared with 3%), although more men than women reported 'family demands,' relating to needing to spend time with family (13.7% compared with 1.3%).

Table 3.33: Exercuses (reasons given first)

	All participants		Women		Men	
First-given reason	*N*	%	*n*	%	*n*	%
Working late	51	39.5	35	44.9	16	31.4
Time limitations/ priorities	21	16.3	13	16.7	8	15.7
Tired	17	13.2	13	16.7	4	7.8
Health/injury issues	10	7.8	4	5.1	6	11.8
Childcare unavailable	9	7.0	7	9.0	2	3.9
Family demands	8	6.2	1	1.3	7	13.7
Bad weather/too dark	8	6.2	1	1.3	7	13.7
Can't be bothered	3	2.3	2	2.6	1	2.0
Gym too busy	1	0.8	1	1.3	-	-
Buddy unavailable	1	0.8	1	1.3	-	-
Total	129	100	78	100	51	100

Relationships between those who adhere to plans and music use

Making exercise plans, adhering to plans and using music

Chi-square tests for independence were carried out to look at the relationship between (a) propensity to make exercise plans (three levels: yes, no, sometimes) and (b) propensity to follow exercise plans (four levels: yes, no, sometimes, no plan), and music use (two levels: yes, no). For making plans, there was no significant effect across the sample ($\chi^2(2, n = 280) = 3.08$, $p = .214$, $V = .11$, small effect), nor when data was analysed by gender (women: $\chi^2(2, n = 158) = .238$, $p = .888$, $V = .04$, small effect; men: $\chi^2(2, n = 116) = 3.11$, $p = .211$, $V = .16$, small effect). For adhering to plans, there were no statistically significant findings across the sample ($\chi^2(3, n = 282) = 7.17$, $p = .067$, $V = .16$, small effect, 37.5% cell-count violation), nor when data was analysed by gender (women: $\chi^2(3, n = 159) = 5.53$, $p = .137$, $V = .19$, small effect, 37.5% cell-count violation; men: $\chi^2(3, n = 117) = 3.15$, $p = .369$, $V = .16$, small effect, 37.5% cell-count violation).

Making exercise plans, adhering to plans and music preferences

The relationship between (a) propensity to make exercise plans (three levels) and (b) propensity to follow exercise plans (four levels), and music preferences (four types) was tested. For making plans, there were no significant findings across the sample ($\chi^2(6, n = 171) = 1.66$, $p = .948$, $V = .07$, small effect, 41.7% cell-count violation), nor when data was analysed by gender (women: $\chi^2(6, n = 95) = 7.65$, $p = .265$, $V = .20$, small effect, 50.0 % cell-count violation; men: $\chi^2(6, n = 72) = 5.24$, $p = .514$, $V = .19$, small effect, 66.7% cell-count violation). For adhering to plans, again there were no significant findings ($\chi^2(9, n = 172) = 7.91$, $p = .544$, $V = .12$, small effect, 50.0% cell-count violation), nor when data was analysed by gender (women: $\chi^2(9, n = 95) = 7.35$, $p = .601$, $V = .16$, small effect, 62.5 % cell-count violation; men: $\chi^2(9, n = 73) = 7.61$, $p = .574$, $V = .19$, small effect, 68.8 % cell-count violation).

Pre-activity listening

Participants were asked about music use before and after activities. The majority (61.2%) did not use music before an activity (see Table 3.34).

Table 3.34: Listening to music before an activity

	All participants		Women		Men	
	N	%	*n*	%	*n*	%
Always	17	7.8	9	6.8	8	9.8
Sometimes	41	18.7	21	15.9	19	23.2
Occasionally	27	12.3	16	12.1	8	9.8
No	134	61.2	86	65.2	47	57.3
Total	219	100	132	100	82	100

Participants described their reasons for using pre-exercise music in their own words. Responses were coded to produce five reasons (see Table 3.35), the most common being to promote a particular mood deemed suitable to exercise (n = 37), with motivation mentioned by 18 participants.

Table 3.35: Listening to music before exercise: reasons

	All participants		Women		Men	
	N	%	*n*	%	*n*	%
To promote a particular mood/'psych up'	37	55.2	21	52.5	16	59.3
Motivation	18	26.9	11	27.5	7	25.9
Liking for music/frequent listener	8	11.9	6	15	2	7.4
A need for music	2	3.0	1	2.5	1	3.7
Passes the time on the way to an exercise session	2	3.0	1	2.5	1	3.7
Total	67	100	40	100	27	100

Coding produced six reasons for not listening to music before exercise (see Table 3.36), the most common of which was impracticality (n = 27), due, for example, to participants exercising immediately after work. The next most common response was that participants did not see any point to using music prior to exercise (*n* = 19), while a substantial third group (*n* = 15) had not considered listening to music before exercise.

Table 3.36: Not listening to music before exercise: reasons

	All participants		Women		Men	
Reason	*N*	%	*n*	%	*n*	%
Impractical	27	37.0	19	33.9	5	35.7
No need/no point	19	26.0	13	23.2	6	42.9
Hasn't occurred to me	15	20.5	14	25.0	1	7.1
'I just don't'	5	6.8	3	5.4	2	14.3
Music is saved for exercise	5	6.8	5	8.9	-	-
Listening to non-music radio	2	2.7	2	3.6	-	-
Total	73	100	56	100	14	100

The question was also asked with regard to music use before competitions, and the frequencies are shown in Table 3.37: most participants did not use music prior to competitions.

Table 3.37: Using music before competitions (excludes non-competing participants)

	All participants		Women		Men	
Pre-competition music	*N*	%	*n*	%	*n*	%
Always	12	8.6	6	7.8	4	6.9
Sometimes	24	17.3	12	15.6	12	20.7
Occasionally	17	12.2	11	14.3	6	10.3
No	86	61.9	48	62.3	36	62.1
Total	139	100	77	100	58	100

Around half of participants who expressed an opinion preferred not to use music during competitions such as races (see Table 3.38), but a similar proportion sometimes did, or would have done if allowed.

Table 3.38: Using music during competitions

Competition music	All participants		Women		Men	
	N	%	*n*	%	*n*	%
Always	11	7.2	10	11.4	1	1.7
Like to, but not always allowed	24	15.7	15	17.0	9	15.0
Sometimes	19	12.4	12	13.6	7	11.7
Occasionally	22	14.4	8	9.1	13	21.7
Prefer not to	77	50.3	43	48.9	30	50.0
Total	153	100	88	100	60	100

Adhering to exercise plans and listening to music before exercising

The relationship between adhering to previously-made exercise plans (four levels), and music use prior to exercise (two levels: yes, no) was analysed with chi-square tests to look for the possible impact of pre-exercise music on adherence. Findings were not significant ($\chi^2(3, n = 219) = 1.38$, $p = .710$, $V = .08$, small effect, 37.5% cell-count violation), nor were there any significant findings when data was analysed by gender (women: $\chi^2(3, n = 132) = .39$, $p = .942$, $V = .05$, small effect, 50.0% cell-count violation; men: $\chi^2(3, n = 82) = 2.31$, $p = .511$, $V = .17$, small effect, 50.0% cell-count violation). This indicated no significant relationship between the extent to which participants listened to music prior to exercise and their exercise plan adherence.

3.5 Discussion

The most noteworthy findings from the study related to the influence of formal music training on exercise music use, and the gendered nature of this. Those with more years of formal music training were more likely to listen to music during exercise, although there was no clear relationship between formal music training and type of music preferred or tendency to synchronise.

Women were more likely to listen to music during exercise than men, more likely to synchronise their movements to the beat and also had more years of musical training than men.

Physical performance had a negative relationship with music use. Those with higher 5k Performance scores were less likely to use music than those with lower 5k Performance scores, and this may have been related to age due to a correlation between age and score. No effects were found for 5k Performance, formal music training, propensity to synchronise, or music preference.

Relationships were found between personality traits and the choice and application of music: higher levels of Openness were associated with preferring Intense and Rebellious music to Conventional and Upbeat music, and being a purposeful synchroniser. For men, Extraversion was associated with purposeful synchronising, while for women there was a borderline relationship between Extraversion and using music in exercise.

3.5.1 Adherence

No relationship was found between listening to music and adhering to exercise plans. Nevertheless, some participants reported motivational effects from music listened to before exercise, describing using it to adjust their mood or frame of mind to feel more disposed to exercise. Of those who did not play music prior to exercise, several noted that they had not considered doing so before. This suggests that there may be some role for playing music prior to exercise to assist initial motivation to start a session, and this is explored in Study 4 (see Chapter 6).

The role of work in preventing adherence, although not directly connected with music use, should be mentioned: working late was the most common reason for missing planned exercise. And some participants described not playing music prior to exercise because of the impracticalities of doing so in the workplace. The expectations of workplace cultures may, therefore, be an area where fundamental change is needed if exercise is to be more widely adhered to.

The nature of the study – participants were invited to discuss their use/non-use of music during exercise – meant that participants were generally regular exercisers, many of whom had been exercising for many years. This meant they were likely to be exercise adherers, limiting comparison with non-adherers, although there was some variation in reported adherence. The findings did not support the expectation of Karageorghis et al. (1999) that music use in exercise would increase adherence, but there may be other factors: for example, those with high physical performance ability may consider music a distraction from focused training, and also be more likely to prioritise their training sessions.

3.5.2 Music training

Participants with higher levels of music training were more likely to use music in exercise, although the effect was small. There were concerns that this might be confounded by women having more music training and using music in exercise more often than men, so further analyses were carried out for genders separately to avoid confounding the results.

Although synchronising and music preferences showed clearly different patterns for women and men, these were not large enough to be significant. It is possible that lengthy formal music training reflects a strong liking for music generally, and that listening to music during exercise is another facet of such liking. Generally, music preference is influenced by a wide range of factors (see discussion of the reciprocal feedback model in Chapter 1, Figure 1.2), and instrumental repertoire may simply have been seen as irrelevant for exercising, leading participants to choose from other styles.

3.5.3 Synchronising

This study represents some of the most detailed data yet collected on synchronising to the beat of exercise music, suggesting that although many people intentionally incorporate synchronous activities into their exercise, the majority either do not synchronise or synchronise accidentally. The data reflects self-reporting on synchronisation, and a practical experiment to explore synchronising among exercisers, measuring the extent to which they synchronise and asking them, post-test, about their perceptions of synchronising during the activity, would shed further light on this.

Prior to this study, it was known that synchronisation among exercisers when not given instruction to do so was relatively uncommon, with one of sixteen participants in Hallett and Lamont (2014) doing so, accidentally, and one in sixty participants in Van Noorden and Franěk (2012). The findings of the current study indicate that around a third of participants are synchronising on purpose, around a quarter are not synchronising, with the remainder synchronising accidentally.

Karageorghis et al. (2010) speculated that a propensity to synchronise should be stronger among women than men, associated with their wider participation in synchronised exercise to music classes and enjoyment of dancing at social events, and higher exposure to dancing lessons during childhood. They note that evidence to support this had not shown substantial differences between men and women at that point, although the reported synchronisation among participants here showed a statistically significant difference between genders, with women showing more inclination toward synchronising their movements to music. This provides support for the speculation.

3.5.4 Personality

Openness, sometimes referred to as openness to experience, was a possible factor in music preference and propensity to synchronise movement to the beat, reflecting higher scores indicating being more positively disposed towards new ideas and activities. Participants with higher levels of Openness preferred Intense and Rebellious music, perhaps through exploring music outside the mainstream, or through desire for novelty provoking engagement with less mainstream media channels. Those who are regularly synchronising may be going through a more demanding process of exploring music to find tracks at a particular tempo, while non-synchronous playlists do not require this level of musical analysis to find suitable tracks.

Rentfrow and Gosling also found a relationship between Openness and liking for Intense and Rebellious music (2003), although they found a stronger association with Reflective and Complex music. This is likely due to Reflective and Complex music being insufficiently upbeat for exercise; Hallett and Lamont (2014) found this was a common criterion for exercisers using music in gyms, while Rentfrow and Gosling were studying music more generally in everyday life.

3.5.5 Limitations

The survey and sampling method was an effective way to gather a large amount of data efficiently over a short period of time, and many participants provided considerable detail in their responses, allowing a wide range of factors to be explored. However, there were some limitations. Because the participants were drawn from an opportunity sample, some of their characteristics differed from wider populations. Use of social media inevitably attracts ‘people like us’ to take part in research, and the large number of runners and high proportion of trained musicians may be attributable to my own background and social connections. Additionally, the many differences between men and women that emerged during the analysis meant that analysis by gender took on a particularly important role.

Nevertheless, the sample also offered some advantages: because running is a sport where participants often use music (unlike, for example, playing football), a large amount of data could be collected reflecting the variety of music choice among participants. The many trained musicians facilitated a meaningful analysis comparing exercise music responses of musically trained and untrained participants.

While it was expected that men's average 5k pace would be faster than women's, it was anticipated that adjusting for gender and age when generating 5k Performance scores would result in the women's and men's averages being closely matched. This was not the case. While this does not relate directly to music use and adherence, it is an important finding with regard to exercise adherence more generally. A possible reason is the recruitment methods, with a number of participants recruited at a local parkrun. Parkruns are weekly timed 5k events open to all standards of runner. It is possible that women are more likely to take part in such an event when they are relative newcomers to exercise, whereas men may feel they need to reach a certain standard before running competitively in public.

3.6 Summary

The findings in this study contradict 'common sense' assumptions, most notably that trained musicians use music differently to those with less or no musical training (although they are more likely to listen to music while exercising), and that synchronising to the beat is the 'norm' among exercisers generally. The marked difference between 5k Performance scores of men and women was not anticipated and raises a number of questions regarding differences between women's and men's attitudes towards different contexts for physical activity. Further exploration is needed regarding the possible motivational effect of music use before exercise, as those who used it in this way did so for motivational reasons, while many of those who did not use music before exercise either had not the opportunity or had not considered doing so.

Having explored statistical trends across the survey data, the next chapter documents a qualitative study (Study 2), which formed a follow-up phase to the survey. Ten of the survey study participants were interviewed in depth about their use of music in exercise, providing further insights into some of the trends.

Chapter 4

Study 2: Music use in exercise – an interpretative phenomenological analysis

4.1 Aims

Study 1, discussed in Chapter 3, collected data on music use in exercise from a large sample. Key findings were that women were more likely to use music than men, and more likely to synchronise their movement to the beat. Formal music training was associated with greater music use in exercise, while superior 5k Performances were associated with less music use during exercise.

For Study 2, ten participants from Study 1 were interviewed to elicit a greater level of detail about their practices, gaining a deeper understanding of music listening activities behind the statistical trends, and of the experiences of individuals as they exercised to music. A qualitative approach was chosen, using interpretative phenomenological analysis to explore how music and exercise are experienced at an individual level, and to establish patterns across the data of those who were interviewed. The purpose of this part of the study was to examine the whys and hows of the findings from Study 1 and to gain understanding of the mechanisms behind them.

4.2 Background

As discussed in the first chapter (Sections 1.3.2 and 1.4), a small amount of research has previously explored the use of personal listening devices (PLDs) in everyday life, most notably Bull's large-scale studies firstly of personal cassette-player use (2000) and more recently of iPod use (2005, 2007). Heye and Lamont (2010) looked specifically at device use while travelling, while several studies (Krause, North & Hewitt, 2013; Greasley & Lamont, 2011; Sloboda, O'Neill & Ivaldi, 2001) have used the experience sampling method to collect data on listening experiences during the day. Brief mentions of exercise are made in these studies, but there is little further exploration. Priest and Karageorghis' 2008 qualitative study of exercise music in gyms collected data from 13 participants, with seven sometimes choosing their own exercise music, delivered via a PLD. However, the research focused primarily on criteria for selecting music for gym PA systems, and little attention was paid to the practices of the self-selectors. Additionally, the original data collection came from a PhD submitted in 2003, since when music listening practices have changed considerably.

This leaves a vast area of PLD use during exercise about which little is known. Commercial organisations have targeted this market with specifically-designed workout tracks and collections, yet research into music use in everyday life has suggested a highly active selection process dependent on sociocultural background, mood and environmental context. There is little support in the literature for categorising listeners as a homogenous group because they happen to be exercising. While the analysis in the previous chapter found various relevant trends, the actual experiences underpinning these findings are unknown. For example, not synchronising may be due to preference, an inability to find appropriate material in terms of beats per minute, or difficulty coinciding movement with a beat.

A phenomenological approach, using interviews to explore the findings of the survey offered the route to understanding music use in exercise as individuals experience it, investigating whether there were common patterns of behaviour across the data set. This study set out to discover how people experience exercising to music, from music selection to exercise practices, in order to understand better why they make particular choices for exercise accompaniment.

4.3 Method

Interpretative phenomenological analysis (IPA) was chosen as a method because of its scope to discover deep, rich meanings within data, recognising individualities and commonalities between participants, as discussed in Section 2.2.5. Ten individuals who had responded to the online survey in Study 1 were interviewed, their data transcribed and the analysis carried out in accordance with IPA processes in Smith et al. (2009), as detailed in Section 4.3.4.

4.3.1 Participants

The participants completed the online survey on music use in exercise for Study 1 during the Autumn of 2012, in which they had been invited to provide email contact details with the possibility of this leading to an interview. Participants were selected on the basis of their survey responses so that a range of exercise activities, music preferences and sporting abilities were reflected. The interviewees' details are in Table 4.1.

Table 4.1: Participants' age, location and occupation

Name*	Age	Location	Occupation	Interviewed
Sophie	36	Suffolk	Radiographer	At her home
Charlotte	32	UK (unspecified)	Freelance educational consultant	Over the phone
Belinda	47	Wiltshire	Not currently working	At her home
Ruth	40	Staffordshire	Speech and language therapist	At her home
Sarah	39	Staffordshire	Management consultant	At her home
Amanda	31	Staffordshire	University teaching fellow	At Keele
Steven	36	Staffordshire	Designer	At his home
Katie	26	West Midlands	Training and volunteer co-ordinator	Over the phone
Andrew	39	Staffordshire	Sports coach	At Keele
Martin	58	Staffordshire	Not currently working	At his home

**All names are pseudonyms.*

Two of the participants had experience in sport/exercise instruction, and music use during exercise across the ten participants ranged from never to always. Initial contact was by email, with details of the interview process. For those willing to participate, arrangements were made to meet or to carry out a phone interview. Six participants were interviewed in their homes, two in a private office at Keele University and two over the phone from my home without any others present. Sophie and Ruth both had relatives present in the house during my visit.

4.3.2 Materials

A generic outline interview schedule (see Appendix B), supplemented with questions arising from each participants' survey responses, was used for all interviews. The generic outline included questions about usual exercise activities and adhering to exercise plans, with music-related questions regarding playlist content and how tracks had been selected. Individual questions related to specific points noted in the survey responses: for example, one participant had mentioned exercising when the gym music was 'too loud,' and this was noted so that further questions could be asked. Ten tailored schedules were created and used in a semi-structured capacity. The schedules were guidelines rather than strictly adhered to, and when unanticipated information emerged during interviews, this was explored in more depth.

Exercise activities varied between individuals and this information was added to the schedule so that music use across different activities (particularly where participants exercised individually and in classes) could be explored. Interviewees' formal music training was also covered: several had had many years of instrumental lessons and had been or still were active in ensemble music-making. The descriptions of music choices in the initial online survey were, in some cases, quite detailed and choices and the reasons behind them were discussed further in interviews. Interviews were recorded using a digital recorder, and the recordings were transcribed using ExpressScribe software.

4.3.3 Interview process

The interviews lasted, on average, around an hour. Before starting each one, the participant gave informed and was advised that they could withdraw at any time in accordance with the ethical approval granted to the study. All participants consented to being quoted in publications arising from the research, on the understanding that they would be given pseudonyms to preserve their anonymity. For the two participants interviewed by phone, consent forms were completed electronically prior to the interviews. This administration was carried out before the digital recorder was switched on. Participants were advised at the moment it was activated, and made aware it could be stopped if they wished, and any data deleted.

My interview strategy was to ensure that all the questions on the schedule were covered, as these were particularly pertinent to the study. Nevertheless, I also aimed to let the interviewees lead the interview where possible, encouraging them to expand on the experiences they described, since interviewee autonomy was more likely to lead to a focus on their priorities and experiences than my leading the interview. This was advocated by Smith et al. (2009), who outlined IPA interviewing strategies to help facilitate a focus on the interviewee.

4.3.4 Analytical process

The analytical process followed the steps suggested in Smith et al. (2009). Although they recommended that the first stage of the analytical process should be reading the transcription, the transcription process itself was an opportunity to reflect on the data, and I noted observations both after the interview and during transcription.

Following transcription, I printed out all the transcripts, reading, re-reading, and replaying the recordings. I used different-coloured fineliner pens to make notes in the transcript margins according to the initial stages outlined by Smith et al. (2009). The first step was to make descriptive comments, reflecting initial ideas on the data. These emphasised the most obvious elements of the content, bringing them to the fore and providing a context, and provided a framework for examining the less obvious content. Throughout this stage of the analysis, I also noted ideas that I knew, from memory of the interviews, would appear in other transcripts.

The next stage was to examine language use to try to elicit meaning from the words participants chose to describe their experience. Their vocabulary was sometimes highly evocative and expressive beyond its basic meaning: Ruth's repeated use of the stem irritat- (irritating, irritated, irritate), for example, expressed a frustration with music use which built during that section of the interview because of its reiteration.

Next, conceptual comments were noted, building on description and language to consider deeper meanings. From these stages, themes within the transcript were identified and examples noted. This process was repeated for each separate transcript with the aim of finding rich meaning at an individual level. The interviewing and transcription process meant that participants were also considered in the context of the other interviews at an early stage of the analysis.

After individual analysis of each interview, I considered possible themes across the transcripts, refining these using a combination of mindmaps and tables. These can be found in Appendix C. The first stage was a mindmap of possible themes, annotated with quotes from the transcripts, colour-coded to participants (Appendix C-i). The busier areas of the mindmap indicated where themes might be found and helped create a more organised sense of the many ideas within the data. I then collated all pertinent quotes in a single document, assigning each a theme and subtheme (excerpt in Appendix C-ii). I listed themes and subthemes, noting frequencies and possible overlaps, then refined the themes into fewer categories (Appendix C-iii to C-vi)), eventually reducing the analysis to four main themes (Appendix C-vii). While these themes expressed commonalities across a number of transcripts, the experiences relating to them were nevertheless individual. The danger of approaching the analysis focusing on commonalities was that the richness of each participant's experiences could have been lost: Smith et al. (2009)

emphasised how even in analysis of a group of transcripts, the individuals' voices must be maintained through the example quotes to preserve the ethos of IPA: some themes, therefore, show contrasts between individuals as well as commonalities.

As IPA encompasses a reflective approach to the analytical process, the ongoing changes during analysis and subsequent report-writing should be mentioned. While drafting out the current chapter, selection of quotes to underpin the themes extended the analysis process and the refining of themes. The exercise music literacy theme, for example, was originally titled 'music objectively' but this failed to describe the theme's essence: a competence in selecting music that suits personal needs and meets particular criteria, passing judgement on whether particular tracks are suitable or not, and the ability to source, download and compile libraries and playlists.

4.4 Results

The themes widely found across the transcripts were:

Taking control: This theme involved using music to control the exercise environment both in terms of shutting out unwanted elements and managing personal, internal challenges such as the motivation to start exercising. Also included are the achievement of control, its acquisition and its phenomenology.

It's all about me: This theme concerned an emphasis on individuality, differentiation from others and personalisation through associations, life stage and motivations. It reflected a strong sense of self within a time, a personal history and a social context.

Exercise music literacy: This theme concerned the competence to select and source music suiting one's needs and to convey it to a PLD ready for listening. Exercise music literacy is a new term, and might be defined as "the wide range of skills and competencies that people develop to seek out, comprehend, evaluate and use music to make soundtracks to increase quality and/or enjoyment of exercise," an adaptation of Zarcadoolas, Pleasant and Greer's definition of health literacy (2006).

Embodiment: This theme concerned the interaction of the body and music, synchronisation and the contrast between internalised music and externalised hardware, often in an antagonistic relationship. As mentioned in Section 2.2.2, experience is mediated by the body, and the exercise-to-music context brings a particular focus to this.

4.4.1 Taking control

The interviews reflected a common need to master the exercise process and gain control over barriers to activity, whether due to the participant's lack of motivation or the environment in which they exercised. This section is therefore divided into three subthemes: (1) internal challenges primarily concerned with motivation, (2) external challenges concerning adverse circumstances presented by other parties, and (3) the achievement of control through using music (or an alternative, equally beneficial strategy).

Internal challenges

'Internal challenges' refers to self-motivation, and the difficulties sometimes experienced in achieving a mental state conducive to beginning and continuing an exercise session. It typically occurred where there were no external barriers to exercise (e.g. time, equipment), and there was an intention to exercise, but difficulties converting this to action. In this section, anticipation of enjoying music, music creating a sense of confidence and music used to distract from challenges and enhance positive affect are considered, with the focus on self-control.

Several participants mentioned struggling to get started (as did many of the other Study 1 participants), but only one interviewee, Andrew, described the opportunity to listen to music as a conscious element of the motivation to begin exercise, although he was not listening to music beforehand:

> Andrew: I really struggle to go out running on my own if I'm honest. Um, I find that the, the, I don't know, the lure of listening to it, the accompaniment of music while I'm out running, um, is kind of part of the reason that I go out the door …because I can listen to it loud on my earphones and enjoy the music while I'm running and I'm doing something that I enjoy and listening to music that I enjoy at the same time [90-95].

Andrew framed the anticipation of listening to music very positively, and his description of the 'lure' of listening to music was particularly evocative. His discussion of his music featured a number of descriptions of strong emotional responses to music and deep engagement with it, as in the following quote:

> Andrew: [Music] gets in your head and it, it changes the way, it changes the way you feel at that particular time and that's like I say in the 90s grunge music it just, I don't know, music was almost like a kind of drug I suppose, it changed the way I felt instantly um, mentally so, or psychologically, so it has to have that kind of effect on me … sometimes I listen to music and it makes me feel really good, other times I listen to music and it's, I mean I can listen to some music and it's that good, that sometimes I feel I could cry [446-452].

The language Andrew used suggested a craving to listen to music for its emotional impact. He described the effects of music as relating primarily to its intrinsic qualities, stating explicitly that extramusical associations were not necessary:

> Andrew: I can listen to a piece of music that I haven't really heard before, or I may only have heard it twice before and I've got no association with that music, but it still has that effect [469-471].

Most discussion of music to increase motivation concerned activity duration, particularly anticipation of longer exercise sessions. It seemed music was primarily used to keep going, rather than to get started, and it was also mentioned in this capacity by Andrew:

> Andrew: Last week I went out on Wednesday evening, I, um, ten miles and if I wasn't listening to the music I'd probably have got to about six miles and thought, "Flagging off now," and headed off home, but because the music's there and I can listen to it for the full ten miles, it just kind of helps keep me out there [195-198].

Again, Andrew commented on the psychological effect: music distracted him from the physiological sensation of tiredness. Andrew's use of music appeared to help him 'block' negative psychological tendencies. Having initially trained without music, believing it affected his focus on technique, he changed his outlook after being presented with a running CD at the London Marathon Expo, and saw it as improving his training because it helped him achieve longer sessions.

Longer runs seemed to provoke a dependency on music for several of the participants. Steven's language implied incapacity to run without music – "certainly can't" [306] – if required to do a long training run alone:

> Steven: I certainly can't do long distance stuff, I can't marathon-train without music on, you know, unless I'm with others, um, I always think that I'm going, I'm, I'm slower without, to be honest [306-308]

Again, it might be inferred that this was a psychological rather than physical barrier. There was a compulsion to have a distraction: without music, he felt he ran slower, although this could not be verified. Steven’s description of music use was characterised by the way it stimulated positive thoughts, increasing his confidence:

> Steven: Things that are going to produce positive vibes and get me thinking, “I can be this person” or “I can do that thing” and no obstacles are going to be too big or, or whatever it might be and it, you know, I'll suddenly find I'm running a bit faster as a result of thinking more gung ho and positive if you like, and so the music is, is a massive help in that respect [81-85]

The mechanism increasing confidence was fundamental to Steven’s use of music, and the passage above describes a psychological transformation from running with music. He described his state of mind rather than physiological changes, apart from the feeling that his speed (which he did not monitor in any detail while running) was affected. The internal challenge was mental rather than physical.

For Sarah, music had to be imagined during a 20 mile race as competitors were forbidden to use PLDs. Her technique to dissociate from the discomfort of unexpectedly cold weather was to create a mental representation of an audio track:

> Sarah: Well Ashby, because it was snowing and it was freezing cold, and I was, like, the weather forecast was complete, I'd set off in, I had short sleeves on and um cropped leggings and that was it, and then it started snowing about four miles in and so I would, and

> I was just cold, you know like when, you know if there are like, I was cold, so I was, like, “What can I?” so I'll do singing to myself where I've got, um, a particular song that I do, it's because it's, um, Catatonia, International Velvet and it's got a beat and I hear that beat in my head to keep myself going, du dududu, du dududu, and I just do that and keep like to kind of, “I'm not cold, I'm not, it's not snowing, this hill isn't really going on forever,” and so I hear that and that's a kind of, it's a sort of, when I hear it in my head when I'm running, I kind of that's the pace, I think, that's the pace I'm trying to be running [222-231].

Sarah’s description focused on the beat of her imagined song, alongside using imagery to overcome the challenges around her through a psychological denial. Her use of the steady, imagined beat to pace herself is important because she also described difficulties in keeping time with an audible beat when clapping along at a concert, taking part in an aerobics class or using commercially-produced synchronous running tracks. Imagining the beat herself, Sarah felt she was running in time and this constituted part of the psychological process of dissociation from a difficult running environment, helping her ‘block’ perception of the weather conditions.

The use of individual tracks to deal with time perception also seemed to relate to a need for removal from the actuality of exercise, and the impetus to keep going to the end of the track was mentioned:

> Charlotte: If it does get to a point and I feel I'm starting to feel a little bit tired and I've still got however long to go then I tend to sort of say to myself, “Well, just focus to the end of this song,” and then that might be a couple of minutes away for example, and then by the time the song's finished and another song's come on, I've almost forgotten that I felt a bit sort of a bit, um, lacking in motivation or whatever before, and again I think that's partly due to the variety of the music and because I have it on shuffle so I don't know what's coming next [508-513].

Belinda used a similar technique:

> Belinda: I will do things like, “Right I'm not allowed to look at the numbers on the screen until this track's finished,” and that, force myself not to look so I use it almost as a timing device as well [118-120].

Charlotte’s comments on using shuffle suggest that the novelty of wondering what the next track would be helped distract her, and the anticipation kept her going. There was a sense of delayed gratification: the longer she could wait to check progress, the greater that progress would be. Ruth, who had stopped listening to music while running, used a system of counting in a similar way to Belinda and Charlotte’s use of tracks, particularly Belinda’s delaying tactics for looking at her activity statistics during exercise:

> Ruth: I thought by counting it would be a way of checking my pace, by making it 100 more each time, it means that I'm not constantly looking at my watch so it gives me a time, like I can look at my watch when I'm on 900 and I can look at my watch when I'm on 1000 and check that I'm still, still there so it's sort of gives me a time limit of when I can check my watch [268-271].

The techniques described above concerned strategies to keep going through exercise sessions, whether for the length of a music track or for a 20 mile run. These were tailored to individual needs: Sarah’s strategy included imagining music, Steven used abstract positive thinking triggered by music, and Andrew derived emotional pleasure from intrinsic music qualities. Belinda and Charlotte used the end of a music track as a time-based target, and Ruth substituted music tracks with counting to achieve the same aims. Yet these rituals, despite their similarities, were also tailored by the individual to their own requirements and preferences: Andrew, Sarah and Steven discussed quite different tracks that worked for them personally, but which were not mentioned by other participants.

External challenges

While internal challenges relate to self-control, external challenges relate to dealing with environments where others' impositions decrease motivation. Self-chosen music helped participants gain control over exercise environments where proximity of other exercisers and broadcast music were disliked. Broadcast music in gyms was criticised:

> Katie: It is sometimes a thing of get control. I find it sometimes, because I quite like having the videos on the screen um I quite like that because there's a lot of times maybe where you haven't seen the music video and that can be quite interesting but there's been a lot of music on that I don't like. It is quite distracting to have that going on in the background so having your own music, say preparing to bring your own music in to get back control because it doesn't really matter what goes on around you, so you don't have to listen in to what everyone else is listening to, you can kind of have your own little bubble, in a way [347-353].

This was echoed by Sarah:

> Sarah: I don't like it when in the gym where they've got loud music blasting out that kind of drowns you out though, because I want my own cocoon rather than what they tell, what they're playing [573-575].

In both these descriptions, the participants conveyed a sense of wanting to control their immediate environment (Katie specifically used the word 'control') and, through the use of the words 'bubble' and 'cocoon,' a need to protect themselves from their surroundings. Both expressed dislike of gym music. Katie found gym music was a distracting background noise, and described how music from classes often competed with music over the gym's PA system:

> Katie: That exercise area is conflicting with the music that's on the loudspeakers so if you've got one beat going on in your class but you can, you've kind of got one ear on what's going out on the floor [202-204].

Katie's response to gym music played over the PA system (rather than in classes) was somewhat ambivalent. Sarah's comments were more suggestive of discomfort, underpinned by the words 'blasting' and 'drowns' conveying unpleasant physical sensations. There is a sense of too much music, and it being inescapable, and Sarah's music 'cocoon' suggested a need for protection from this environment.

While Katie's tolerance of gym music was higher than Sarah's, with a need to be in charge rather than to escape, her description of music in exercise classes at the same gym conveyed a sense of psychological discomfort:

> Katie: I find especially with if they do like spin classes, often they're done in studios and they're quite claustrophobic and they can be quite dark and there's a lot of mirrors and they put on this pumping sort of house music, um, and I don't find that particularly kind of, I suppose it's quite a claustrophobic kind of atmosphere and the music sort of makes me feel like I'm in a nightclub that I can't really escape from [78-82].

Katie conveyed a sense of feeling trapped, overwhelmed by the psychological rather than physical aspects of the class. 'Pumping,' potentially a positive descriptor for lively club music, acquires negative meaning through context. Katie's description here contrasted with her more practical, take-or-leave attitude to music played on the gym floor; in the gym, however, she could choose her own music or the gym's. In a class, she did not have that option, so the music became more important to her.

Katie contrasted the music used in classes at her current gym with that at her previous one, where there were a number of Les Mills classes. The Les Mills organisation produces pre-choreographed CDs for its registered instructors, creating a consistent brand, and although the choice of music was not within Katie's control, developing familiarity with it gave her a sense of control through its predictability:

> Katie: When I knew the routine well enough, I didn't have to think about what the instructor was going to do, I automatically knew what was coming next because of what was happening with like the music [107-109].

There was a sense of comfort and familiarity, and Katie talked positively about how the Les Mills choreography was suited to the music:

> Katie: They structured each track with a different routine, so you might have an hour that's made up of between eight and twelve tracks, um, four or five minutes each and each one has its own set of moves and I find that was a lot better [than classes at her current gym], um, because it was a set kind of routine [87-89].

Katie and Sarah's own music offered a way to control an exercise environment with many factors which they were not able to influence. For Sarah, disconnection from the gym environment was important, while for Katie needed some predictability to feel in control. Others' choice of music was acceptable if it corresponded with her own music interests, or if she became familiar with the track's choreography. Without that, the music became a threat, control was lost, and audio and visual aspects of the environment contributed to her psychological discomfort.

Other participants positioned themselves somewhat differently regarding instructor-selected music. Amanda delegated control to her fitness class instructor (discussed in the next section). For Ruth and Belinda, classes were a secondary activity after running and, in Belinda's case, gym work and cycling. Charlotte attended classes frequently, but although she found certain tracks did not work for her, she did not express the discomfort that Sarah and Katie found when other-chosen music was disliked.

Achieving control

Steven and Andrew described how music took them into a 'zone' when they were exercising, and there was a sense of control in their comments:

> Steven: I'm in that right frame of mind, the music's, the right music's on, the weather's lovely such as it was yesterday, there weren't too many people around, um, and you feel, um, yeah, what's the, not unbeatable but something, something along, along those lines, yeah, but yeah, can't think of the exact words now or phrase but yeah, it just, it, it provokes, that, that sort of feelings of greater confidence and self-belief if you like, um, at that precise time. It might not last you know within a few hours of being back in, in at home in the real world, you know I might be a grump again, I don't know but, yeah, whilst I'm, whilst I've got that music on and I'm running at even if it's a slow pace, you know, I might feel great about that, about the world [566-573].

This description is the opposite of Katie's description of her claustrophobic class where she had no control of the music. Steven had the 'right' music and his description of the outside environment conveys a sense of transformation, and a positive solitude. Sarah too implied a need for space when discussing the gym: "when people are around you, I find it a little bit claustrophobic" [582-583]. Control was achieved through a combination of the 'right' music and a sense of space.

For Andrew, whose comments focused particularly on intrinsic musical qualities, the music was fundamental to getting into a 'zone':

> Andrew: I choose it [the music] because I know it works for me when I'm out running, it's, it's got the desired effect on me while I'm running, you know, it takes me into that kind of zone where I'm just enjoying it and I'm enjoying the music and it helps me enjoy the running and I think that's why I choose it [207-210].

For Andrew, the focus was on music and running: the environment became more important when he did not have music, as was the case on some of his shorter runs. His description of a 'zone' was reserved for instances where music and running interacted. 'In the zone' is a common phrase used in sport referring to peak performance, and corresponds with Csikszentmihalyi's flow (2002), a state where the individual achieves satisfaction from a balance of challenge and being equipped to meet that challenge – thus having control of the situation (see Section 1.2.1).

Amanda seemed to prefer to pass control to someone else by going to exercise-to-music classes:

> Amanda: Someone else takes control of the situation, tells you what to do, so you don't have to have planned and thought. The kit you need is fairly simple, it's all there as well which is helpful, I think, once they've showed you them and yeah, when I'm, I'm in full on gym mode then yeah, I do like my classes a lot [69-72].

While Amanda described passing control to others, it is an oversimplification to see this as surrendering control. Rather, it was a delegation to a suitably competent individual to deliver Amanda's requirements. Her classes were part of a holistic strategy of physical activity and diet: she referred to "The fitness diet plan I, I follow, sort of abide to currently" [546], and this again suggested her applying an external framework to fulfil a need for control. Amanda had clear requirements and was utilising whatever resources she deemed necessary to deliver them.

Amanda was pursuing the effect of the music: she described how she had built an association between dance tracks she exercised to and the exercise activity itself. The instructor acted as a facilitator, triggering Amanda's physical activity associations. While for Andrew, the facilitation happened by pressing the 'play' button on the iPod, for Amanda it took place by arriving at an exercise class where she knew the processes would trigger a desire to move:

> Amanda: It's not that I like dance music that much, but the beat it, it, I'm guessing it possibly makes, it, it produces more adrenalin I suppose, it's automatic association … plus the only times I listen to music are in the car driving or generally at exercise classes. I don't tend to listen to music for anything else so there's a definite association probably in my brain. I hear certain music and I want to do particular exercises that I'm used to doing to that particular music [91-98].

Katie's enjoyment of classes at her previous gym seemed to have some element of delegation to an instructor, but also involved a sense of control as she became familiar with repeated routines, as discussed in the previous section. Both Katie and Amanda exhibited a sense of managing exercise through delegation to an instructor who was required to fulfil certain criteria: when these requirements were not delivered, as in Katie's new gym, lack of control had a dramatic effect on enjoyment of exercise.

4.4.2 It's all about me

Analysis revealed highly individualised exercise music use across the interviews, and this was frequently connected to self-identity. Participants sought to differentiate their practices and motivations from those perceived among others. They also identified themselves within groups, by their life stage and by the broader autobiographical context in which they were exercising.

Differentiation from others

The most commonly-found theme/subtheme, identified in eight of the ten transcripts, was the presentation of self-identity through differentiation from others' use of music. Sophie, in the following extract, only briefly considered the question before moving to contrast herself with others:

> Rachel: Do you think having an iPod particularly affects the way you select music at all, make playlists?
> Sophie: Yeah, I suppose, I suppose years ago, when I used to run on the treadmill in the gym we had a great big you know, CD player thing that you would listen to a CD, or listened to the music that was playing in the gym, yeah, I wouldn't listen to anything else out and about then so I suppose the iPod thing, and I get to a lot of friends who can't run without music at all, you know, need to listen to something all the time, they can't they can't, find it a real struggle in a race and they can't listen to music, but I say for me I can fit to [sentence trails off]
> Rachel: Do you think that makes a difference because you still sometimes run without and sometimes with it?
> Sophie: Yeah, I don't rely on it, obviously some people do but no, I don't rely on it all the time. [164-174].

Sophie presented an identification with running culture, acknowledged events prohibiting music players ("…and they can't listen to music"), and positioned herself as capable of running without music, differentiating herself from her friends; the inference was that music was something of a crutch for others, but not for her. This related to themes of using music to distract from physical difficulties, considered shortly: Sophie implied it was a weakness if the runner felt unable to manage without music.

Other participants differentiated themselves through music choice. Katie compared her preference for individual tracks to others listening to whole albums: her comment “I know some people would go ‘right, I’m going to run for the entire length of that album,’” [280-1] presented a difference, explained later in the interview when she described playing music in her car on the way to the gym:

> Katie: I'm not the kind of person that wants to listen to an album from start to finish. I'm too picky and kind of fickle. I'd rather just have the radio on and flick around and see what comes up [424-426].

Katie’s comments indicated her need for novelty and stimulation; underpinning them was her presentation of herself as a particular kind of person, and lack of identification with an album-listening ‘type.’ This contrasted with Andrew’s preference for albums:

> Andrew: Most of the albums I listen to, the music's kind of flowing through from one track to the next and I don't want that sudden change of tempo, or sudden change of style or rhythm or whatever, you know, I'd rather just put an album on and listen to the album really [356-8].

For Andrew, the consistency was a benefit, while for Katie the opposite was the case, and her comments implied a high degree of control over each track she listened to.

Charlotte contrasted herself with others by suggesting that her practice of not synchronising to music was comparatively rare:

> Charlotte: I'm probably quite unusual in some ways in the way that I run because I tend to have a sort of comfortable speed really … the only time I would really pay attention to the actual speed of the music as such would be if I was doing something where um a particular I don't know, a particular song came on that was just slightly faster, slightly faster beat than I was currently running at… I think I'm quite unusual, I think a lot of people try, try and run in a rhythm to the music whereas I find that my rhythm is quite different [133-152].

However, Charlotte reflected a widespread trend among exercisers of not intentionally synchronising movement to the beat (see section 3.4.1), and only Belinda and Katie reported frequently synchronising. There was no indication that asynchronous activity was perceived as negative; of all the participants, Charlotte was the most frequent user of exercise music – "always, always" [51] – and her comments suggest she was trying to explain how the music worked for her, rather indicating that she wanted to synchronise but was unable to, or that being unusual was problematic.

The style of music was also a focus for differentiation. Steven, who reported listening frequently to film soundtracks while running, at first seemed to have forged a connection with another runner with similar taste:

> Steven: I have met, well, not met but come across a chap on YouTube, who makes his own, um, blends from, from epic film scores as he puts it, um, he, he's a runner and we follow each other on Twitter now since I sort of mentioned that I love that, my running stuff, and he said "Well that's why I do it because I run," and it's like "Wow, a kindred spirit!" I don't think there's many people who would have the music I do to, um, to run to [339-343].

Steven had found someone who shared his preferences and wanted to maintain some sort of personal interaction in recognition of this, hence using Twitter. Yet even with their similar tastes, and Steven's professed liking for many of the other runner's musical choices, he explained that he needed to go through a process of careful selection, omitting some of the tracks:

> Steven: I didn't want his mix so then I had to basically go through his, his things and see which ones they were by, you know, clearly he'll credit the composer and what film it's from so I, I gone through and saw, ah that's from such a movie by such a composer or artist and then go buy some, buy it myself so I've not downloaded his mix [359-362].

Even in this example of emphasised similarity, Steven presented his music requirements as highly personalised. He considered some of the other runner's tracks to be unsuitable for his own running and preferred to spend time sourcing individual tracks rather than downloading the complete mix and tolerating unwanted tracks: every track on his playlist had to meet his requirements.

Differentiation was related to both specified and unspecified others: Charlotte talked about "a lot of people" [151-2] running in time to music, unlike her, and said she included more long runs in marathon training than "the average person" [343-4], but also described how she enjoyed a section of the Nottingham marathon that a woman running alongside her disliked:

> Charlotte: I always really enjoyed that bit and I think it was because you knew it was probably two or three miles, didn't you, by the time you'd finished it, and for me, I thought oh, I'm just going to run down this pond here then that'll be, you know, about three kilometres and I was absolutely content doing that whereas the woman I was running it with, she didn't, she couldn't do it, just oh my god, and she really found that bit horrible [373-377].

The other runner was not a friend, but another racer whose pace matched Charlotte’s (because marathon pace is relatively slow, chatting is usual further back in the field). Belinda also differentiated her exercise habits from those of a friend she had recently started training with:

> Belinda: I'm looking across and making sure she's put hers on fast enough, no cos she's trying, she wants to get into the Specials, you know the police thing… she might get cross with me if I start nagging her too much so I'm sort of trying to gently prod her [360-8].

As a former personal trainer, Belinda seemed to be trying to balance acting in a professional capacity to help her friend with not giving unwelcome advice. This differentiated their roles in the ‘gym buddy’ relationship, while simultaneously demonstrating affiliation through shared workouts. There was not a clear demarcation between attitudes to generic others and attitudes to friends: Charlotte generalised non-specifically above (“lots of people”; “the average person”) while Sophie described “a lot of friends who can’t run without music” [169].

These comments show exercisers presenting themselves as competent individuals, using music in a way that was right for them, perceiving differences from others. There was a distinctive autonomy and ownership of the process of exercise music use, and a sense of individuality pervading it.

Life stage and context

Several participants presented an exerciser self-identity connected with their life stage. This was particularly evident in Sophie’s comments. As a mother of two young children, running provided ‘me-time,’ and she conveyed a sense of escaping to a former life with fewer responsibilities, listening to a playlist featuring 1990s indie music from her time at university:

> Sophie: That's student days I suppose, a lot of those songs probably have, yeah, quite a lot of different memories and things and that's kind of real, yeah, extension of them I suppose, because I suppose with my running a lot of the time, particularly since I've had the children, it's thinking time and just, you know half an hour, an hour to myself, so sometimes it's nice, I suppose you do reminisce a bit [159-163].

For Belinda, whose children were much older, motherhood also marked a period of detaching from music listening:

> Belinda: I had, you see my first child in eight, 1988, so then the music, going out dancing didn't happen [laughs] for a long time and then you sort of lose touch with music quite a lot, well I did, anyway, because I've never been, you know, [husband] doesn't tend to buy much music either so, it wasn't coming into the house really [130-134].

Like Sophie, Belinda's exercise playlist contained music from her time at university, and was linked to reminiscing:

> Belinda: It's just a feeling, yeah, yeah. It's not, although I suppose there are certain things like if the Communards come on, um, because we used to, because that's an association with exercise and, um, socialising and feeling good, it was, because there used to be four of us and we had this like little arrangement so that the flats, the university flats were there, the campus was there, sports hall was at the top. We used to all trot up, go to – it was so healthy! – go to aerobics, come back, call in at the bar, have a pint or two, trog all the way back to, um, the flats, shower, get changed, go back, back into the bar and into the club bit of the bar and dance all night … when the so the Communards come on I think that that, that I very much associate it with that time when I was doing that, because we all used to do it, 'cos I say, because we used to go to the club bit early so we used to have the dance

> floor to ourselves and get the DJ to play the Communards and we'd all start grapevining round, messing about and having a giggle [201-213].

These university tracks had particularly personal associations. In Belinda's case, the music was associated with multiple playings over a period of time, rather than the memory of a specific event associated with a track: "It's just a feeling" [201]. Sophie too commented on "quite a lot of different memories" [159-160] again suggesting that the music was the soundtrack to a particular life stage and listening to it offered escape from the demands of motherhood. Belinda, further along her journey as a parent, did not express feelings of escape, yet there was still a recognition of university as a time of fun and lack of responsibility. She positioned her as a member of a small group, and mentioned another group member with whom she was still in touch: identity was socially articulated, and Belinda placed herself within a social world. Sophie, on the other hand, did not discuss other people, and it appeared for her the primary purpose of the music was to provide a brief 'escape' into herself.

Connections with others

Belinda's comments in the previous section related to people as well as the life stage she associated with particular tracks. While most of the transcripts showed strong elements of differentiating oneself from others, identity was also related to social connections and membership of friendship groups. These, in turn, seemed to be related to life stages, indicating interconnections between the subthemes of the main 'It's all about me' theme.

The Communards reminded Belinda of "my friend … who's up in Northumberland" [209], while another friend was associated with The Cure:

> Belinda: 'Lovecats' particularly but, um, yeah, no, the Cure I associate with him, and that was one summer, um, lovely we're in a flat not together, but, you know, in a shared flat …

> you do go off and think about memories or whatever, or what, you know, um, so I wonder if that’s why I like particular songs as well because it does, I hadn’t really thought about it but I think it probably does trigger memories of sort of good times [246-250].

Belinda’s speculation about the influence of memories on her preferences suggested a possibly unconscious process, yet when asked about musical associations, she could describe them in detail. Belinda’s love of aerobics and dancing prior to motherhood, and the lack of music exposure after having her first child, meant that many of her musical preferences dated from an era with an active social life which also involved physical activity to music. Belinda mentioned some more recent music from the early 2000s onwards, but the tracks did not carry associations:

> Belinda: I've got that Charlotte Church one um – god my memory is so bad – um, ‘She Needs Therapy,’ that one, I've got that one on and I really, really like it and I think why have I got that and I don't know how that's, and a couple of old Girls Aloud ones as well and I think, I have no idea [261-264].

The exception was a CD mentioned by a lecturer when Belinda had returned to university as a mature student:

> Belinda: I've got actually I even bought their CD, the album, what are they called, um, oh my memory is just so bad, remember ‘Keep on Dancing’ that was, that from when I was at Uni, at Brookes so that was like from 2000s, must have been 2002 or something, they suddenly burst. Anyway, one of the lecturers came in and said [Rachel: Scissor Sisters?] That's it. Yeah… and she came in and said “Ooh, I went for a run this morning” and it's a young lecturer, “And I got this new album, it's really good.” So I went and bought it [273-279].

Earlier in the interview, Belinda mentioned that during her return to university she only exercised in the holidays, although, over a decade after the event, she remembered that the lecturer was using the music to run to. Unlike her previous associations, this was a specific episodic memory, yet (as with the Communards), academia, social connections and physical activity all related to the musical association. Having described herself and her husband as infrequent music buyers, it was particularly interesting that the recommendation compelled her to purchase the album, and this suggested wanting to connect with the academic world around her at this time and those within it. It is possible that university provided a particularly meaningful experience for Belinda as she returned to her own self-development after spending time bringing up children.

Sarah's playlist was the result of an evening of music-sharing with her husband:

> Sarah: [Husband] and I had an evening where we just went through random CDs picking out songs and making some playlists just for fun, like he put some songs on that he knew that I didn't know and so that when I was listening to them they'd kind of like have a "Oh, this is what he picked," kind of, and it would just kind of keep me going. That was quite fun … my favourite one which is one called 'Only Losers take the Bus' which is like every time I hear it, it just makes me laugh. He put it on so I would like, no, you're not taking the bus, you're going to keep running and it kind of ironically appears when you're going up Anchor Road. It did the first time it, I heard it, 'cos I he'd just put it on, I'd just put it on my, my pod and he'd, it was like I'm going up Anchor Road and it's 'Only Losers take the Bus' and it's a really kind of like pushing you on kind of, yeah, no I'm not getting the bus, I'm not getting the bus, I'm not getting the bus, so that sort of kind of happy association songs [180-191].

Sarah described how making playlists helped her connect with her husband both during an enjoyable evening of selecting music and, through association, while listening to it during her runs. She described her running soundtracks as a companion: when she originally started running, using a downloaded Couch to 5k programme with an audiofile, the voice giving instructions over the music was important to her because of the sense of being supported: “I needed the little voice and the encouragement” [774-775]. The association of ‘Only Losers Take the Bus’ with her husband seemed to be similarly beneficial, creating a sense of encouragement from a loved one that also had positive associations with a specific memory and carried meaning for her running.

For Katie, downloading a Britney Spears album initially led her to question herself and the music’s meaning:

> Katie: There’s memories of people that I was friends with at the time and that was going, so kind of the soundtrack thing sort of 16, 17 at college. What I’m playing at the moment is I like, um, I remember I was out, on a night out with some friends and I was probably quite tipsy and we were somewhere where a Britney Spears song came on and that's a bit of a guilty pleasure, and we were “Oh, this is awesome, remember this, this is so cool,” and when I got home that night I was like, downloading it off iTunes and I was “Oh, I've got the Britney album now, what am I going to do with it?” But putting it on now it is, it's massively different, it's proper cheesy, but they're pop songs and therefore they're light-hearted and you can sing along in your head and they've got quite good beat to it, it kind of reminds me of sort of like my friends, and college and school and things like that, so I don't mind it like that, um, and that's kind of I suppose why I like the pleasure, um, you know, comes from that it's having so, that kind of association [292-304].

The music’s meaning during a night out with friends and alcohol seemed lost when the music was taken out of context. Katie’s comment, “What am I going to do with it?” suggested the music could no longer function the same way if she listened alone. The songs reacquired meaning only when used for exercise because they met Katie’s exercise music criteria and offered positive associations and memories: these appeared to relate to a phase of life – “my friends, and college, and school and things like that” – rather than the specific night out. Exercise may have helped because of its associations with feelings of wellbeing and relaxation, presenting physiological similarities to a night out. Katie used the term ‘light-hearted’ several times, conveying that her exercise needed to be fun, and the Britney Spears tracks provided appropriate associations.

These examples show how music choice reflected a sense of self for participants, which was carried over to an ‘exercising-self’ differentiated from unknown and known others. Music choices were highly individual because of their participant-specific associations, but their use and the meanings they carried showed commonalities. Participants reflected on their identities within social groups while simultaneously promoting their individuality, creating an overall sense of who they were and the social worlds to which they belonged.

4.4.3 Exercise music literacy

The process of sourcing music and building playlists requires technical competencies rarely necessary ten years ago. The theme of exercise music literacy recognises how participants used these skills alongside musical judgements to (1) identify, (2) obtain and (3) compile collections of music suited to exercise.

Musical judgement

The first stage of exercise music literacy is identifying appropriate music for exercise. ‘Judgement’ relates to musical taste, but also covers suitability for exercise based largely on intrinsic details. Participants described various criteria for exercise music, and also identified unsuitable characteristics. Charlotte’s description of techno emphasised its homogeneity and repetitive structure:

> Charlotte: I just don't like it, no it doesn't, I just don't like it and it sort of goes on and on and on, and vaguely changes at some point in the whole 45 minutes and it never, I never used to enjoy the classes as much [222-224].

Katie’s description of music she referred to as “pumping sort of house music” [80] was very similar:

> Katie: I don't really like that type of music, it's like it's too repetitive for me and the beat is too, it's too standard, there's no kind of peaks and troughs in it [82-84].

These participants both attributed their dislike to the lack of change within the music. The absence of tension and resolution may have led to understimulation. Katie emphasised her preference for classes where sections of choreography were matched to the music’s structure, again indicating a need for periodical change. Although both Katie and Charlotte had formal music training, their terminology here was non-specialist and their criticisms of the music were simply due to its repetitiveness.

Charlotte described finding a ‘dance’ version of a familiar classical work unsuitable for her exercise because of associations from her classical music training, although she recognised that the intrinsic qualities created were appropriate:

> Charlotte: It's all been produced, et cetera, and made into this sort of more rocky type thing. Because I know the original, I just think, “Oh no!” It just, it doesn't fit right with me because I know I've already played it, it's one of those and I just think, “No, I can't, this isn't.” I don't like the version of the track really, full stop. Although I can see why it works in that class in some ways, I just do feel as a whole it, I just, it, because I know what it how it would have originally, I think that's how I know it's set, and that's how I know it most. I think that's why it puts me off a little bit. I guess, um, where perhaps if you didn't know

> how it was originally, what it's meant to be, for argument's sake, then you might feel more, you might feel, “Oh, this is quite a decent energetic piece of music” [231-238].

These comments showed Charlotte’s thoughts in progress as she tried to describe her own associations with the music in terms of its content: she acknowledged that the intrinsic musical elements were not the issue. Her knowledge of the original version, not just as a listener but having performed it, seemed to create an association which prevented her perceiving the track as exercise music. Her familiarity with it was so great that she disliked the new version, and she was able to describe objectively why this music did not work for her. Yet Amanda was positively inclined towards dance versions of classical and classically-oriented pieces with which she was familiar:

> Amanda: The one I really, really like that got a few looks is The Phantom of the Opera-esque, a dance remix of Phantom of the Opera and there's also a Bach Toccata and Fugue dance remix and as a classical person, these ones appeal to me quite a lot [287-289].

There was a sense here of music associated with Amanda’s musician identity: she referred twice to “the musician in me” [78, 86]. The classical-dance hybrids satisfied her because she associated dance styles with exercise, but also because classical references were familiar and identity-related. Need for familiarity had led her to replace the unfamiliar music on the Couch to 5k podcasts with her own choice, using music editing software, and drawing on the exercise associations the music had for her.

These extracts all involve familiarity and suggest an optimum level of stimulation, balancing the familiar with the novel. For both Charlotte and Katie, some music selected for gym classes was too repetitive and became over-familiar as it continued to play. For Charlotte, the original version of a piece of music was too familiar for her to enjoy a dance version, although Amanda found the cross-genre pieces in her class provided an acceptable and even motivational familiarity through classical content.

Intrinsic details

Participants tended to consider objectively their criteria for suitable exercise music, focusing on the music's intrinsic features. These were more important than the music's aesthetics, and several participants reflected that their music choice was 'cheesy' or embarrassing, but that the musical content was particularly suited to exercising. Katie commented that "My iPod is pretty cheesy, I'd be quite embarrassed if someone found it and had to hand it to me" [229-230], but also discussed a running music compilation:

> Katie: Some of the tracks did work on there, um, you know, they are the cheesy pop ones which just happen to have a good beat [379-380].

Belinda had a similar situation with a particular track:

> Belinda: And a really bizarre one that I do like, um, um, god, what were they called? 'Some Girls Do,' oh, really old, 70s
> Rachel: I know the one you mean, I can remember it, remember it on 'Top of the Pops.' Racey?
> Belinda: Racey, yeah, that's it [lots of loud laughter]. That's really embarrassing. And that, you can really do your intervals well to that, the beat of it, is absolutely brilliant to do 400 metre repeats, I would sometimes go and find it and do it [163-168].

Here there was a shared recognition that the track might be considered embarrassing if listened to for enjoyment, but its functionality provided justification for the embarrassment of including it on a playlist.

In contrast with the extrinsic associations, participants were less inclined to contextualise intrinsic characteristics, but also struggled to describe the interplay of music and exercise. Charlotte, a trained musician, tried to explain how intrinsic elements of the music motivated her:

> Charlotte: I suppose the quite heavy bass line in there, that probably helps a bit, um, I'm not being particularly specific, it's difficult to say [86-87].

Charlotte offered descriptive terms for the musical element – “heavy bass line” – but her analysis suggested a less conscious process at work. She believed the intrinsic detail was motivating her, but struggled to express how. It seemed that alongside objective appraisals and an understanding of the required intrinsic factors, there was an unconscious element, perhaps a ‘gut feeling’ of what might work.

Steven was not a trained musician, but used similarly descriptive vocabulary – “builds to this epic crescendo” [136] – to describe the content of a track, and considered its effect in increasing his speed. However, like Charlotte, he struggled to explain the process:

> Steven: How that sort of just builds and builds and builds to this epic crescendo, I mean that again if, if you and I had the same music, same track lists and at the same point and you just watched me on the treadmill for an hour, you could probably say, he's listening to such a song, by the speed of my legs, because I probably speed up and slow down with the music
>
> Rachel: So is that actually, it's not in time to the beat or anything?
>
> Steven: No, I don’t think so
>
> Rachel: So there's something else going on
>
> Steven: Yeah, it's, yeah.
>
> Rachel: ’Cos things don't generally accelerate
>
> Steven: Something more emotional in, in my brain probably, it's so you know, it's difficult to pinpoint [135-145].

Steven’s remarks inferred an unconscious cognitive process where the sound of the music triggered emotions that in turn resulted in a motor response. He specifically sought out music that began quietly or slowly then ‘built’ in some way, indicating a conscious awareness that this generated the desired motor effects for running, but the emotional factor between sound reception and motor control proved difficult to explain. This did not hinder practical application: when a track partially fulfilled Steven’s criteria but slowed in its closing section, he chose to listen, then move to another track unless the section coincided with a cool-down:

> Steven: I've got the Goonies Suite, which is the beginning and some other bits, but the beginning bit is again a sl-, quite a slow start and just builds up, and that's one of my favourite films ever and so I just love that. I'll just thrive when that comes on, but then I'll have to hit the shuffle to move it on afterwards because it just slows right down, um, and that's OK if I time it, Goonies comes on just as I'm finishing, I can have a speed burst and then slow down and have a bit of a cool down [172-177].

Andrew described the need for a continuous, rhythmic beat over which changing sounds and samples created interest. This helped him focus, although he did not give the focus an object.

> Andrew: When I'm running, I just want something that's like, like it's rhythmic and it's got that continuous beat, and the music that I listen to it's got, like, sounds that come in, sounds that come out, you know, um, it's sort of, like, lots of samples in it and stuff like that but, um, there's always that constant rhythmic beat to it and I suppose when you're running that's, that's the kind of stuff I like really, that's got that beat and it helps me like focus [153-157].

Andrew was the only participant who discussed musical structure at album level. He preferred to run to albums because they were conceived as a whole, providing consistency throughout the run:

> Andrew: The music's kind of flowing through from one track to the next and I don't want that sudden change of tempo or sudden change of style or rhythm [358-360].

For other participants, randomisation (the ‘shuffle’ function) and lack of structure were preferred, creating motivation through unpredictability. Charlotte took this approach to avoid associating particular tracks with specific points along her running route:

> Charlotte: If I did just do the playlist and just play it each time, so the same each time then I think that I'd, I don't think that would work as well for me. Um especially if, you know, there are hills and things and you think this song means my hill [514-517].

Charlotte’s comments contrasted with Katie’s preference for predictable music and choreography in classes, yet Katie’s description of her self-selection process indicated a far less structured approach: “I’m like a channel hopper on flick mode” [317]. This may be due to the activities: the choreography in an exercise class demands more advanced motor skills and concentration than the repetitive movement when running or using gym cardiovascular equipment, and familiarity of the music may have helped reduce stimulation and cognitive demands. With less complex physical movement, more stimulation may be required from music, with novel music more appropriate (see discussion of Berlyne’s research in Section 1.4).

Unstructured playlists could, however, be problematic when an unanticipated track had inappropriate intrinsic qualities. Belinda described starting a high intensity section of treadmill training with music she could synchronise her footfall to, and how a change in bpm in the next track made this harder:

> Belinda: If you're trying to go fast and suddenly you get, with an interval, then suddenly this slower beat comes on and you think, “No!” and try, you know, keep this pace up [176-178]

It is difficult to operate a PLD during vigorous activity (alternated with rest periods in interval training) hence Belinda continuing to try to maintain her pace with the ‘wrong’ music, rather than cut short the intense section. She conveyed the feeling of increased effort required, and there was a sense of the music temporarily sabotaging her workout aims.

There was widespread use of intrinsic musical qualities to manage activity. As mentioned previously, Belinda used the “embarrassing” Racey for 400m repeats (a kind of interval training) because of its pace: subsequent analysis revealed a tempo of 184bpm, ideal for fast synchronous running. Martin also selected music to help control his pace, although in his case it was to reduce pace to avoid pain due to health issues:

> Martin: I like to have, yeah, sort of a mix of, I think I pick the mood, and I can change, I think it does change what speed I'm walking, well now because of having the stoma here, I don't know, because you see I've got a double hernia done, and what was happening was if I walked over a certain pace, I'd get intense pain here … I ought to try walking a bit quicker but I'm still thinking, I'm still stopping myself I think, thinking that I'll get the pain here [417-422].

Sarah also chose listening material to manage arousal: she had recently begun listening to podcasts and audiobooks during slower runs because music increased her arousal, resulting in her running too fast:

> Sarah: If I want to run for 20 miles I need to keep it going, so I need to pace myself and I think that's when I started listening to sort of audiobooks as a kind of, or podcasts, talking rather than reading … I think it sort of slows you down a little bit because you haven't got the beat pushing you on so that's more of a kind of, I feel like that's more of a conversational run, because I'm trying to run at conversational pace, so if I'm listening to people talking, my theory is that I'm, you know I don't, um, so I listen to that. I'm listening to a couple of audio books. I'll listen to Marathon Talk, or something like that, kind of podcasts, where people are talking and I'm listening and then almost as if I'm kind of in the

> conversation. So that's the pace that I'm running, is what I'm trying to do, and therefore I'm sustaining my energy [167-176].

She listened to music during faster runs to increase her arousal levels:

> Sarah: If I listen to speech then I think it sl-, it doesn't keep, doesn't wake you up enough or wake me up enough so then I'll put music on [177-179].

Sarah's descriptions evoked two quite different frames of mind. For shorter runs, she increased musical stimulation, pushed by the beat with a sense of the music controlling her to make her run harder. For long runs, the conversational qualities of her listening were very different: her feeling of being part of a recorded conversation implied a two-way interaction, even though her decision to replace music with speech had the same aim: for an external source to help her control her pace. Yet with the speech, it was the absence of the beat that seemed to have the effect, and the listening served to distract from the length of the run.

Sarah described being reliant on music in her early days of running, then moving towards increased social interaction with other runners. Being part of a recorded conversation may have been a substitute when another runner was not available to keep her company (Sarah also described long runs where friends have accompanied her for part of the run).

Technological competency

This subtheme relates to the second stage of exercise literacy: obtaining music, compiling playlists and adding tracks to PLDs. Sarah described trying a range of listening material, most recently podcasts. She began running with a "Couch to 5k" (C25K) beginners' plan available online (NHS, n.d.), with a downloadable recording featuring music overlaid with spoken instructions. She subsequently experimented with commercially-produced synchronous running music, and her preference at the time of the interview was the playlist mentioned previously, put together by her husband. This varied pattern of sourcing, and active engagement in finding music that ‘worked,’ was evident in several of the transcripts. There was a dynamic process of altering playlists, noting and sourcing tracks heard in everyday life, and transferring them to exercise contexts.

Most of the interviewees conveyed confidence using technology for acquiring and managing music libraries, and delivering their exercise music requirements. Amanda described the process of selecting music for a gradually evolving playlist:

> Amanda: I look at my collection, at MP3s that are, of that variety, um, I start off going through the names and see if I actually recognise the name and add those to the list or that they're from a previous playlist, so some, quite often I'll build on what I already had, delete a few tracks that I’ve decided I don't like quite so much, and add a few more, um, and sometimes I'll just have them on, sat on my computer, just playing and delete the ones that I get bored during them and they get deleted and then I can turn that into my playlist later um so there are certain tracks that I would always add to lists, they're the ones that are on there at the moment, they're the ones that I want on the next playlist [132-139].

Over time, she made small changes to the collection of MP3s on her computer, which subsequently became a new playlist. She removed tracks either because she disliked them, or they ‘bored’ her – although they must, at some point, have been enjoyed. Amanda described always including the same ‘core tracks’ in her playlist, suggesting that the rate at which she became bored with tracks varied. The manipulation of the playlist demonstrated a high level of autonomy, collecting and managing tracks through a clearly defined process which she had developed.

Charlotte and Sophie were also technologically competent, and described the same evolutionary process with playlists:

> Charlotte: They tend to last just out a year before I think well, I'm bored with it, and then I'll play back through the old tunes, work through and download some new stuff … some of those songs on the current playlist now they still get recycled a bit really, they might have a break and come back…there are certain tracks they keep popping up, so if you were to look back at my lists from five, you know eight years ago, there are probably some tracks that are still there now [448-467].

> Sophie: That's the great thing with like, you know, iPod means you can quickly do stuff to a playlist to listen to out on your run so yeah, I go back to lists, previous ones occasionally, but yeah, they do evolve over time [259-262].

Although Amanda liked to pass control of her exercise, including the music, to an instructor for a class, her music choice when exercising alone was highly tailored; she had used specialist software to remove the original music from her C25K podcasts and replace it with her own choice of music backing the spoken instructions:

> Amanda: I have software that allows you to run the two together … You can record your own speaking if you want but I don't, I use theirs, so you just download that, it's one track and then you put music in the second and then you merge them to make an MP3 [167-171].

Participants also described sourcing their material, looking for new music or tracking down a piece they had heard. Steven's choices, as mentioned, were inspired by another runner who listened to similar styles of music and placed mixes online, with Steven using them to inform his choice:

> Steven: I've not downloaded his mix 'cos there was lots on there that I didn't, that I wouldn't have ran to or been, you know, been comfortable running to [361-363].

Steven's comments indicated that if the music was not 'right' for him, he experienced some discomfort. He had not tried running to these tracks, having not downloaded them, yet had evaluated them as unsuitable. He preferred instrumental film tracks to ones with vocals, and used music from lively film scenes such as battles, although he struggled to describe his criteria, creating the impression that his choices were instinctive:

> Steven: I can't think of what, um, what there is or why, why there are things that I don't sort of, um, go for [369-370]

Andrew also went online to discover new material, using a variety of sources:

> Andrew: On Amazon, probably flicking through the albums, you know when you can try the clips, different clips of music, sort of listening to clips, downloading stuff, sometimes I'd listen to it once and not listen to it that often again and I'd hear other, hear, Spotify was really good, I don't know if you can like listen to a lot of stuff there, and I suppose with my iPod as well with the iTunes it gives you the option of sort of like discovering other music similar to that. I don't know how it works, it's, I suppose it's marketing things isn't it, which I absolutely hate, I detest marketing [330-335]

For Andrew, autonomy was key. He struggled to reconcile his enjoyment of suggestions by website algorithms because of the implication of surrendering autonomy and providing commercial gain. There was, however, little choice when searching for and obtaining music legally. In the broader context of his interview, and the enthusiasm he expressed for finding moving musical experiences, the acknowledgement of the role of commerce presented Andrew with a dilemma: to source the music he wanted, he had to interact with the marketing he hated. Love of music overrode his dislike of online promotion.

Martin’s approach was similar in its craving to discover the new, yet his negotiation around marketing was quite different. Since his health problems had limited his income, he was unable to purchase much music, and relied on sourcing free legal downloads:

> Martin: I've got three or four sites I go onto, and also there's a great record shop in Brooklyn and they have online about three or four thousand completely free legal tracks from different bands, which means you can listen to, you know, all sorts of stuff [255-257].

Martin’s interview detailed a lifetime of being exposed to and seeking out an eclectic range of music, from his father’s Baroque organ-playing in his childhood to the punk scene in London pubs in the mid-1970s. In his late fifties at the time of the interview, he continued to source new material across many genres. His walking appeared to be an accompaniment to his music, rather than vice versa: his music carried more importance than his exercise.

Relatively new technology was at the heart of the comments on hardware, and there was a sense of empowerment and control that this provided, suggesting a further element of the Taking Control theme discussed in Section 4.4.1. There was a high degree of technological literacy among the exercise music users, which may be a recent development: Heye and Lamont (2010, with data collected in 2006), found many of their student participants lacked such literacy and persuaded others to upload material to their PLDs for them (private communication with A. Lamont).

Charlotte discussed her journey through technology, starting with “… a trusty Walkman in the old days” [399], conveying a sense of comfortable nostalgia. In marketing terminology, she was either an innovator or early adopter (see, for example, Mahajan, Muller and Srivastava, 1990); a consumer who purchased a product early in its life cycle, and had had varying levels of success with new gadgets.

> Charlotte: I tried very, very briefly with, um, a C, a portable CD player, but I found that didn't work though, ’cos it slipped, so I was back with just a CD, with a tape, then there

> was a brief listening the two minutes that minidiscs were around. I had a minidisc player, um, and I don't think it's too long after that that the first iPods came in [401-404].

Belinda, in contrast, described being defeated by technology, and talked of how this limited her choice of playlists alongside the inconvenience of a rapidly discharging battery:

> Belinda: I use my old, um, iPhone at the moment because I haven't got, this is new and I didn't have the SD card or something. I'm hopeless and [daughter] sorts me out, um, but I've not managed to get any music onto it because with my iPhone I did it all from my CDs, loaded it onto iTunes and put it on my iPhone but I don't know how to do it on that one and [daughter] couldn't figure it out either because, um, she always just downloads music, she doesn't have CDs, she just downloads everything so, she tried to do it for me and failed, because it was another format or something and so I have to just charge up my old iPhone and use that as an iPod, but the battery's gone on it so you have to charge it because it only lasts for about 12 hours and then it's all gone again so, um, yeah, and I've just got a couple of playlists on there that I use [98-106].

The language here – "hopeless," "failed" – indicated a much more uneasy relationship with technology, and almost a sense that technology had the upper hand and Belinda had to compromise. This contrasted with the other participants' descriptions, where conveyed control over music library technology; they were literate in their selection of appropriate music for their exercise. Belinda was more musically literate than technologically literate, and she needed both competencies to avoid compromises in her playlists.

4.4.4 Embodiment

The embodiment theme operated on several different levels. Internalisation refers to a sense of becoming one with the music, signifying a close, positive relationship with it. Synchronisation – movement in time to the music's beat – created a more problematic sense of embodiment; participants described difficulties synchronising, despite wanting to do so. The third subtheme, 'hardware hassles,' reflects an antagonistic relationship with PLDs, despite technological literacy in compiling music libraries. The participants generally saw hardware as non-embodied: its sound may have become part of them, but the hardware – with one exception – did not.

Internalisation

Several participants described the music becoming part of them. Andrew described how music became internalised as he ran:

> Andrew: For me, it's got to really get in your head and it's, and I think you become kind of wrapped in that environment, if you know what I mean, it's a difficult one: I'm not listening to the tracks, the music is in me, if you know what I mean…Running and the music are kind of intertwined [100-106].

Belinda expressed similar internalisation:

> Belinda: It's almost instinctive, aren't they, when you know music really well, you almost stop thinking about it and I think you react quite instinctively to them, they're almost sort of part of you [190-192].

There was a vivid sense of an experience beyond simple listening, and both quotes suggested a transitional process into a state where music was embodied – “become wrapped” [Andrew], “stop thinking about it” [Belinda] – becoming integral to the physical activity.

For Steven, the embodiment of music “in my head” [317] led to what might be described as an optimal experience:

> Steven: If I'm up for it and there's, the music is right in my head at that precise moment, is to just go like a bat out of hell and, you know, just you feel so alive and the music's going off, whatever it could be, and you know. Like yesterday, I just found that for a few seconds I was running at like four-fifty mile pace, so yeah, I think, um, the music can help in that respect [317-320].

The brevity of this experience was striking, yet the description conveyed its intensity. The effect may have been flow, or ‘runners’ high’; embodiment of the music appeared to be the trigger.

The challenge of synchronising

In Study 1, findings indicated that a minority of participants purposely synchronised their movements to the beat of the music either all or most of the time (see Section 3.4.1). Others described synchronising accidentally, and this was evident in this study, along with difficulties synchronising either through using music with an inappropriate tempo or failing to sense a beat.

Belinda synchronised her moves with much of her playlist, but did not compile it with the intention of doing so:

> Belinda: I must have got it about right when I did it originally, mustn't I? That was a stroke of luck [428-429].

Participants did not report compiling playlists with synchronous music, and the order, juxtaposing different tempi, could be problematic:

> Belinda: You know if you're trying to go fast and suddenly you get, with an interval, then suddenly this slower beat comes on and you think, 'No!' and try, you know, keep this pace up… I think that's perhaps why I like the music that I like to dance to, ’cos it's the same thing, isn't it? It's keeping the rhythm, yeah. [175-178]

Belinda, despite not purposefully selecting synchronous music, seemed to prefer it and utilised it where possible. Similarly, Charlotte sometimes synchronised if a suitable track was playing, but was aware that she would only respond to the beat of the music if the pace challenged her. If it required slowing down, she overrode the option to synchronise, and seemed to find this less difficult than Belinda:

> Charlotte: It tends to be that the, um, that the synchronised, bit more, do, pushing me, like the, above the comfort zone, if you like, kind of makes it sound uncomfy and I don't mean that, held a rhythm is what I'm doing. It feels as if I've got in this zone, if you like and then I've, then a track comes on and I find myself going with it, and I tend to go faster. I don't tend to synchronise slower because with most of these activities, if I'm going slower than where I feel comfortable, then I actually find it harder … if I am going a bit faster and I happen to synchronise I'll probably stick with it as far as I can [193-198]

Charlotte was keen to point out that increasing her speed was not uncomfortable in these circumstances, emphasising the potential of music to facilitate more intense exercise. By using the word ‘zone,’ Charlotte presented an optimal situation in her workout, provided somewhat randomly by the track which happened to be playing. She synchronised if the opportunity arose and she felt it would benefit her workout. Katie, on the other hand, wanted to synchronise but had difficulty identifying appropriate tracks:

> Katie: If I'm on the treadmill, I will make the speed match how fast I want to run to be in time with the music. Sometimes I even find myself running loads faster than I would normally do or just, you know, slower just so I've got that really OCD thing of the thing, of the feet, how my feet are coming down on the treadmill [367-370]

Her use of the term ‘OCD’ implied an obsessive need to synchronise. She described how synchronising was less important for her on other machines because the movement is more fluid, without the moment of making contact with a treadmill belt. A need to synchronise while running, however, overrode the risk of injury:

> Katie: I can’t work faster or slower than the beat on the track, so ’cos I can’t change the tempo on my, on my iPod, if it doesn't match, like it will be upset me if, like, when I'm putting my feet down it's off the beat, track, that makes me get a bit, throws me off balance a little bit and I've like tripped over a couple of times just trying to put my feet down at the wrong time [244-248].

Katie seemed to struggle identifying music suited to her running cadence. Suitable tempo (bpm) can vary considerably from runner to runner, depending on factors such as surface (treadmill, road or trail), speed and stride length. There was a sense of unease as Katie’s music demanded movement of her body which she struggled to deliver.

This contrasted with Sarah’s description of her attempts to synchronise, which conveyed a sense of disconnection between her mind and her body:

> Sarah: Yeah, I just couldn't, you know I always felt like I'm trying to and it's like, you know, make, you're 1, 2, 3, and my, my feet, I wasn't doing that. I'm trying but my feet aren't doing that so it was too much of a distraction [361-363].

The separation in Sarah's description – "*I'm* trying … but *my feet*…" – suggested she was constructing a self where her body and her cognitive processes were disconnected entities. She subsequently acknowledged more general difficulties in keeping time to music, and struggled to sense a regular rhythm:

> Sarah: Everybody's in a concert all clapping in time. I will start off in time with everybody and then I have to stop a little bit later 'cos I realise I'm not in time anymore. I mean it doesn't worry me, but I just, it's maybe that's why I can't run in time to music … that's probably why I choose music for association purposes rather than trying to run at a beat [447-451]

Again, there was a sense of disconnection between cognitive processes and motor activity, with a delay between Sarah 'desynchronising' and realising that she had done so. This contrasted with the comments from participants describing music being embodied (although they did not necessarily synchronise). Sarah's struggle to synchronise seemed to go alongside a lack of embodiment. She was aware of trying to make her body move in time with the beat, but her cognition and movement seemed not to connect.

Participants were asked whether they used tracks specifically designed to synchronise to, such as Audiofuel (http://www.audiofuel.co.uk/) and Podrunner (http://www.djsteveboy.com/mixes.html). Sarah had tried using them and, perhaps unsurprisingly, struggled:

> Sarah: I didn't, I couldn't do it, why that was, I couldn't, I didn't really get out of it what I thought I would, so whether it's like you know, it the beat gets faster and you're supposed to run faster, I found I was trying to, I couldn't, I don't know if it's the coordination or whatever, it's just the way that my, I couldn't, I felt like I was out of sync with the music and I couldn't get back in sync with the music [349-353].

Sarah’s preferred music also reflected aspects of social interaction, which the tracks for synchronising did not deliver, in addition to demanding synchronous running skills that Sarah lacked. For Belinda, familiarity was more important than synchronising, evident when we discussed commercially-produced synchronous running music:

> Belinda: It's not recognisable songs within that hour?
>
> Rachel: No. That wouldn't appeal unless it was recognisable?
>
> Belinda: I'd try it, but I don't think I'd like it. I think I'd just zone it out. I wouldn't, I don't know, yes I might download it and try it and see if I like it, but it doesn't sound appealing [444-447].

“Hardware hassles”

Despite some participants describing embodiment of their exercise music, the bodily relationship with the hardware used to deliver it was frequently antagonistic: this was the most widely-evidenced of all the subthemes. Although Belinda described a tendency to develop a headache when using music for outdoor running [392-399], problems generally related to inconvenience rather than discomfort. Sophie referred to the “extra bulk of carrying that thing…it’s just something else to delay you going out the door,” [175-176]. Ruth had stopped using music altogether, partly because she found herself irritated by many of the tracks, but also through becoming irritated by the headphones:

> Ruth: The earphones as well keep falling out and just irritate me, you know I'd be that there and having to keep putting them in, and then you can't hear anything else, you know, you just hear the music and just having those in your ears and then you're, you know when it goes down, you can put it, oh it just irritated me [185-188].

Ruth's frequent use of the terms 'irritate,' 'irritating' and 'irritated' conveyed a frustration with music and hardware: the 'wrong' song would come on, and she frequently needed to adjust the headphones. Her description of the experience implied that her run's focus was lost to the continual need to change track or adjust hardware. Having exchanged a music player for a strategy of counting in her head, she compared her running to meditation:

> Ruth: I do meditate as well so I wonder if that's why I'm like that when I'm running [290-291].

The interruptions and irritations of using a music player while running had been jettisoned entirely, and she was able to focus on the flow of running and counting.

Several participants had concerns regarding loose wires. Amanda said she would "worry that the headphones would get tangled" [535] during resistance work, so used other media for weights exercises, while Katie described "having wires flapping everywhere" as a reason not to use music while running outside. Steven did not race with music for the same reason:

> Steven: I just fear that they're, the wires might get in the way and I'll pull it out, or I'd be faffing forever and I don't want that when I'm racing [105-107]

These comments implied a lack of embodiment of hardware, but Charlotte was the exception. Her description of her journey through changing technology conveyed an engagement with music players, encapsulated by her description of her well-used iPod and its embodiment as it became marked permanently by perspiration:

> Charlotte: It's got all, sort of white stuff which is, which is the salt come off my skin and I can't quite get [it] off properly anymore [418-419]

Charlotte had quite literally begun to 'become one' with her iPod. While the general trend across the transcripts was an embodiment of musical sound and resentment of the inconveniences of the hardware, Charlotte's embracing of new technology was fundamental to her exercising – "always, always" [51] with music – and she held the equipment in higher regard.

4.5 Discussion

The findings demonstrate the complexity of using music in exercise. Self-identity proliferated in the interview data, with participants expressing their individuality through exercise music practices, which fits neither a view of music as a social tool nor simply as a means of individual mood regulation. Musical identity is often articulated through expression of musical preference to others, and music is described by Hargreaves, Miell and MacDonald (2002) as "essentially a social activity." Yet, outside classes, the participants here played music only to themselves. To some extent, mood regulation was the desired outcome: Sarah's description of her playlist invoking happiness arose through associating it loved ones and thus related to her social identity.

Biographical memories are often accessed through music choice: Bull (2007) refers to iPod users choosing music to invoke "memoryscapes" (p.141). Janata, Tomic and Rakowski (2007) identified four objects of autobiographical memory: places, people, events and periods, with event and place being more common referents in their participants' responses than people or periods. In the study here, events were occasionally described, such Katie's night out dancing to Britney Spears, but people also featured strongly in both these examples, and Katie referred to nostalgia for college and associating Britney Spears with that period. Belinda's university memories were strongly connected to period, place (the campus), people and regular events. The application of musical autobiographies by the participants seems more complex than the Janata et al. (2007) framework suggests.

Returning to Sloboda's (2010) summary of emotions when hearing music (see Table 1.1), exercise music seems to straddle the everyday and non-everyday: for some exercisers, music helped relieve boredom, leading to longer exercise sessions, while for others, it contributed towards peak experiences and the achievement of flow. The purpose and meaning of associations is clearly important: Sophie's use of music-invoked memories seemed related to escape and rediscovery of a pre-motherhood identity, drawing on tracks associated with a time before she had children. This goes beyond the management of mood: there was a desire to recognise and reinforce elements of self-identity. Belinda, recalling exercise-to-music classes at university, described "socialising and feeling good" while Sarah talked about "happy association songs," suggesting that their chosen music's associative qualities also evoked positive emotions. Music may influence affect by facilitating the recall of episodic memories and the corresponding emotions: this need not be the memory of a specific event, but can also be related to a period of time or general events (Juslin & Västfjäll, 2008), as seems to be the case with Belinda and Sophie.

Sophie's reinforcement of her identity through music while running was a ritual carried out in isolation, and the implications for music as a social tool are important. Bull (2005) discusses the "privatised auditory bubble" (p.344), and both Sarah and Katie used the term 'bubble' in the same way (Sarah also used the word 'cocoon'). Outside the bubble, Sarah and Katie could not control their environment in the way they wished, while Sophie's usual environment was something from which she sought periodic escape. Again this echoes Bull's findings: he described how iPods allow other people and environmental sound to be blocked, providing the listener with control and privacy, reinforcing perceived rights to personal space and avoiding the intrusion of others, behind which is a sense of threat to individual autonomy (2007).

Given the previous research into music use to reduce rate of perceived exertion or RPE (Karageorghis & Terry, 2009; Karageorghis et al., 2009; Dyrlund & Wininger, 2008) and the

RPE's association with dissociation (Elliott, Carr & Orme, 2005), it was surprising to find that dissociation and distraction were more frequently associated with exercise duration. Interviewees wanted to achieve control over their psychological desire to cut activities short, instead pushing themselves to keep going until the end of a song, or using music or podcasts as distraction during long runs. Longer exercise sessions are carried out at a lower intensity than shorter sessions (Sarah particularly emphasised the need for a conversational running pace during a 20 mile training run), while physical discomfort was associated with short, intense sessions. Dissociation in long sessions, therefore, seems to assist with psychological rather than physical discomfort.

While research has focused on music's potential to improve performance, this was not a theme found in the interviews; there was a perception among participants that making exercise more tolerable through music was at odds with performance improvement. Andrew's acknowledgement that music was important to ensure a better quality workout related to its duration rather than intensity.

Control therefore concerned the internal, psychological hurdle of completing a full exercise session, and was needed to overcome external constraints placed on the exercise environment. This is an important distinction to make; exercisers may have few or no performance goals, unlike a professional athlete, and much of the previous research considered music's benefits in performance-focused contexts; protocols such as 400 metre sprints (Simpson & Karageorghis, 2006) are not a regular activity for most people. Although some participants took part in competitive events (particularly running events), exercise aims were not purely focused on achieving particular speeds or race times. Rather, wellbeing in terms of physical or mental health, and enjoyment were motivating factors. Indeed, Andrew rejected the goal of reaching his former levels of peak fitness on the basis he did not wish to put in the necessary work, yet he enjoyed running with music.

Control over external factors was frequently linked to exercise enjoyment, particularly a desire to avoid disliked music played in gyms. This has parallels with self-selected music in pain management facilitating a sense of control (Mitchell, 2006). In the gym environment, which may be psychologically and physically uncomfortable, music may assist with discomfort management rather than pain management, but there are clear links between the two contexts.

Individual identity appears crucial to selection and use of music, and while there were commonalities across the transcripts, there were also substantial differences between the participants and how they engaged with music – or did not. Accompanying this was a specific skill-set in selecting music to produce the results required, much like the competencies of choosing music in everyday life which DeNora referred to (2000: see Section 1.3). Technology has developed considerably since DeNora's study, and the current study reflects the development of skills over time to utilise resources available. As music becomes disseminated through technology such as streaming and downloads, those using music adopt the necessary practices to derive benefit from this, retaining their autonomy while drawing on an ever-expanding skill-set.

For researchers, this presents a considerable challenge to investigating the effects of music on exercise in controlled conditions, where the selection of motivational music is central to a study. While tools such as the Brunel Music Rating Inventory (BMRI: Karageorghis, Priest, et al., 2006) have been used with some success, this has been with socio-culturally homogenous groups, typically male undergraduates. Yet Gabrielsson (2002) noted that while musical 'codes' denoting, for example, happiness or sadness, are read consistently by listeners, induction of consistent moods across listeners is much less reliable, often for personal biographical or sociocultural reasons. Sloboda (2005) observed that although listeners often agree on adjectives to describe particular pieces of music, there is a tendency to anticipate homogenous responses when the music is played: this is the 'pharmaceutical' approach. Sloboda (2005) argued for the opposite, proposing:

> "the listener as an active agent, who makes choices about what music to listen to, where and when to listen to it, and what to listen for, according needs, goals and purposes." (p.319)

Nevertheless, there were some areas where participants lacked skills, most notably in selecting music for synchronous activity. When synchronisation occurred, it was by 'happy accident' and participants described difficulties synchronising through use of inappropriate tempi and/or being unable to keep in time with a beat.

In practice, finding synchronous music within one's music collection that fits other criteria can be time-consuming, particularly for running (which was the most commonly-practised exercise activity), since few tracks have tempi above 150bpm and running typically requires 160-180bpm. None of the participants knew their running cadence nor, therefore, an appropriate bpm. Websites advising on and delivering synchronous exercise tracks (www.musicandmotivation.com; jog.fm; www.audiofuel) base their guidance on speed, despite variations in stride length affecting the speed-cadence relationship. Nevertheless, participants did not express a wish to choose music specifically for synchronising. Other characteristics were more important to them, particularly associations and the music's potential to confer energetic feelings. Familiarity, a quality lacked by bespoke tracks such as those from Audiofuel, was important to participants, and cited by Belinda as a reason that specially-designed synchronous running music did not appeal.

Karageorghis and Terry (2009) presented three types of listening: pre-task, synchronous and asynchronous. They described asynchronous music as background music to "make the environment more pleasurable" (p.15) without conscious synchronisation, while synchronous music was suggested for athletes to match their movements to. The capacity of asynchronous music (the participants' usual listening material during exercise) to invoke moods, reinforce identity, increase effort, help facilitate longer periods of activity and to generate specific psychological states such as happiness (Sarah) or self-confidence (Steven), goes far beyond Karageorghis and Terry's conceptualisation.

Synchronising is a straightforward example of entrainment, defined by DeNora as "the alignment or integration of bodily features with some recurrent features in the environment" (2000, pp.77-78), and DeNora explored it through a study of aerobics classes. Yet, as she also pointed out, the use of music in neonatal intensive care, or to slow down shoppers to encourage browsing demonstrates that entrainment has a much broader application. The embodiment theme within the data here reflects entrainment in the sense that music provides the recurrent features that affect participants' physiological behaviour. The threshold between body and environment that DeNora questioned in relation to neonates becomes blurred when music is used in exercise, with the suggestion from participants that music becomes a part of them. They aligned their mood through associations with particular tracks, felt physically empowered by the music's content and/or structure, and achieved a sense of personal space through auditory input. The music facilitated the meeting of a variety of objectives without the need to synchronise movement.

With PLDs becoming ubiquitous, the purpose of music played over PA systems in gyms must be questioned. Priest's research aim in his 2003 PhD study (the source of data for Priest and Karageorghis' 2008 paper) was to identify motivational music for gym settings. He found that gym members exercised for longer when a gym played music selected for its motivational qualities using the BMRI-2, compared with its default playlist, which incorporated slower ballads and blues tracks. There was no notable effect on their affect, however. Within the gym business model, longer exercise sessions at busy times with no increase in positive affect may result in queuing for machines and decreased member satisfaction, while for the lone runner outdoors this is not an issue.

Participants in this study demonstrated competence in finding motivational music without using formal rating systems. Indeed, the BMRI-2 has been found to be most effective in environments where the same music is experienced by a group of people with similar sociocultural backgrounds and of a similar age (Karageorghis, Priest, et al., 2006). While the BMRI-2 is advocated for athletes to help select appropriate music for training (Lane et al., 2011), the study on which this recommendation is based did not compare BMRI-2 use to unassisted music selection. The current study's findings question the use of a formalised rating system for individuals with high levels of exercise music literacy, who apply various criteria that the BMRI-2 does not include.

Selection of synchronous music, for which there was less literacy, is not addressed by using the BMRI-2.

As far as adherence, the focus of the research project, is concerned, this study indicates that music can help adherence to a planned session once that session has commenced, whether this involves finishing a three-hour marathon training run, or completing a few more seconds of a high intensity interval. The themes indicate contributing factors: exercise music literacy is required to select appropriate music reflecting personal requirements, conferring control of the environment and leading to a sense of becoming one with the music, achieving flow.

There are elements of music that motivated participants during exercise, and those which were disliked, particularly when control was unwillingly surrendered. Herzberg's two-factor theory (1987: see Section 1.3.2) may be relevant here, with motivators – the correct music – encouraging exercisers, while disliked music and absence of control over music during exercise behave like hygiene factors in the workplace, with higher absenteeism taking the form of non-adherence. The relationship between the themes identified in the analysis, and two-factor theory is summarised in Figure 4.1.

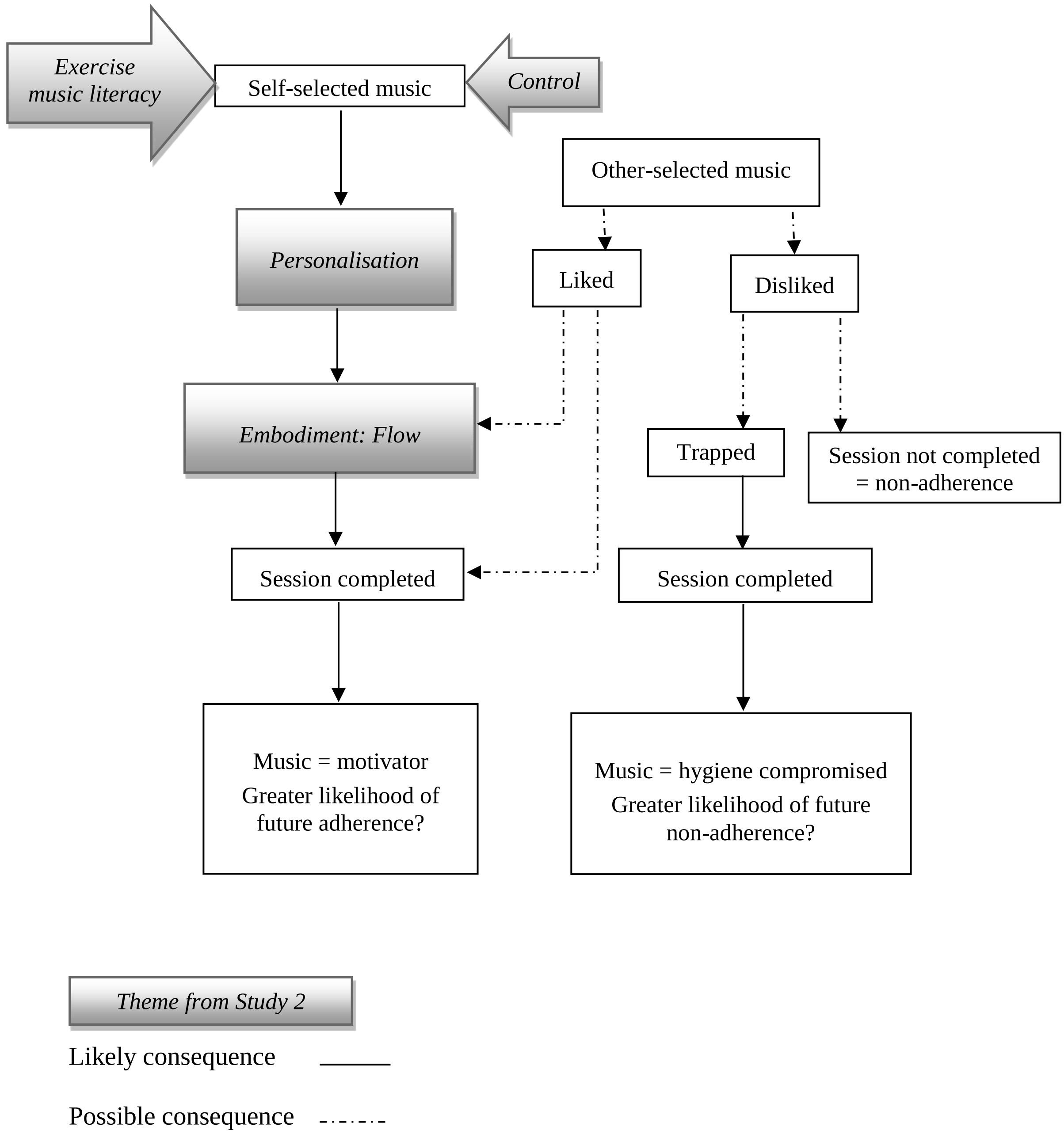


Figure 4.1: Music as motivator or hygiene factor

Sampling

Although around half of the online survey respondents provided an email address to express willingness to take part in follow-up interviews, a number of those selected because of particularly interesting responses in the survey did not respond to interview requests. Nevertheless, those who did provided a broad range of experiences; interviewing had the benefit of exploring ideas that the participants had not realised might be relevant or had not felt compelled to include in their survey responses.

Interviewing

This study explored reasons behind the statistical findings in the previous chapter. It established that exercising with self-selected music involves processes of entrainment relating to identity and control, and that participants are high in exercise music literacy, recognising what works for them and sourcing appropriate tracks. While the online survey in Chapter 3 collected a large volume of useful data, the interviews suggest that deeper reflections result from the direct involvement of a researcher and the use of interviews. While the sample size was large for an IPA study (Smith et al., 2009), there was not saturation as might be sought with a grounded theory approach. Each participant had an individual pattern of exercise behaviour, music use and motivation, and further research may find other practices and ways of experiencing music in exercise not evident in the data here. Nevertheless, the methodological approach elicited important themes through analysing interview data.

4.5.1 Reflexivity

Because of the nature of the recruitment process, using social media for the initial survey, some of the interviewees were acquaintances, although I did not know any of them well. Having received extensive musical training in the past, having worked in the fitness industry and having taken part in some of the road races to which participants referred, I felt some familiarity with the experiences they described. Nevertheless, by letting the interviewees lead the process as much as possible, I soon became aware of differences in our experiences of the same event or practice.

During the interviews, I became increasingly aware of how my own practices of using music in exercise differed from those of my interviewees. I was surprised, given the capabilities of the technology, that interviewees did not make wider use of the scope to have different playlists for different activities. Rather, interviewees described having one playlist that was periodically updated, or two playlists at the most. My use of music with particular beats per minute for different activities to facilitate synchronisation, particularly using it for weight training, appears to be unusual. This may stem from my training to incorporate resistance exercises into aerobics classes and to select appropriate music to accompany them. Comparatively few of the tracks I select for exercise have autobiographical significance, and the emphasis on personal meaning of the music that many interviewees selected was a surprise: I expected intrinsic musical qualities to feature more prominently.

On several occasions, interviewees described themselves as unusual when they were, in terms of my own data, similar to other participants. I avoided making this observation, as clearly their experience was that they were different and this was important to explore. After the interview had finished, if participants were curious about my findings so far, I discussed these. At times, because of my own involvement in exercise and music, I wanted to take a more active role in the interview, but tried to prevent myself from doing so as much as possible in order to preserve the integrity of the data. As the interviewing and analysis continued, the importance of balance between engaging and holding back became clear. Engagement with the participant was vital so that meaningful data could emerge and they could feel comfortable exploring their experiences. Simultaneously, the conventions of social dialogue, where information is exchanged, could not be followed because of the need to hold back one's own experiences to provide the space for participants to explore theirs without researcher influence.

The richness of data and the way in which one brings one's own experiences to bear when trying to understand other people's means that analysis does not necessarily have an endpoint. If I were to return to the transcripts a year from now, they may lead me to find new insights. Indeed, discussing my research with others often leads to anecdotes being relayed to me, and this can lead to me further questioning my findings. The dynamic nature of the research should therefore be acknowledged.

4.5.2 Studies 1 and 2: a comparison

The results of Studies 1 and 2 demonstrate the complementary nature of quantitative and qualitative approaches. Study 1's findings indicated relationships between variables, such as those with music training being more likely to use music in exercise, and also revealed trends, such as purposeful synchronisation being a minority activity outside exercise classes. Such findings needed a large sample for analysis to be viable.

Study 2 uncovered some of the reasons underpinning the results of the statistical analysis, revealing subtleties beyond the what could be learned from the survey results. In Study 1, participants fell into three groups: purposeful synchronisers, accidental synchronisers and non-synchronisers. The interviews suggested something more fluid: Belinda found by accident that a track was ideal for speed training, but reported frequently returning to it to use it for that purpose. Katie's purposeful synchronising was not through choosing appropriate tracks, but trying to fit her running cadence to whatever track she wished to listen to. Sarah wanted to synchronise, but found it difficult to move in time with the beat, abandoning her attempt to be a purposeful synchroniser. While Belinda might best be described as an accidental synchroniser, Katie as a purposeful synchroniser and Sarah as a non-synchroniser, the boundaries between the categories are blurred.

The interviews revealed considerable depth regarding the criteria applied to selecting music. While many of the participants in Study 1 reported associations were important when choosing exercise music, the participants in Study 2 explained the benefits, and it became clear that associations were key to social identity and personal history, emphasising the importance of the individual and carrying the meaning over into exercise. Sarah's playlist, for example, constituted support from her husband, and instilled a happy mood conducive to an enjoyable exercise session.

Particularly evident, and appropriately so for an IPA approach, was the expressive language participants in Study 2 used to describe their experiences of using music. Steven's descriptions of the transformative effect of music were highly evocative, and his description of his sense of confidence and lack of inhibition provided some insight into the 'what-it-is-like-ness' of running to music as he experienced it.

The interviews also gave an insight into those participants who did not fit the statistics: Ruth had a life-long love of music, and extensive formal training, but her description of struggling to construct a positive experience of running with music was a clear expression of how it felt for her. Her sentences repeated variants of 'irritated' a number of times, conveying a deep sense of frustration. This richness of detail could not be gained from the survey.

These examples show how the results of both studies complement each other. Each adds to knowledge about music use in exercise, but together they provide statistical trends and correlations, along with rich descriptions which interrelate to build a deeper understanding of the topic.

4.6 Summary

This chapter has looked at exercisers' music use through in-depth interviews, gaining understanding of how exercise music is experienced. Analysis has found key themes common across multiple transcripts: personalisation of music choice, exercise music literacy, embodiment and control/autonomy. With regard to adherence, there was evidence of music helping exercisers complete a planned exercise session once started, and in two cases, the attraction of music-listening instigating the exercise session. Music may be playing two different roles, enriching the exercise experience as a motivator, but, when unsatisfactory, acting as an absent hygiene factor. There are clear parallels with Herzberg's theory (1987), where the outcomes were to work more when motivated and for absenteeism to occur when hygiene factors were not in place. It is also possible that for regular exercise music users, the presence of music becomes a hygiene factor and being unable to listen to music during exercise leads to non-adherence. This is an area that needs further research, although it is beyond the scope of this project.

Although there was support for music's role in adherence regarding completing a planned exercise session, no participants reported playing music prior to an exercise session. Nevertheless, participants reported strong associations between certain tracks and physical activity, as well as using musical associations to help generate a positive affect. The question arises, therefore, of whether this can be harnessed to instigate exercise in the first place: a session cannot be completed, after all, unless it is begun. The latter two studies of this thesis, covered in the next two chapters, explore possible relationships between music and adherence, and the final study (described in Chapter 6) tests a music-based intervention.

Chapter 5

Study 3: Exercise adherence, media use and individual differences

5.1 Aims

Having gained a better understanding of how exercisers use music during their workout sessions (see Chapters 3 and 4), the next stage was to explore the relationship between music and adherence. Studies 3 and 4 test relationships between music use and adherence: in the present study, the focus was music use in exercise, while in Study 4 (see Chapter 6), a pre-exercise music intervention was tested. Although a relationship between exercise adherence and music use was suggested some time ago (Karageorghis et al., 1999), supporting evidence has not been gathered. Additionally, individual differences appear to have an impact on adherence (Rhodes, Courneya & Hayduk, 2002; Rhodes, Courneya & Jones, 2003; Rhodes, Courneya, Blanchard & Plotnikoff, 2007), and may influence the use of music to increase arousal in exercise (Chamorro-Premuzic & Furnham, 2007). As yet, the three factors – music, exercise and individual differences – have not been explored together.

Because there are so few existing studies offering insight into these areas, an appropriate starting point was an exploratory study. Study 3 was designed to explore gaps in knowledge by taking a sample of gym members and collecting data measuring (1) use of music and other media in the gym, (2) individual difference scores (3) frequency of exercise. Descriptive statistics were used to establish the characteristics of the sample, and correlation analysis was used to explore possible relationships between the variables pertaining to media use, individual differences and exercise frequency. Following this, regression analysis was applied to see how much variance in total exercise sessions could be explained by media use and individual differences.

5.2 Background

The relationship between music and exercise adherence has received little attention from researchers. Outside sport and exercise, studies have found relationships between individual differences and the way in which people use music. Chamorro-Premuzic and Furnham suggested that extraverts are more likely to use music to raise arousal levels in monotonous situations “such as cleaning, jogging and data-entry” (2007, p.177), yet this speculation was neither explored nor substantiated. It is possible that music might firstly help adherence, and secondly might be used in exercise according to one’s personality but neither suggestion has been tested.

Research into exercise adherence and personality traits (Rhodes and Courneya, 2003; Rhodes et al., 2004; Rhodes et al., 2007) suggests that some Big Five traits may contribute to adherence, but the findings are inconsistent (see Section 1.5.3). Additionally, these were brief studies, lasting as little as two weeks (Rhodes et al. 2002; Rhodes et al. 2003). Since several of the samples were students taking part for course credit, it is not clear whether they would have considered exercising independently of a study, or whether participation affected their exercise practices. The design of Study 3 addresses these weaknesses, using retrospective data from regular gym attendees. Additionally, it includes measures of motives and strengths, individual difference variables not examined in this context previously.

Study 3 formed an explorative study to address the lack of empirical evidence on adherence. Exercise data was collected for a 6 month period, retrospectively, from members at a local authority gym. This was a substantially longer duration than in existing studies, and enabled analysis of data pertaining to real-life exercising habits. Data including individual differences and media use allowed these factors to be explored with the intention of gaining new insights into the possible influences on exercise adherence.

It was hypothesised that, as suggested by Karageorghis et al. (1999), positive relationships would be found between listening to music during exercise and frequency of exercise (H1). Since results across various studies into personality traits and exercise have been inconsistent, and there had been no equivalent studies using strengths or motives measures, hypotheses in relation to personality and individual differences were highly speculative, but it was anticipated that Conscientiousness would be positively correlated with exercise adherence (H2).

5.3 Method

The design was correlational, with data collected (1) through a survey on participants' personality traits, motives, strengths and media use, and (2) through exercise frequency data for the previous six months from a computerised gym system, to establish relationships between these factors.

5.3.1 Participants

Participants were 60 members of a Local Authority Gym in the West Midlands (30 men, 30 women), age range 18 to 79. Details of age and length of gym membership are shown in Table 5.1.

Table 5.1: Participants' gender, age and duration of gym membership

		Age			Membership length in years (n = 22)	
Gender	N	Range	M	SD	M	SD
Both	60	18-79	39.78	12.96	4.59	2.64
Female	30	18-79	38.57	14.75	3.85	2.16
Male	30	23-61	41.00	11.02	5.21	2.94

The gym’s members reflected a broad demographic and were concentrated in the 30-60 age group. The leisure complex was situated in a small market town in the North West Midlands. Although there are affluent commuter villages nearby, there was also social deprivation associated with rural decline. Wages in the area were low and public transport links to economic hubs were limited. Members represented a variety of socioeconomic backgrounds, and their fitness levels ranged from those who had recently commenced exercise to regularly-competing amateur athletes.

5.3.2 Equipment and measures

Field research using retrospective data from a computerised workout system meant that autonomous exercise sessions were measured, rather than exercise undertaken specifically for the study, avoiding participation influencing activity (see Section 2.5.1). The local authority gym used for the research was selected because it had installed Fitlinxx, a computerised workout system, allowing instructors to create programmes and members to log workouts, and enabling the collection of retrospective data. Fitlinxx was used by both members and staff to track attendance. Members entered a login code on arrival at the gym, then entered the code into each machine they used, which recorded their activity. The Fitlinxx system holds a large amount of data, including activity, duration and total output in distance (for cardiovascular machines) and kilograms (for resistance machines): data collected pertained to the number of recorded exercise sessions.

Data was collected from the Fitlinxx computerised gym system and through an online questionnaire (see Appendix D) created using SmartSurvey software licensed to Keele University. A hard copy version was also created.

Personality was measured using the TIPI (Gosling et al., 2003: see Section 3.3.3 for full details). Motives were measured using a survey based on the self-rating questionnaire in Reiss (2009b), with six statements, three positive and three negative, to rate for each motive. The same 7-point Likert scales were used as for the TIPI, allowing more subtle answering than the Reiss

(2009b) version which, for each motive, invites the reader to tick any statement which is "definitely" like them, scoring 1 for each positive statement ticked and -1 for each negative statement ticked, giving a score between 3 and -3 for each motive. In this study, the same six statements were used for each motive, but responses were scored from 1 to 7 on a Likert scale, as with the TIPI. Negative items were reverse-scored, the totals for each motive added together and the result divided by the number of items. The responses reflected degree of agreement with each statement, and were used for most of the analysis. The exception was for calculations of high or low scores (Table 5.6), where all 'agree strongly' ratings were equated to a 'tick' for scores to be calculated using the Reiss's original self-test protocol (2009b).

Some small alterations were made to the statements, primarily to simplify the language, but also to address some wording that was felt to be inappropriate, particularly for the Romance motive. A full list of changes and the reasons for them can be found in Appendix E. Cronbach's alpha was calculated for each motive to assess the reliability of the scales. Ideally, a scale should have 10 or more items for this test because smaller numbers of items often produce small alpha scores (Pallant, 2010) but since motives had not been extensively empirically tested and the 6-item measure was still suitable for the analysis, alpha scores were calculated. A number of items scored under .7: Pallant (2010) suggests that to be considered reliable, scores should ideally be above .7. For two of the motives, Order and Romance, the scores could be raised over the threshold by removal of an item and this was done prior to statistical analysis. However, a number of the motives – Curiosity, Eating, Honour, Independence, Power, Saving, Status and Tranquillity – could not be raised above the threshold by removing an item. The alpha scores are included in Table 5.7.

Strengths were measured using a questionnaire from Seligman (2011). Each strength has a positive and negative statement which the participant rates for the amount it is 'like them' on a 5 point scale ranging from 'very much like me' to 'very much unlike me'. For each strength, the positive and reversed negative scores were added together to produce a score out of 10. The reliability of the Strengths scales was unknown and had too few items per measure to use

Cronbach's alpha. Its purpose here was for comparison, particularly with the motives where there appeared to be some commonalities. The same measure has been used in subsequent research by Furnham and Ahmetoglu (2014), looking to reduce it to a smaller number of 'virtues' combining the items.

Exercise frequency was measured using number of workouts over the previous 6 months. Most of the data could be taken from Fitlinxx. However, having worked as an instructor at the facility, I was aware that participants may have also taken part in non-gym activities such as running and classes, which they may or may not have logged on Fitlinxx. Because these sessions needed to be included in the Total Exercise variable, questions were added to the survey regarding exercise outside the gym. From this data, six month totals for non-gym exercise were estimated using the calculation in Table 5.2. The final figure was based on 24 weeks of activity rather than 26 to reflect Christmas and New Year where the gym is closed for much of the holiday. While precise retrospective measurement was not possible, this method helped ensure the Total Exercise variable reflected differences between those who occasionally exercised away from the gym and those who trained outside the gym several times a week.

Participants reported how often they exercised outside the gym and how often they logged these sessions on Fitlinxx, with options of always, sometimes, rarely and never. Those responding 'always' needed no extra sessions added to their Fitlinxx data. For participants who did not always log additional exercise, the calculations in Table 5.2 were applied.

Table 5.2: Calculation method of estimates of non-logged gym exercise

Weekly sessions outside the gym (self-reported)	Weekly sessions figure used in calculation	Number of non-gym exercise sessions added to Fitlinxx total		
		Sometimes logged[a]	Rarely logged[b]	Never logged[c]
<1	0.5	6	10	12.5
1-2	1.5	18	30	37.5
3-4	3.5	42	70	87.5
5+	5	60	100	125

[a]Participant 'sometimes logged' non-gym sessions: 50% of sessions assumed to be logged, 50% unlogged
[b]Participant 'rarely logged' non-gym sessions: 20% of sessions assumed to be logged, 80% unlogged
[c]Participant 'never logged' non-gym sessions: 0% of sessions assumed to be logged, 100% unlogged

5.3.3 Procedure

Members visiting the gym during March and April 2012 were invited through notices and flyers in the gym to take part in the research, and the study was advertised through Facebook and on the gym's Facebook page. I also visited the gym several times and made direct approaches. The questionnaire was completed by 61 participants: however, one gave an incorrect login code so exercise data could not be collected, and their other data was therefore excluded from analysis.

Participants were invited to access the survey online, or to complete a hard copy from which responses were entered into the online version; all data was therefore collated in SmartSurvey. Participants were asked to provide their login code for the gym's computerised system so that their data for the previous 6 months could be accessed. I then captured Fitlinxx data individually for each participant by reviewing their activities logged over the previous 6 months, adding this figure to the estimate of non-logged exercise outlined in the previous section. Questionnaire responses were downloaded from SmartSurvey as an Excel spreadsheet, then imported into SPSS statistical analysis software. I added logged and non-logged exercise data to the SPSS worksheet manually.

5.3.4 Analysis

Firstly, descriptive statistics were produced for individual differences, exercise frequency and media use, and these were compared with general population norms where available. Norms were available for the TIPI, while for the motives, typical distribution in a population should show approximately 20% of participants with a low score and 20% with a high score (Reiss, 2009b). No comparisons of average scores were available for strengths. The data was explored across the whole sample and also for by gender.

Exploratory regressions were carried out for personality traits, motives, strengths and media use to see if any individual measurement system was particularly useful to explain exercise frequency. Additionally, correlation analysis was used to explore relationships between individual differences, media use and exercise frequency, with correlations showing a strong statistical significance examined using regression analysis, combining variables from different measurement systems. Again, the data was analysed across the sample and by gender.

Factor analysis was considered but was not possible as there were too few participants and too many measurements. Pallant (2010) recommends a minimum sample size of 150+ with a case:variable ratio of 5:1: the sample size here was 60, with 45 measures of individual difference, giving a ratio of 4:3.

5.4 Results

The results below reflect the stages of analysis described in the methods section, exploring relationships between traits and exercise frequency, and between media use and exercise. The first section examines frequencies using descriptive statistics and comparisons to norms where possible. Correlation analysis provided further indications of the most relevant variables, and these were explored through regression analysis.

5.4.1 Descriptive statistics

Exercise frequency

The descriptive statistics for exercise frequency are shown in Table 5.3. The mean number of exercise sessions logged on Fitlinxx over the 6 month period was 38.08 (*SD* = 31.62), with an average of 44.01 unlogged (estimate) (*SD* = 38.69). This gave a mean of 82.19 sessions in total (*SD* = 45.96), an average of 3.16 sessions per week across the six months. The maximum number of exercise sessions was 242 over the period, the minimum 12.5 (non-integer value due to formula to calculate unlogged exercise).

Table 5.3: Frequency of exercise, comparing gender and exercise sessions

	Mean total exercise sessions	SD	Sessions per week	Range
All	82.19	45.96	3.16	12.5 - 242
Women	78.82	52.38	3.03	12.5 - 242
Men	85.57	39.11	3.29	16 - 183.5

Analysis by gender indicated that men exercised slightly more frequently than women. Both the most frequently and least frequently exercising participants were female at 242 and 12.5 sessions over the period respectively. The higher figure indicates some days with multiple workouts.

Lapses

Of the 60 participants, 42 had at least one lapse in the six month period, defined as eight or more consecutive days without exercise (see Section 1.5.1), with an average of 2.55 lapses among this group (1.79 across all participants). The period during which the gym was closed over Christmas was excluded, but there was no data explaining non-attendance during the rest of the six months: holidays, for example, would be included as a lapse. The average duration of a lapse was 40.89 days (*SD* = 42.06).

These statistics suggest something of an ‘on-off’ pattern for the participants, but there were varied lapse patterns, ranging from one eight-day lapse barely attending over the six month period. The longest single lapse was 159 days, and several participants had multiple lapses totalling over 150 days.

Media use

Table 5.4 shows the frequency of use of various media in the gym. The figures showed a preference for music ahead of TV, with women more likely to use their own music than men and men more likely to listen to gym music than women. There was comparatively little interest in reading magazines during exercise.

Table 5.4: Media Use

	Frequently		Sometimes		Rarely		Never	
	n	%	*n*	%	*n*	%	*n*	%
Gym music								
All (n = 57)	23	40.35	13	22.81	10	17.54	11	19.30
Women (n = 28)	10	35.71	9	32.14	5	17.86	4	14.29
Men (n = 29)	13	44.83	4	13.79	5	17.24	7	24.14
Own music								
All (n = 56)	23	41.07	10	17.86	4	7.14	19	33.93
Women (n = 28)	14	50.00	6	21.43	2	7.14	6	21.43
Men (n = 28)	9	32.14	4	14.29	2	7.14	13	46.43
TV with subtitles								
All (n = 56)	12	21.43	17	30.36	16	28/57	11	19.64
Women (n = 28)	6	21.43	10	35.71	7	25.00	5	17.86
Men (n = 28)	6	21.43	7	25.00	9	32.14	6	21.43
TV with headphones								
All (n = 56)	9	16.07	11	19.64	10	17.86	26	46.43
Women (n = 28)	7	25.00	7	25.00	6	21.43	8	28.57
Men (n = 28)	2	7.14	4	14.29	4	14.29	18	64.29
Magazines								
All (N = 55)	2	3.64	3	5.45	4	7.27	46	83.64
Women (N = 27)	2	7.41	2	7.41	4	14.81	19	70.37
Men (N = 28)	-	-	1	3.57	-	-	27	96.43
MP3 usage in everyday life								
All (N = 60)	15	25.00	13	21.67	19	31.67	14	23.33
Women (N = 30)	9	30.00	7	23.33	9	30.00	6	20.00
Men (N = 30)	6	20.00	6	20.00	10	33.33	8	26.67

Personality

Mean scores for personality traits were calculated and compared to TIPI norms (*N* = 1813 in Gosling et al., 2003). These comparisons are presented in Table 5.5. The current sample displayed a higher level of Conscientiousness than the TIPI norms, particularly for men. Men in the sample also had higher levels of Extraversion, higher Emotional Stability and greater Openness to new experiences than the norms, while women displayed less Openness and less Emotional Stability than the norms. Both genders showed less Agreeableness than the norms.

Table 5.5: Comparison of trait scores in the sample to trait score norms

Trait	Data						TIPI Norms					
	All $N = 60$		Women $n = 30$		Men $n = 30$		All $N = 1814$		Women $n = 1173$		Men $n = 633$	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Agreeableness	5.09[c]	1.23	5.22[a]	1.18	4.97[a]	1.29	5.23	1.11	5.32	1.11	5.06	1.10
Conscientiousness	5.90[b]	1.08	5.79[a]	1.24	6.00	0.91	5.40	1.32	5.51	1.11	5.19	1.15
Extraversion	4.68	1.51	4.52	1.55	4.83	1.47	4.44	1.45	4.54	1.47	4.25	1.41
Openness	5.31[b]	0.99	5.10[a]	1.00	5.50	0.95	5.38	1.07	5.40	1.06	5.34	1.09
Stability	4.98	1.39	4.60	1.32	5.37	1.38	4.83	1.07	4.66	1.45	5.13	1.31

(TIPI Norms from Gosling et al., 2003: 526)
[a]*n = 29*, [b]*n = 59*, [c]*n = 58*

Motives

As outlined in Section 5.3.2, the questionnaire on which the motives measure was based (Reiss, 2009b) uses a very simple scoring system: if the respondent feels a statement is “definitely” like them, they tick it, with ticks scoring 1 for positive statements and -1 for negative statements. Reiss considers that -2 and -3 indicate low levels of a particular motive and +2 and +3 indicate high levels. As previously explained, in the current study, the scoring was changed to a graduated system using a 7 point Likert scale for each statement, and these scores were used for correlation and regression analyses.

However, for comparison with Reiss's expectation that 20% of the population will have low levels of a motive, and 20% will have high levels, scores were also calculated based on treating all 'strongly agree' responses as ticks ('moderately agree' responses were not included, so scores are conservative. These scores are useful because they indicate where extreme motives exist, and they are summarised in Table 5.6.

Table 5.6: High and low motivation frequencies

	High			Low		
Motive	All N = 60	Women n = 30	Men n = 30	All N = 60	Women n = 30	Men n = 30
Acceptance	1	1	-	18	7	11
Curiosity	6	3	3	3	1	2
Eating	7	4	3	-	-	-
Family	20	10	10	-	-	-
Honour	16	7	9	-	-	-
Idealism	13	9	4	-	-	-
Independence	14	9	5	1	-	1
Order	12	5	7	2	2	-
Physical Activity	29	13	16	-	-	-
Power	2	2	-	-	-	-
Romance	1	-	1	3	3	-
Saving	2	1	1	1	1	-
Social	18	9	4	1	-	1
Status	-	-	-	5	-	5
Tranquillity	1	1	-	7	4	3
Vengeance	4	1	3	13	9	4

Reiss's expectations equate to 12 participants, indicating that the sample showed particularly high scores, unsurprisingly, for Physical Activity. Nobody in the sample was negatively motivated towards Physical activity, even to a small degree, and almost half the sample scored highly. Acceptance, on the other hand, showed the reverse pattern, with only one participant motivated by Acceptance. Larger than expected numbers of participants of both genders also scored highly for Family and Honour motives. Reiss does not discuss differences between genders, so it is not clear how this population varies with those tested in his research. If the 20% expectation applies by gender, then women had high Social, Idealism and Independence scores and men scored highly for Order. Women had low scores for Vengeance. Detailed tables showing frequencies for each score, across the whole sample and by gender, are included in Appendix F.

For the Likert scale scores for motives, scores were calculated on the same basis as the TIPI, reverse-scoring negative items and averaging the score across the 6 items, or 5 items in the cases of Order and Romance, where Cronbach's alpha indicated a clearly improved score by removing an item. The scores can be seen in Table 5.7.

Table 5.7: Likert scores for motives

Motive	Mean *N* = 60	SD	Mean: women *n* = 30	SD	Mean: men *n* = 30	SD	Cronbach's Alpha
Acceptance	2.59[b]	0.99	2.94[e]	1.05	2.25[e]	0.81	.802
Curiosity	4.64[c]	0.61	4.70[e]	0.64	4.58[f]	0.59	.229
Eating	5.20[a]	0.94	5.29	1.07	5.10[e]	0.78	.510
Family	5.53[d]	1.11	5.38[h]	1.30	5.67[g]	0.89	.757
Honour	5.09[a]	0.63	5.12[e]	0.63	5.07	0.64	.390
Idealism	5.13[c]	0.99	5.41[e]	1.05	4.84[f]	0.84	.725
Independence	4.62[a]	0.67	4.63[e]	0.69	4.62	0.66	.256
Order	4.73[a]	1.02	4.62[e]	1.19	4.85	0.82	.708*
Physical Activity	5.84	0.98	5.74	0.96	5.95	1.00	.712
Power	4.66[a]	0.84	4.45[e]	0.94	4.86	0.68	.608
Romance	4.21[b]	1.10	3.75[e]	1.12	4.66[e]	0.88	.727*
Saving	4.47[c]	1.01	4.24[f]	1.07	4.69[e]	0.90	.568
Social	4.89[b]	1.25	4.83	1.25	4.94[f]	1.28	.790
Status	3.68[b]	0.80	3.76[e]	0.70	3.59[e]	0.89	.257
Tranquillity	3.27	1.01	3.58	1.11	2.97	0.81	.640
Vengeance	3.27[c]	1.11	2.89[f]	1.02	3.63[e]	1.10	.707

[a]n = 59, [b]n = 58, [c]n = 57, [d]n = 53, [e]n = 29, [f]n = 28, [g]n = 27, [h]n = 26

**For 2 motives scoring below .7 for Cronbach's alpha, analysis indicated removal of one item for each motive would redress this: for Order, removal of item 3 increased the alpha score from .682 to .708 while for Romance, removal of item 1 increased the alpha score from .648 to .727.*

The highest scores across the sample were found for Physical Activity, Family, Eating and Honour, with the lowest score for Acceptance. Men were more likely to be motivated by Vengeance, Saving, Romance, Power and Family than women, while women were more likely to be motivated by Idealism and Tranquillity than men.

Strengths

The mean scores for strengths are given in Table 5.8. Across the sample, the highest scores were or Gratitude, Integrity, Loving, Perspective and Zest. Men displayed scored highest for Integrity, Loving, Perspective, Playfulness and Zest. Women scored highest for Fairness, Gratitude, Integrity, Loving, Modesty and Perspective. The most notable gender differences were for Citizenship, Fairness and Gratitude (women scoring higher than men) and Leadership, Playfulness, Self-control, Valour and Zest (men scoring higher than women).

Table 5.8: Mean scores for strengths

Strength	All participants N = 59 *M*	*SD*	Women n = 30 *M*	*SD*	Men n = 29 *M*	*SD*
Curiosity/Interest in the World	6.82[b]	1.42	6.72[d]	1.31	6.93[e]	1.54
Love of Learning	7.34[c]	1.62	7.41[f]	1.78	7.28	1.49
Judgement/Critical Thinking/Open-mindedness	7.17[a]	1.33	7.03[d]	1.50	7.31	1.14
Ingenuity/Originality/Practical Intelligence/Street Smarts	7.04[b]	1.65	6.57[e]	1.60	7.48	1.60
Social Intelligence/Personal Intelligence/Emotional Intelligence	7.32[b]	1.39	7.14[e]	1.65	7.48	1.09
Perspective	7.93[a]	1.32	7.83[d]	1.49	8.03	1.15
Valour and Bravery	6.98	1.57	6.50	1.59	7.48	1.40
Perseverance/Industry Diligence	6.97[a]	1.72	6.96[d]	1.84	6.97	1.61
Integrity/Genuineness/Honesty	7.86	1.21	8.00	1.23	7.72	1.19
Kindness and Generosity	6.71[a]	1.84	6.76[d]	2.03	6.66	1.67
Loving and allowing oneself to be loved	7.71	1.74	7.83	1.88	7.59	1.62
Citizenship/Duty/Teamwork/Loyalty	6.66	1.53	6.93	1.53	6.38	1.50
Fairness and equity	7.10	1.92	7.50	2.06	6.69	1.69
Leadership	7.19	1.33	6.83	1.49	7.55	1.06
Self-Control	6.36	1.72	5.67	1.73	7.07	1.41
Prudence/Discretion/Caution	5.90	1.89	6.07	2.08	5.72	1.69
Humility and Modesty	7.29	1.46	7.53	1.57	7.03	1.32
Appreciation of Beauty and Excellence	6.75	1.91	6.87	2.03	6.62	1.80
Gratitude	7.90	1.37	8.23	1.48	7.55	1.18
Hope/Optimism/Future-mindedness	7.29	1.52	7.27	1.51	7.31	1.56
Spirituality/Sense of purpose/Faith/Religiousness	6.93[a]	1.36	6.90[d]	1.57	6.97	1.15
Forgiveness and Mercy	6.41[a]	2.22	6.76[d]	2.12	6.07	2.31
Playfulness and Humour	7.24	1.70	6.67	1.90	7.83	1.23
Zest/Passion/Enthusiasm	7.71	1.60	7.37	1.67	8.07	1.46

[a]*N = 58,* [b]*N = 57,* [c]*N = 56,* [d]*n = 29,* [e]*n = 28,* [f]*n = 27.*

One participant completed only the motive and TIPI measures, and left all the strength measures blank.

5.4.2 Correlations

Media correlations

Table 5.9 shows the correlations between Total Exercise and level of media use. Only one correlation was statistically significant: that between Total Exercise and Own Music (personal choice of music played in the gym using portable listening devices), and this applied only to men (r = .401, n = 28, p = .035).

Table 5.9: Correlations between Total Exercise and level of use of various media

	All N = 60		Women n = 30		Men n = 30	
Medium	r	p	r	p	r	p
Gym Music	-.158[a]	.244	-.090[e]	.657	-.238[c]	.213
Own Music	.205[b]	.133	.068[e]	.737	.401*[d]	.035
TV (Subtitles)	.150[b]	.275	.289[e]	.144	-.007[d]	.971
TV (Headphones)	-.005[b]	.972	-.104[e]	.606	.197[d]	.316
Magazine	-.045[b]	.743	-.013[e]	.950	-.089[d]	.651
MP3 use in everyday life	.009	.945	.057	.764	-.028	.885

Sample size: [a]n = 56, [b]n = 55, [c]n = 29, [d]n = 28, [e]n = 27
**Significant at p < .05*

Personality correlations

The results for correlations between Total Exercise and personality traits are shown in Table 5.10. Across the sample, Conscientiousness and Stability were both found to correlate positively with Total Exercise at a significant level. When analysed by gender, however, only men's results were significant, and only for Stability, although Conscientiousness almost reached significance. The women's results were not significant.

Table 5.10: Correlations between Total Exercise and personality traits

	All $N = 60$		Women $n = 30$		Men $n = 30$	
Trait	*r*	*p*	*r*	*p*	*r*	*p*
Agreeableness	.163[b]	.223	.101[c]	.603	.264[c]	.166
Conscientiousness	.265*[a]	.029	.238[c]	.215	.356	.053
Extraversion	.214	.101	.227	.228	.184	.330
Openness	-.095[a]	.474	.039[c]	.841	-.316	.089
Stability	.319*	.013	.226	.229	.430*	.018

*Significant at $p \leq .05$ *Sample size:* $^{a}n = 59$, $^{b}n = 58$, $^{c}n = 29$

Motive correlations

The correlations between Total Exercise and motives are shown in Table 5.11. For the whole sample, there was a significant negative correlation between Acceptance and Total Exercise and a significant positive correlation between Power and Total Exercise. For men, significant negative correlations were found between Tranquillity and Total Exercise, and Acceptance and Total Exercise, and a significant positive correlation between Power and Total Exercise. No significant correlations between Total Exercise and motives were found for women.

Table 5.11: Correlations between Total Exercise and motives

	All N = 60		Women n = 30		Men n = 30	
Trait	r	p	r	p	r	p
Acceptance	-.318*[b]	.015	-.232[e]	.226	-.446*[e]	.015
Curiosity	-.020[c]	885	.044[e]	.819	-.099[f]	.615
Eating	-.158[a]	.231	-.189[h]	.318	-.083[e]	.669
Family	-.022[d]	.877	-.099[e]	.629	.105[g]	.601
Honour	.246[a]	.061	.322[e]	.088	.163	.390
Idealism	.060[c]	.658	-.059[e]	.762	.364[f]	.057
Independence	-.062[a]	.643	-.319[e]	.092	.287	.125
Order	.211[a]	.109	.326[e]	.085	-.016	.932
Physical activity	.156	.233	.050	.793	.283	.130
Power	.322*[a]	.013	.246[e]	.198	.448*	.013
Romance	-.134[b]	.314	-.173[e]	.371	-.233[e]	.224
Saving	.023[c]	.863	-.082[f]	.679	.158[e]	.414
Social	.140[b]	.296	.079	.676	.220[f]	.261
Status	-.112[b]	.401	-.079[e]	.684	-.144[e]	.456
Tranquillity	-.211	.105	-.029	.879	-.508**	.004
Vengeance	-.231[c]	.084	-.329[d]	.087	-.208[e]	.279

Sample size: [a]n = 59, [b]n = 58, [c]n = 57, [d]n = 53, [e]n = 29, [f]n = 28, [g]n = 27, [h]n = 26,
**Significant at p < .05   **Significant at p < .005*

Strength correlations

Correlations for strengths are shown in Table 5.12. The only statistically significant correlation between a strength and Total Exercise was a positive correlation for men between Total Exercise and Playfulness and Humour.

Table 5.12: Correlations between Total Exercise and strengths

	All		Women		Men	
	N = 60		n = 30		n = 30	
Trait	r	p	r	p	r	p
Curiosity/Interest in the World	.132[c]	.329	.137[d]	.480	.122[e]	.537
Love of Learning	-.097[d]	.475	-.086[f]	.670	-.112[d]	.562
Judgement/Critical Thinking/Open-mindedness	.093[b]	.486	.126[d]	.515	.017[d]	.930
Ingenuity/Originality/ Practical Intelligence/ Street Smarts	.128[c]	.343	.081[e]	.683	.170[d]	.379
Social Intelligence/ Personal Intelligence/ Emotional Intelligence	-.138[c]	.306	-.176[e]	.372	-.094[d]	.626
Perspective	.084[b]	.532	-.026[d]	.895	.260[d]	.174
Valour and Bravery	.119[a]	.368	-.001	.995	.263[d]	.168
Perseverance/Industry Diligence	.203[b]	.125	.276[d]	.147	.096[d]	.621
Integrity/Genuineness/ Honesty	.240[a]	.067	.239	.204	.272[d]	.154
Kindness and Generosity	.070[b]	.603	.087[d]	.654	.047[d]	.809
Loving and allowing oneself to be loved	.056[a]	.676	.019	.922	.129[d]	.506
Citizenship/Duty/ Teamwork/Loyalty	.025[a]	.853	-.127	.503	.270[d]	.157
Fairness and equity	-.021[a]	.876	.149	.432	-.263[d]	.169
Leadership	.080[a]	.549	.172	.365	-.146[d]	.449
Self-Control	.152[a]	.250	.039	.836	.295[d]	.120
Prudence/Discretion/ Caution	.024[a]	.859	-.014	.942	.105[d]	.588
Humility and Modesty	-.032[a]	.812	-.248	.186	.350[d]	.062
Appreciation of Beauty and Excellence	.026[a]	.847	.130	.494	-.122[d]	.528
Gratitude	-.123[a]	.355	-.022	.908	-.256[d]	.180
Hope/Optimism/Future-mindedness	.170[a]	.197	.282	.132	.027[d]	.889
Spirituality/Sense of purpose/Faith/Religiousness	-.047[b]	.728	-.206[d]	.284	.224[d]	.243
Forgiveness and Mercy	-.046[b]	.729	-.018[d]	.927	-.065[d]	.740
Playfulness and Humour	.121[a]	.362	-.054	.775	.435*[d]	.018
Zest/Passion/Enthusiasm	.225[a]	.086	.162	.394	.301[d]	.113

**Significant at $p < .05$*   *Sample size: [a]n = 59, [b]n = 58, [c]n = 57, [d]n = 29, [e]n = 28, [f]n = 27*

5.4.3 Regressions

Standard multiple regressions were carried out firstly for each set of measurements, and then selecting items with high correlations to Total Exercise from across the various measurements.

For the variables relating to media, there were no statistically significant findings for the whole sample, nor when analysed by gender. This was also the case for a regression using the 5 personality variables, and for a regression using the 16 motives and, finally a regression using the 24 strength variables. However, across the various measures, several individual differences showed statistically significant correlations with Total Exercise for the whole sample, and for men (there were no significant correlations for women). These variables were used in two further standard multiple regressions, with no violations of assumptions of multicollinearity, normality, linearity or homoscedasticity.

Firstly, the personality traits Conscientiousness and Stability, and the motives Acceptance and Power were explored in relation to Total Exercise for the whole group, with significant results. The total variance explained by the model (Adjusted R square) was 12.3% (F (4,52) = 2.96, p = .028). The coefficients are shown in Table 5.13.

Table 5.13: Coefficients for mixed measurements regression, men and women

	B	SE B	β
Constant	-45.79	75.07	
Conscientiousness	6.77	6.26	.16
Stability	5.71	5.69	.17
Acceptance	-.98	8.86	-.02
Power	13.33	7.49	.24

No beta score reached statistical significance of p < .05
Dependent variable: Total Exercise

These outcomes are reported as recommended by Field (2009): B indicates the unstandardised coefficient, required to construct a regression equation (the constant is also included for this reason), while SE B indicates the standard deviation of sample means. β indicates the unique contribution of each variable to the model (Pallant, 2010), measuring the extent to which one standard deviation change in the variable will affect the outcome, measured in standard deviations of the outcome (Field, 2009).

Secondly, (use of one's) Own Music, along with the personality traits Conscientiousness and Stability, the motives Acceptance, Power and Tranquillity and the strengths Playfulness and Humour were explored in relation to Total Exercise for men. Although Conscientiousness did not quite achieve statistical significance in the correlation analysis (p = .059), it was marginal, so was included and produced the only statistically significant beta score in the model (discrepancies between correlation and model significances are likely due to the way regression controls for other variables, since collinearity was low). The total variance explained by the model (Adjusted R square) was 37.3% (F (7,19) = 3.21, p = .020). The coefficients are shown in Table 5.14.

Table 5.14: Coefficients for mixed measurements regression, men

	B	SE B	β
Constant	-187.09	136.74	
Own Music	3.84	5.15	.13
Conscientiousness	17.75	8.13	.41*
Stability	2.74	7.49	.10
Acceptance	7.38	12.69	.15
Power	19.19	10.46	.34
Tranquillity	-10.19	11.78	-.21
Playfulness & Humour	8.03	6.35	.25

**p < .01*
Dependent variable: Total Exercise
See note to Table 5.13 for fuller explanation.

5.5 Discussion

This study designed as an exploratory piece of research into adherence, and the results show several noteworthy findings. Central to the main research question, 'Can music help people adhere to exercise programmes?' is the issue of relationships between music use and the frequency with which participants exercised. The results showed that for men, there was a relationship between the amount they listened to their own choice of music while exercising and the frequency of their exercise sessions. This indicates that music and adherence may indeed be linked, supporting the first hypothesis. It is, nevertheless, under specific circumstances: no such results were found for music played over the gym's PA system, and there was no evidence of a similar link among the women participants. Similarly, partial support was found for the second hypothesis, that Conscientiousness is positively related to exercise frequency.

The exercise data provided an insight into exercise frequency among a population sufficiently committed to exercise to have gym memberships and, for most participants, attend regularly. Participants carried out slightly over three sessions each week on average. The weekly sessions figures compare to a national figure for England of 20.5% of men and 12.4% of women exercising three or more times per week (Sport England, 2011); participants' frequencies here therefore exceed those of around 80% of the general public. The Sport England data was taken from telephone interviews with 166,000 participants for the period October 2010 to October 2011, and included all moderate or higher intensity exercise undertaken for 30 minutes or more at a time: it excluded recreational walking and cycling, although more intense forms of walking and cycling were included (e.g. hiking). Yoga, Pilates, bowls, archery and croquet were included for the over-65s only. It is possible that a small amount of data included in this study would have been excluded from the Sport England data: for example, participants' non-gym exercise totals included estimates that may have included lower intensity exercise, as exercise type was not specified.

While collecting exercise data from Fitlinxx, several different patterns of attendance emerged. Some members showed very regular attendance, perhaps exercising on Monday, Wednesday and Friday each week. Others had a more 'stop-start' pattern, with attendance varying from one week to another, and several members showed changes in exercise habits over school holidays. Some members had longer periods of no exercise, followed by 'bursts' of activity which may suggest adherence was more of a struggle for them. Although it is possible that during these periods, participants were exercising elsewhere and not recording this on Fitlinxx, a variety of patterns were seen for those who reported recording all their activity on Fitlinxx, and/or exercising only in the gym. This kind of information demonstrates the importance of collecting 'real life' data to reflect the varying commitments in people's lives which must be balanced with regular exercise if they are to become long-term adherers. Some participants exercised very frequently, and sometimes multiple sessions in one day were logged – for example, a gym workout followed by a class. It is also quite usual for athletes to train twice a day (referred to as 'split sessions') and this may explain some of the frequent exercise statistics.

The fact that statistically significant findings were far more numerous for men than women, including the first evidence of a link between music use and adherence, may relate to differences between men and women's use of music identified in Study 1. Women were more likely to use music during exercise than men, and more likely to synchronise to the beat. Men's style preferences were more inclined towards Intense and Rebellious music than women's, and Colley (2008) notes similar findings with regard to undergraduates listening to music in everyday life, with more men than women favouring heavier styles. Other research has found gender differences in music listening: women are more likely to report 'chills,' strong emotional responses to passages of music (Panksepp, 1995). Any of these factors, or other gender differences, might be contributing to the differences between the findings for men and women in this study.

In the rest of the results, gender differences also applied to the relationships between personality, motives and strengths, and total number of exercise sessions. Significant relationships between variables were found more frequently for the men. Similar patterns were also evident in Emilsson et al.'s study of compliance with prescriptions for asthma medication (2011), indicating that gender may be a factor in the wider issue of adherence to health behaviours. However, Jerant et al.'s large study of medication adherence (2011) found no significant gender differences. These inconsistencies may be due to the diverse populations sampled, method of measurement, study context, the intervention or the behaviour being studied.

Comparison with previous adherence studies shows inconsistencies in key personality traits and their relationship with adherence. Extraversion and exercise adherence were found to be correlated in previous studies (Rhodes et al., 2002; Rhodes et al., 2003) but this was not replicated here; this may be due to higher TIPI scores among the sample than the norms, which were particularly notable for Extraversion. The results for Conscientiousness in this study were, as with the Rhodes studies, inconsistent, providing partial support for Hypothesis 2: the relationship with Total Exercise for the group as a whole was weak, but Conscientiousness had a significant role in explaining variance in men's Total Exercise. Stability (sometimes measured negatively as Neuroticism in other studies) was found to relate to Total Exercise, and was also found to be important in the Rhodes studies and the medication adherence studies. Of the five personality traits, Stability appears to be found most consistently. The effect in this study was related to gender, only applying to men. The average scores for Stability in the men were above those in the TIPI norms, whereas for women they were below. Again, there were differences between genders, perhaps indicating greater heterogeneity among the women, or that factors not considered in this study influence women's exercising.

The strengths measures were, for the most part, unhelpful in identifying factors influencing exercise frequency. With only two questions per strength, it was not practical to assess Cronbach's alpha and the measures may have lacked reliability. It is possible that strengths are not relevant to adherence, although Seligman's description of the Perseverance/Industry/Diligence strengths suggests similarities with Conscientiousness, for which there were significant findings. Furthermore, there was a strong, significant correlation between the two variables: $r = .546$, $n = 58$, $p < .001$. This raises the question of whether the strength measure lacked the necessary detail and questioning to gauge strengths reliably.

The motives measurements, on the other hand, despite being adapted from a simple self-test tool (Reiss, 2009b) offered important benefits. Most noteworthy was the Acceptance motive, which achieved robust alpha scores and displayed possible negative links with exercise frequency:

low Acceptance was associated with higher exercise frequency. The motive refers to accepting the status quo, and those exercising regularly might be assumed to be opposing acceptance, wanting to improve their fitness and perhaps their appearance. This belief in one's ability to change is related to self-efficacy theory (Bandura, 1977), often associated with successful implementation of healthful behaviours (see Section 1.5.2). Power and Tranquillity motives were also found to be important. Tranquillity's negative association with exercise may indicate that adherence was associated with a need for stimulation, and this may be linked to Extraversion which, although somewhat ambiguous in this study, was found to be an important factor in other research (Rhodes et al., 2002; Rhodes et al., 2003). The reason behind Power's association with exercise may relate to feeling more physically powerful because of developing strength through exercise, or to the benefits of general fitness helping one deal with everyday life by, for example, reducing stress (Salmon, 2001). Certainly the motives seem to offer greater potential for understanding exercise adherence than the strengths.

5.6 Summary

In this chapter, I have shown that several factors drawn from measures of individual differences and from music use may have a relationship with exercise frequency. Significant results were found for the men as a group, but not for the women, and this is a pattern seen in other literature. Using one's own music during gym exercise was associated with increases in the men's exercise frequency, and this is the first support for Karageorghis et al.'s suggestion that music played during exercise might help adherence (1999: see Section 1.3.2). In the next study, I move the focus to using music as a tool to boost motivation prior to exercising.

Chapter 6

Study 4: Music use and exercise adherence – an intervention study

6.1 Aims

This chapter reports on the final part of the PhD project, a longitudinal intervention study exploring whether a pre-exercise music intervention would result in exercise adherence and fitness improvements. The previous studies focused primarily on music use during exercise, with Study 1 showing general trends and preferences, Study 2 demonstrating the individual variation in music selection and use, and Study 3 revealing a possible link with adherence,. Study 4 differs in that it considers whether music might help bridge the intention-behaviour gap *prior* to exercise through a motivational effect. Although previous research has looked at music listening for pre-event preparation in sport (Bishop et al., 2007; Laukka & Quick, 2013), and music's use to 'get in the mood' for activities such as housework (DeNora, 1999), there is a lack of research on using music to prompt exercise behaviour. Study 4 seeks to address this.

6.2 Background

As discussed in Chapter 1, there has been little previous literature examining the relationship between music and exercise adherence. Karageorghis et al. (1999) suggested that playing music during exercise improves the experience of exercise, enhancing adherence through positive associations (see Figure 1.1). However, this is speculative and there may be other factors involved. Participants in Study 1 described various barriers to exercise, which applied whether or not they listened to music (see Section 3.4.4). Some barriers were practical, such as working late or lacking childcare, but other reasons were psychological, such as 'can't be bothered.' Tiredness was also cited, and these pre-exercise states hinder bridging the intention-behaviour gap. The period before a planned exercise session is therefore important to adherence outcomes.

Previous research in exercise has examined strategies to overcome pre-exercise barriers (for example, Conraads et al., 2012; Prestwich et al., 2003), but has not included music. Also, research has often lasted only a few weeks, but evidence indicates an initial drop-out phase of six to nine months for new exercisers (Weinberg & Gould, 2007). There is, therefore, scope to explore the use of a music intervention in the context of a long-term study of exercise adherence. Study 4 was designed to address this.

This study tested two pre-exercise interventions: (1) playing motivating music prior to exercise to instil an 'exercising' mood, or (2) using implementation intentions, where strategies for overcoming barriers are devised, and written down in the form "If x happens, then I will do y," with the intention that these are then acted on when barriers occur. A third condition, a control with no intervention, provided a comparison.

The hypotheses were that those using interventions would (H1) achieve more exercise, (H2) meet their exercise goals more frequently. It was not clear whether implementation intentions or music would produce the highest adherence levels. Although the focus of the studies in this thesis is whether music can assist adherence, implementation intentions were included for comparison because of lack of research precedents with music. Implementation intentions already have a supporting literature (see Section 1.5.2). Study 1 results gave mixed indications regarding music use before exercise: of the 67 participants who listened to music before exercising, 55 did so for motivation or to 'psych up' (see Table 3.35), but no relationship was found using basic measurements of planning and pre-exercise music use (see Section 3.4.4). Additionally, using implementation intentions may be easier thank listening to music because no equipment is needed. On this basis, it was hypothesised that the music intervention would show favourable results, but that the implementation intentions intervention's results would be superior (H3). It was anticipated that those with interventions would have more improved fitness, because of greater adherence, compared to the control group (H4). Based on the Study 3 results, higher levels of Stability and Conscientiousness were anticipated among those with higher levels of adherence (H5).

6.3 Method

6.3.1 Design

The design was longitudinal, randomised, controlled, between-participants and field-based, with three conditions. The first condition was the music intervention, where participants were asked to play music to 'get them in the mood' prior to exercise, to coincide with the point at which lack of motivation was most likely to override their intentions. Since this was the first time a music intervention had been tested in a field-based study of exercise adherence, it was important to choose a non-musical intervention with a track record of effectiveness for comparison. The second condition was the non-music, implementation intentions condition, where participants were asked to think of reasons that they might not start a planned exercise session, then to consider ways to overcome these barriers. For each example, they were asked to write a sentence constructed "If… then…" where 'If' preceded a description of the barrier and 'Then' preceded the strategy for overcoming it. They were asked to refer back to these sentences for their intervention.

The implementation intentions intervention was selected because several previous studies have applied it to address barriers to exercise, finding it effective. Prestwich et al. (2003) combined implementation intentions and the decision balance sheet (DBS) in a 4-week study of exercise participation. The DBS is an established strategy in exercise psychology which consists of the participant listing advantages and disadvantages of starting an exercise programme, increasing their awareness of potential benefits compared with losses (Weinberg & Gould, 2007). Prestwich et al. found that implementation intentions outperformed the DBS, although combining the strategies produced the highest success rates. Brickell, Chatzisarantis and Pretty (2006) examined implementation intentions in a five-week study of exercise behaviour, finding it had an effect only for participants who had not previously exercised frequently. Gollwitzer and Sheeran's meta-analysis of 94 studies (2006) suggested that implementation intentions are an effective intervention for goal achievement across many health behaviours, although only five of the studies considered physical activity or exercise. Implementation intentions therefore offered a comparison condition that has shown a good level of efficacy, and it was also practical for administration purposes. The third condition was a control condition, with no intervention; this ensured that any effects in the intervention groups were due to the interventions rather than the processes of participation; all participants were embarking on or continuing a programme of exercise, received regular emails and completed surveys, which could also have had a motivational effect.

A longitudinal design was selected because the attrition rate among returner exercisers is typically 50% over six months, continuing at a slower rate beyond that (Weinberg & Gould, 2007). Many studies into exercise adherence last only a few weeks, giving no indication of the longer-term effectiveness of interventions. Additionally, the length of this study increased the likelihood of physical changes resulting from exercise, which could also be measured.

The original intention was to recruit participants exercising for the first time or returning to regular exercise after a break or lapse. It was, however, apparent early on during recruitment that participant numbers were insufficient. The study was extended to recruit from a wider variety of exercise backgrounds, including participants who had been exercising regularly for some time, labelled 'regular exercisers' in the results. Those who were new to or returning to exercise were labelled ‘returners.’ There was a possibility of lapsing for regular exercisers and returners: in Study 1, where participants were regular exercisers, some still reported missing planned exercise sessions, while many of the returners had been regular exercisers in the past. Both groups were therefore appropriate participants for an adherence study. During analysis, I compared the two groups as well as examining the outcomes across the different conditions.

Returners took part in the study for a year. This was to ensure the period of attrition identified in Weinberg and Gould (2007) of nine months, with attrition focused in the first six months, was accounted for. Those who were already exercising regularly, who were recruited after the returners, took part for six months. This was due in part to the research timeframe, and also ensured that minimal inconvenience was caused (since the returner attrition period was not applicable), but that sufficient data was collected to identify adherence and fitness changes over the longer term.

It was important that the study reflected ‘real-world’ exercising to demonstrate its usefulness to exercisers and reflect the context in which many people try to become more active. A common weakness in previous research is use of protocols involving equipment or exercise programmes that are not widely available, or which are prohibitively expensive. Participants in this study were invited to decide their own activities rather than being prescribed regular exercise sessions. This meant they could select activities and times to exercise that reflected their interests and other commitments, again an important aspect to ensure ecological validity.

The study was administered online, with an initial sign-up survey followed by a monthly request to complete an exercise report, with fitness measurements taken quarterly. This approach allowed data collection from a geographically wider area than would have been practical with a face-to-face design, recruiting from a wider pool of potential participants. In addition to providing a solution to cost and time issues for me as a solo researcher, the online design was convenient for participants as it did not require attending appointments, and surveys could be completed at a time that suited them. While, as discussed in Chapter 2, self-report may lead to inaccurate data, the relative anonymity of online reporting, and the opportunity it gives for participants to think about their responses, may elicit additional detail (James & Busher, 2009) and may reduce social bias in responses, where participants try to please the researcher (Fricker & Schonlau, 2002).

Although the design was somewhat complex with participants taking part on a ‘rolling’ basis, detailed researcher’s schedules of survey requests and follow-up emails week by week allowed straightforward administration of the study. The structure is shown in Figure 6.1.

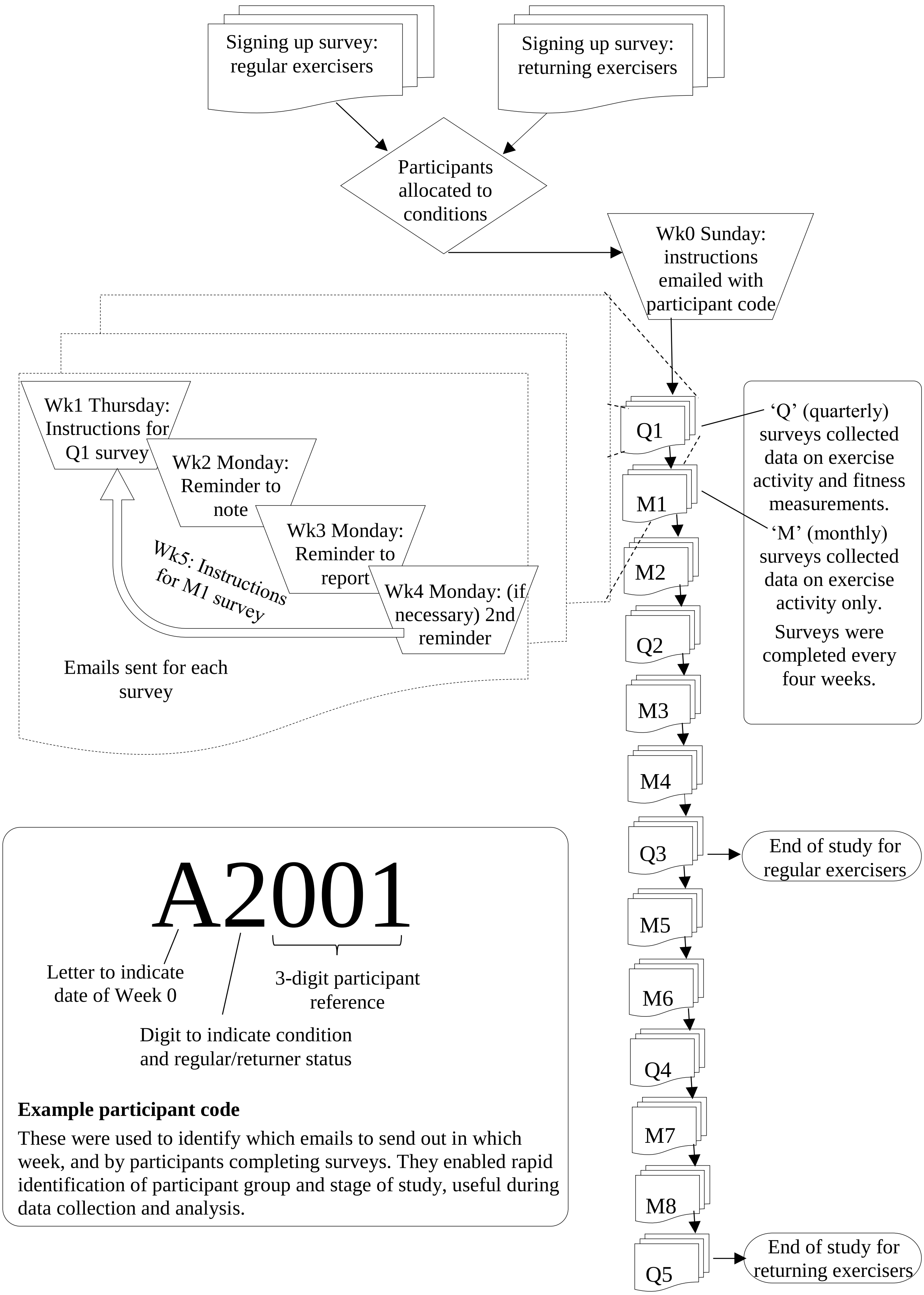


Figure 6.1: Process of survey instructions, study 4

6.3.2 Participants

A total of 99 participants – 30 returners (26 women and 4 men) and 69 regular exercisers (51 women and 18 men) – with a mean age of 40.90 years (*SD* = 13.29) took part. The characteristics of the participant sample are covered in more detail in Sections 6.4 (baseline characteristics) and 6.4.3 (personality).

6.3.3 Apparatus

The study was run using online surveys through SmartSurvey software. Two sign-up surveys were used, one for returners and one for regular exercisers, collecting background data. Further surveys were created: monthly surveys for each of the three conditions; and quarterly surveys for each of the three conditions incorporating extra measurements. There was one survey for post-participation feedback.

6.3.4 Materials and measures

Initial surveys

The initial surveys (see Appendix G) were used for screening and to collect baseline information and personality data. Potential participants were asked to provide demographic information (date of birth, gender) and their exercise plans and history, to describe anticipated barriers, and also to complete the TIPI (Gosling et al., 2003) to measure personality traits. They were asked for a contact email address in order to be able to take part. A PAR-Q (Physical Activity Readiness Questionnaire: adapted from Lane, 2006, p.24) was incorporated into the survey to ensure, for ethical reasons, that participants were not compromising their health by taking part. No participants were excluded on the basis of their responses.

Participants described their exercise intentions in the initial sign-up survey in terms of activity (up to three types, with a free choice so that any activity could be included) and the number of times they intended to carry out each activity per week. From this, the total number of planned exercise sessions per week was calculated for each participant, and used as a benchmark against which to measure actual behaviour.

Data collection surveys

Once a month, participants completed surveys, detailing their exercise sessions and use of the intervention (if applicable). The surveys used to collect data can be found in Appendix H. From this, minutes per week, days per week on which exercise had taken place, and sessions per week (some participants exercised more than once a day) were calculated.

Exercise sessions lasting less than 10 minutes were removed from the data as this is the minimum duration of an exercise session as stipulated in current guidelines (NHS 2011). Non-strenuous physical activities not intended to improve fitness, and which did not meet the criteria set out by the ACSM (American College of Sports Medicine) were also excluded: painting was excluded under these criteria (additionally, it had not been included in the original exercise plans, and was only mentioned in one survey). Gardening was included as it is recognised as being strenuous and was included in initial exercise plans by participants as a means to keep fit.

Participants were also asked to describe any particular challenges, whether they had used their intervention, and whether they had found it useful. Space was provided for further comments. For the first survey, and quarterly after that, data was collected for weight, resting heart rate (RHR), time taken for a step test, and rate of perceived exertion (RPE) during the step test. The step test consisted of completing 20 up-and-down steps in as fast a time as possible, and reporting the time taken and level of exertion. The protocol was taken from Bailey et al. (1976) and chosen as a validated method of collecting fitness data without the presence of an expert measurer. In total, 457 monthly/quarterly surveys were completed out of a possible 891 (achievable if all participants had completed the study, and completed all surveys). Non-completers submitted 72 surveys out of a possible 457, while completers submitted 385 surveys out of a possible 434.

Feedback

A final survey (see Appendix I), administered after study completion, invited qualitative feedback on the process of participation and the interventions, and whether other interventions had been tried after the debrief, following completion of participation. The responses are discussed in Section 6.4.10.

6.3.5 Procedure

Participants were recruited by handing out flyers at gyms and at a local parkrun (www.parkrun.org.uk), coverage in the local paper, publicising the study on the Fetch running website (www.fetcheveryone.com) and on Myfitnesspal diet and exercise website (www.myfitnesspal.com), and promoting it on Facebook and Twitter, encouraging shares and retweets. Flyers and internet posts included links to further information and to one of two online sign-up surveys: one for regular exercisers, and one for those who were returning to exercise after a break, or exercising for the first time. After completing the survey, each participant was allocated to either the music, implementation intentions or control condition; allocation was rotated through the three conditions according to order of completion of the sign-up survey, with separate allocation processes for regular exercisers and returners to ensure each group was equally divided between conditions. Each participant began taking part in the main study as soon as possible after submitting the initial survey. Every four weeks on a Thursday, they were emailed a request to record their activity the following week, and to use their intervention during this period. The email included a link to a survey to report, at the end of the week, what exercise they had carried out, and whether they had used their intervention. At the beginning and end of the study, and every third survey in between, measurements of height, weight, resting heart rate and a step test were also requested. The measurements are described in more detail in Section 6.3.4.

The study was administered through a cycle of emails, as shown previously in Figure 6.1. A planning schedule was created to ensure consistency of the delivery of instructions to participants for each survey, with participants assigned to the study on a rolling basis as soon as possible after they had signed up. Reminders to record activity were sent at the beginning of the allotted week (Monday), and reminders to report the previous week's activity were sent the following Monday. Each email invited the participant to contact the researcher if they could not find the survey link or had forgotten their ID code.

The monthly emails also asked participants to advise the researcher if they were temporarily unable to take part due, for example, to injury, illness or holidays. When this was the case, that survey was not submitted, and the participant resumed with the next survey where possible. This was so that the study focused on usual circumstances, rather than unusual situations where the participant may have wanted to exercise but been physically unable to. In cases of more serious or chronic injuries and illness, participants withdrew.

A substantial proportion of participants did not complete the study. At the end of the week during which they had been asked to report, participants were sent reminders if their survey had not been received. They were invited to take part in the next survey. If a participant did not complete the first survey after several reminders (so had not provided baseline data), or failed to complete two consecutive surveys after several reminders, they were not contacted again and were assumed to have withdrawn. Additionally, some participants advised that they were no longer able to take part (see Table 6.7 for reasons).

The final monthly email advised participants that the survey would be the last one they would be asked to do. Following completion of the survey, they were emailed a debrief explaining the study and their role in it. Subsequently, they were emailed a link to a survey to provide feedback if they wished, and to give consent for this information to be included anonymously in reports, or to request it not be used.

6.3.6 Analysis

The results (Section 6.4) begin with the baseline statistics (frequencies and means) for those who signed up participate (Section 6.4.1), including Age, Exercise history, Exercise plans, Most important aim, and Anticipated barriers. However, there was a high level of attrition, with over a quarter of participants not completing the first exercise survey, and almost half of participants withdrawing before completion of the study. This may indicate non-adherence, so is considered in Section 6.4.2, prior to analysis of participants by conditions. In Section 6.4.3, the relationships between personality and exercise history, and personality and study completion, factors which relate to adherence, are analysed.

The *t*-tests comparing the intervention conditions with the control condition, and ANOVAs comparing the three conditions, were carried out on several different variables: Minutes (mean total minutes of exercise in weeks when surveys were completed); Days (mean number of days when exercise was carried out in weeks when surveys were completed); and Sessions (mean number of exercise sessions in weeks when surveys were completed). Goal Achievement (exercise sessions as a percentage of goal sessions, calculated from exercise intentions described in the initial sign-up survey, averaged across completed surveys) was analysed using non-parametric equivalents (Mann-Whitney and Kruskal-Wallis): the different denominators led to weighting effects, so ANOVAs and *t*-tests were not suitable.

The Goal Achievement variable is comparable to variables used in previous research to measure behaviour against the prescription of a health professional, except participants here self-prescribed their exercise activities. The other measurements were absolute, allowing comparison with official exercise guidelines. Overall, this was intended to allow development of adherence definitions. There were three main elements to consider:

- What is adherence measured against?
- What is an acceptable level of performance against the benchmark?
- What constitutes a lapse?

The results here give some indication of ecologically-valid patterns which can be used alongside those resulting in the first study (see Chapter 3) to propose a framework for measuring exercise adherence. This is discussed further in Section 7.5.4.

In Sections 6.4.4 and 6.4.5, intervention groups are compared to the control group. Firstly adherence for both interventions as a combined group is compared against control group adherence using *t*-tests and Mann-Whitney tests. Next, adherence for the three conditions is compared using one-way between-groups ANOVAs and Kruskal-Wallis tests, then correlations between personality traits and adherence outcomes explored, with the outcomes compared with official exercise recommendations in Section 6.4.6. This is followed by analysis of the fitness measurements taken over the course of the study (Section 6.4.7), using Kruskal-Wallis tests to compare the percentage of change in BMI, resting heart rate (RHR) and step test results between the three conditions. These sections use data from the first six months of the study for both returners and regular exercisers to compare consistent time periods for validity purposes. Following the group comparisons, correlation analysis is carried out to see if personality was related to the outcomes. Eta squared (η^2) is used to show effect sizes for ANOVAs and *t*-tests (as recommended by Levine and Hullett, 2002), rather than partial eta squared: .01 indicates a small effect, .06 a moderate effect and .14 a large effect (Cohen, 1988). For the Kruskal-Wallis tests, *r* is used: .1 is a small effect, .3 a medium effect and .5 a large effect (Cohen, 1988).

Because the surveys indicated that some participants were using their interventions inconsistently, the next section (6.4.8) looks at the extent of intervention use and its relationship with adherence outcomes. To increase understanding of how participants responded to and applied the interventions, this section also analyses their liking for their interventions, and the type of music and implementation intention sentences selected. Participants were asked to describe the music and implementation intentions sentences used and indicate whether they felt the interventions were helpful to identify any difficulties that might not have been anticipated. Because of the sample size and attrition, ANOVAs were not practical for some group comparisons as the groups were too small. Correlation analysis was therefore used to explore intervention use levels. In Section 6.4.9, I look at the data for the second six months of participation for the 12 returners who completed the study, examining possible differences between the two periods. Finally, I reflect on the post-study feedback (Section 6.4.10).

6.4 Results

In this section, I begin by looking at baseline characteristics, considering possible reasons for attrition before looking at the results for adherence and fitness by intervention group. Also included is a section on the returners, looking at the second 6 month of the 12 month participation period (Section 6.4.9). Finally, I look at post-participation feedback on the experience of taking part.

6.4.1 Baseline characteristics

Age

The mean age of the sample (*N* = 99) was 40.90 years (*SD* = 13.29). For women (*n*=77), it was slightly higher at 41.18 years (*SD* = 13.69) compared with the men (*n* = 22) at 39.93 years (*SD* = 12.04). There was no significant difference between the mean ages of the men and the women.

Exercise history

The sample included some participants who were already exercising regularly, referred to as regular exercisers, and some returning to exercise after a break or lapse, referred to as returners. Only one participant had never exercised regularly before; as she did not complete any of the exercise surveys, only data from the signing-up survey was included. The categories of duration are shown in Table 6.1.

Table 6.1: Years of exercise among regular exercisers

	All participants		Women		Men	
Duration of regular exercise	*N* = 69	%	*n* = 51	%	*n* = 18	%
< 6 months	5	7.25	4	7.84	1	5.56
< 1 year (> 6months)	8	11.59	8	15.69	-	-
1-5 years	25	36.23	17	33.33	8	44.44
6-10 years	9	13.04	6	11.76	3	16.67
> 10 years	22	31.88	16	31.37	6	33.33

Most (70%) of those who were not exercising prior to participating reported short-term lapses, having previously exercised less than a year ago (see Table 6.2), hence referring to this group as returners.

Table 6.2: Period of no exercise among returners

	All participants		Women		Men	
Duration of no exercise	*N* = 30	%	*n* = 26	%	*n* = 4	%
Never exercised regularly before	1	3.33	1	3.85	-	-
< 6 months	10	33.33	9	34.62	1	25.00
< 1 year (> 6months)	11	36.67	9	34.62	2	50.00
1-5 years	6	20.00	5	19.23	1	25.00
6-10 years	2	6.67	2	7.69	-	-

Exercise plans

In the signing-up survey, participants were asked to plan up to three regular activities, indicating how many times each week they intended to carry these out. Participants were free to include any activity they liked, in order to incorporate less usual activities. The most popular activity was jogging or running (60 participants), followed by swimming and walking (both with 26 participants). Men and women differed regarding the more popular activities: women were more likely than men to include walking (32.47% of women, 4.55% of men) and exercise classes (19.48% of women, 13.64% of men), and men were more likely than women to include cycling (27.27% of men, 19.48% of women) and resistance training (36.36% of men, 14.29% of women).

The plans were used to calculate number of planned exercise sessions per week. Some participants indicated they would carry out multiple sessions on some days (for example, walking or cycling to work, and visiting the gym). The means for the number of exercise sessions planned are shown in Table 6.3. Regular exercisers planned to carry out slightly more exercise sessions (7.18 per week) than returners (6.38 per week), although the four male returners planned the highest number of sessions: 7.75 per week.

Table 6.3: Planned number of exercise sessions per week: means

	All participants N = 99		Returners n = 30		Regular exercisers n = 69	
	M	*SD*	*M*	*SD*	*M*	*SD*
All	6.94	2.98	6.38	3.14	7.18	2.90
Women	6.77	3.01	6.17	3.02	7.08	2.99
Men	7.52	2.85	7.75	4.03	7.47	2.68

The bar chart in Figure 6.2 displays the percentage of each group – all participants, returners and regular exercisers – planning different numbers of sessions. It shows that the returners were more likely than the regular exercisers to plan lower numbers of sessions, although there is an anomaly with more returners planning 9-10 sessions per week.

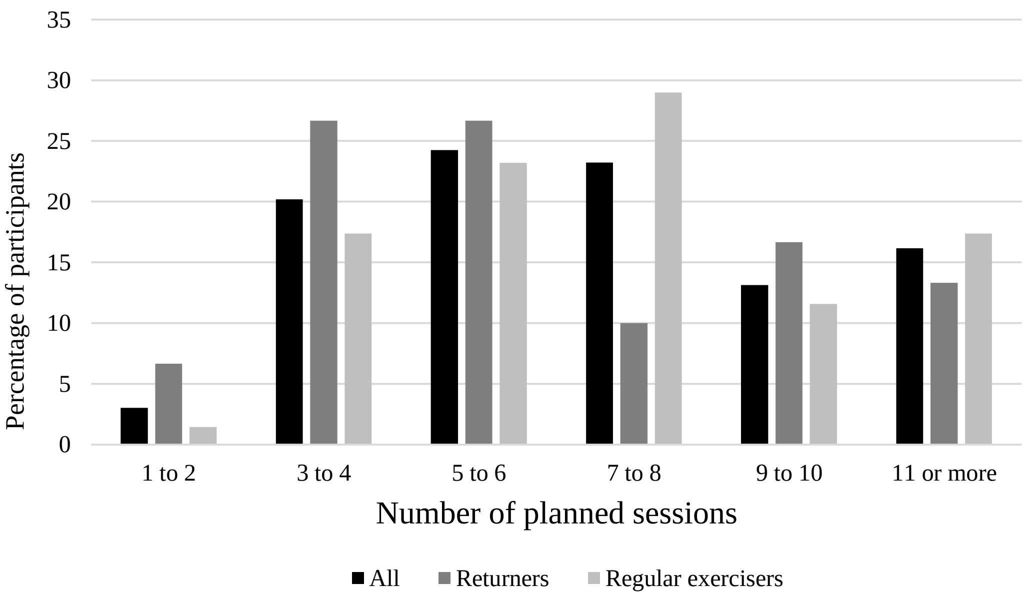


Figure 6.2: Planned number of exercise sessions per week

Table 6.4 shows the participants' first-named activity. Not all participants named further activities. The most popular exercise was running, named as the first activity by over four times as many participants as walking, the second most popular exercise.

Table 6.4: First-named activity

Activity	*N*	%
Run	45	45.45
Walk	11	11.11
Gym	10	10.10
Exercise to music class	8	8.08
Cycle	6	6.06
Resistance	6	6.06
Circuits	4	4.04
Swim	3	3.03
Yoga/Pilates	3	3.03
Conditioning	1	1.01
Team sports	1	1.01
Inline skating	1	1.01
Total (rounded)	99	100

Most important aim

Before taking part, participants were asked the most important outcome for their exercising. There were clear differences between returners and regular exercisers, shown in Table 6.5. 70.00% of returners aimed to lose weight, compared with 26.09% of regular exercisers, while 39.13% of regular exercisers wanted to increase aerobic fitness while only 13.33% of returners stated this as their main goal. The mean BMI of the regular exercisers was 24.33 (SD = 3.25), towards the top end of the healthy range, while for the returners it was 26.49 (SD = 4.81), towards the lower end of the overweight range: a t-test showed that the difference between the two groups' BMIs was not significant. Eight of the 17 returners for whom a baseline BMI was recorded (out of 30 in total) were within the healthy range.

Table 6.5: Most important aim

	All participants		Returners		Regular exercisers	
	N	%	*n*	%	*n*	%
Increasing aerobic fitness	31	31.31	4	13.33	27	39.13
Losing weight	39	39.39	21	70.00	18	26.09
Improving muscle tone	10	10.10	2	6.67	8	11.59
Training for specific event	3	3.03	-	-	3	4.35
To have more energy	2	2.02	-	-	2	2.90
Enjoyment	2	2.02	-	-	2	2.90
Reducing stress	2	2.02	-	-	2	2.90
To address specific health issue	2	2.02	-	-	2	2.90
Increasing strength	2	2.02	1	3.33	1	1.45
Keeping fit	1	1.01	-	-	1	1.45
Bodybuilding	1	1.01	-	-	1	1.45
Maintaining muscle/strength	1	1.01	-	-	1	1.45
Maintaining weight/aerobic fitness	1	1.01	-	-	1	1.45
To look and feel fitter and more healthy	1	1.01	1	3.33	-	-
None specified	1	1.01	1	3.33	-	-
Total	99		30		69	

Barriers anticipated

Almost two-thirds of those registering to take part identified potential barriers, and these are outlined in Table 6.6. The most common anticipated reason, given by almost a third of participants anticipating barriers, was that work or studies would prevent them exercising, followed by injury or illness.

Table 6.6: Barriers anticipated

	All participants		Returners		Regular exercisers	
Barrier	*N*	%	*n*	%	*n*	%
Work/studies	18	28.13	6	20.69	12	34.29
Injury / illness	10	15.63	7	24.14	3	8.57
Unanticipated reason	8	12.50	6	20.69	2	5.71
Motivation	6	9.38	2	6.90	4	11.43
One-off event (move, holiday)	6	9.38	2	6.90	4	11.43
Weather	3	4.69	-	-	3	8.57
Exercise dislike/boredom	4	6.25	4	13.79	-	-
Children	2	3.13	-	-	2	5.71
Buddies unavailable	1	1.56	1	3.45	-	-
Total	58		28		30	

Note: 6 participants (1 returner and 5 regular exercisers) specified that they did not anticipate any barriers, while the remaining participants did not complete the field.

6.4.2 Attrition

A substantial number of participants withdrew from the study or could not be contacted: the attrition rate was 60.00% for the returners, and 44.93% for the regular exercisers. The average number of surveys completed by those withdrawing was 1.47 (SD = 2.16). Regular exercisers who withdrew completed an average of 1.35 surveys out of a possible 7; for returners, the figure was 1.67 surveys out of a possible 13. Of the regular exercisers, 17 completed no surveys, out of 31 who withdrew; for returners, the figure was 11 out of 18. This indicates that the majority of participants who withdrew from the study did so very early. Most (35 out of 49) stopped responding to requests for surveys, without giving a reason for withdrawing. Of those who gave a reason, being too busy with work and/or other commitments, or being injured, were the most common, corresponding to the anticipated barriers described in the previous section: this is shown in Table 6.7.

Table 6.7: Attrition: rates and reasons

	Stopped responding	Injury	Too busy	Family issues
All participants				
N	35	6	7	1
% of attrition	71.43	12.24	14.29	2.04
% of all participants	35.35	6.06	7.07	1.01
Returners				
n	13	1	3	1
% of attrition	72.22	5.56	16.67	5.56
% of all participants	43.33	3.33	10.00	3.33
Regular exercisers				
n	22	5	4	-
% of attrition	70.97	16.13	12.90	-
% of all participants	31.88	7.25	5.80	-

Fifteen participants returned surveys with no exercise recorded (rather than not completing a survey at all, as sometimes happened due to holidays or injury), indicating a lapse; ten went on to complete the study. Nine participants completed just one ‘lapse’ survey, while six participants completed more than one: reasons given included tiredness, workload, illness, moving house and losing weight through dieting and thus not feeling a need to exercise. All six participants recording multiple lapses completed the study. There were five part-completers who each filled in one zero-exercise survey: two completed no further surveys, while the others continued to complete surveys in the following months before withdrawing. Lapses did not, therefore, precede withdrawal in the majority of cases.

As can be seen in Table 6.8, most attrition took place at the beginning of the study, with 55.10% of those who did not complete the study failing to complete the first monthly survey. Possible relationships between attrition and other variables are explored in Sections 6.4.3 (Personality) and 6.4.8 (Intervention use).

Table 6.8: Point of attrition: all participants, and by type, group and reason

			No weekly survey completed		Duration of participation for non-completers completing the first survey (months)						
Group/subgroup		*N*	*n*	% of non-completers	1	2	3	4	5	6	11
All non-completers		49	28	55.10	4	2	4	1	5	4	1
Participant type	Returners	18	11	61.11	1	1	1	-	-	3	1
	Regular exercisers	31	17	54.84	3	1	3	1	5	1	n/a
Group	Music	18	11	61.11	2	1	-	-	2	2	-
	Implementation Intentions	15	11	73.33	1	-	1	-	1	1	-
	Control	16	6	37.50	1	1	3	1	2	1	1
Reason for withdrawal	Stopped responding	35	21	57.14	0	2	3	1	3	4	1
	Too busy	7	4	57.14	2	-	-	-	1	-	-
	Injury	6	2	33.33	2	-	1	-	1	-	-
	Family issues	1	1	100.00	-	-	-	-	-	-	-

Possible underlying factors

Fifty participants completed the study, 21 part-completed (completed at least one exercise survey but did not complete the study), and 28 completed no surveys. Group comparisons were carried out to examine possible underlying factors. Personality was included because of support for a relationship between personality and exercise adherence (Rhodes et al., 2002, 2003, 2004, 2007). Bauman et al. (2012), in their review of correlates of physical activity, note a relationship with age and possibly with obesity; age and BMI were therefore included in the analyses here.

Table 6.9 shows the differences between the groups. The only significant difference was for Extraversion: completers and part-completers had the same mean score (M = 3.90, SD = 1.33 for completers and SD = 1.46 for part-completers), while those completing no surveys scored higher (M = 4.93, SD = 1.60): F (2, 95) = 5.124, p = .008, η^2 = .10 (medium effect). Differences were between early withdrawers and completers (p = .009: Tukey) and between early withdrawers and part-completers (p = .040: Tukey).

Table 6.9: Differences between completers, part-completers and early withdrawers

	Completers			Part-completers			No surveys completed		
	n	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*
Age	50	42.75	13.96	21	38.49	10.47	28	39.39	13.90
Baseline BMI	48	25.15	6.35	17	26.21	4.04	-	-	-
Agreeableness	49	5.23	0.99	20	5.15	1.27	28	5.13	1.36
Conscientiousness	47	5.40	0.99	21	5.19	1.22	26	5.00	1.57
Extraversion*	49	3.90	1.33	21	3.90	1.46	28	4.93	1.60
Openness	49	4.90	1.22	21	5.26	0.92	27	4.98	1.60
Stability	49	4.72	1.59	21	4.93	1.29	28	4.38	1.29

* $p < .01$

All analysis from this point is carried out only on completers – that is, those participants who completed the final survey. For returning exercisers, this was the fifth quarterly survey, while for regular exercisers, it was the third.

6.4.3 Personality

In this section, I examine the sample's TIPI scores compared against TIPI norms (Gosling et al., 2003), then explore relationships between personality and exercise history. Relationships between personality and adherence, and personality and change in fitness, are included in Section 6.4.7.

Personality, gender and exercise history.

Table 6.10 shows the average trait scores for participants who completed all 10 items of the TIPI, indicating consistently lower Agreeableness and lower Openness than the TIPI norms. For Conscientiousness, Extraversion and Stability men scored higher than the norms while women scored lower. The only statistically significant difference between genders was for Stability: t (45) = 3.482, p = .001, with a large effect (mean difference = .169, 95% CI: .71 to 2.66, η^2 = .21). This was also found for the regular exercisers: *t* (34) = 2.894, *p* = .007, with a large effect (mean difference = .157, 95% CI: .471 to 2.68, η^2 = .16 (large effect).

Table 6.10: Comparison of trait scores in the sample to trait score norms

	All			Women			Men		
	n	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*
Agreeableness: All	47	5.20	0.99	35	5.16	1.06	12	5.33	0.81
Agreeableness: Returners	11	5.36	0.98	10	5.35	1.03	1	5.50	-
Agreeableness: Regulars	36	5.15	1.01	25	5.08	1.08	11	5.32	0.84
TIPI Agreeableness	-	*5.23*	*1.11*	-	*5.32*	*1.11*		*5.06*	*1.10*
Conscientiousness: All	47	5.40	0.99	35	5.27	0.93	12	5.79	1.10
Conscientiousness: Returners	11	4.68	0.93	10	4.70	0.98	1	4.50	-
Conscientiousness: Regulars	36	5.63	0.91	25	5.50	0.83	11	5.91	1.07
TIPI Conscientiousness	-	*5.40*	*1.32*	-	*5.51*	*1.11*		*5.19*	*1.15*
Extraversion: All	47	3.97	1.31	35	3.94	1.32	12	4.04	1.34
Extraversion: Returners	11	4.09	1.00	10	4.10	1.05	1	4.00	-
Extraversion: Regulars	36	3.93	1.40	25	3.88	1.42	11	4.05	1.40
TIPI Extraversion	-	*4.44*	*1.45*	-	*4.54*	*1.47*		*4.25*	*1.41*
Openness: All	47	4.98	1.18	35	5.06	1.14	12	4.75	1.31
Openness: Returners	11	4.77	1.13	10	4.75	1.18	1	5.00	-
Openness: Regulars	36	5.04	1.20	25	5.18	1.13	11	4.73	1.37
TIPI Openness	-	*5.38*	*1.07*	-	*5.40*	*1.06*		*5.34*	*1.09*
Stability: All*	47	4.70	1.61	35	4.27	1.59	12	5.96	0.89
Stability: Returners	11	4.18	1.42	10	4.00	1.35	1	6.00	-
Stability: Regulars*	36	4.86	1.65	25	4.38	1.68	11	5.95	0.93
TIPI Stability	-	*4.83*	*1.07*	-	*4.66*	*1.45*	-	*5.13*	*1.31*

** Significant gender difference: p < .01 (TIPI mean scores for N=1814 from Gosling et al., 2003, p.526)*

There were differences between the mean trait scores when regular exercisers were compared to returners. These were significant for Conscientiousness, with returners less Conscientious (*M* = 4.68) than regular exercisers (*M* = 5.63): *t* (45) = 2.99, *p* = .005. The magnitude in difference of the means (mean difference = .94, 95% CI: .31 to 1.58) was large: η^2 = .17. This was also found for the women, with regular exercisers having higher Conscientiousness scores (*M* = 5.50) than returners (*M* = 4.70): *t* (33) = 2.45, *p* = .020. The effect (mean difference =

.80, 95% CI: .14 to 1.46) was again large: $\eta^2 = .15$. Only one returning man completed the TIPI, thus group comparisons were not appropriate for the men.

6.4.4 Comparison of intervention groups and control condition

Two-tailed *t*-tests and Mann-Whitney U tests were used to examine differences between outcomes for the control group and those with interventions, to check for a Hawthorne effect. Such an effect arises when taking part in the study, rather than the interventions, enhances results; it was carried out prior to comparing the data across the three conditions. Table 6.11 (where mean adherence over six months was calculated), shows the results.

Table 6.11: Adherence: means (intervention v no intervention) for completing exercisers (n = 50), calculated over the first 6 months of the study

		Intervention (music or implementation intentions)			Control		
Variable	Key	*n*	*Md*		*n*	*Md*	
Goal Achievement	All**	34	75.53		16	48.61	
	Ret*	9	80.56		3	33.33	
	Reg*	25	75.51		13	55.36	
		n	*M*	*SD*	*n*	*M*	*SD*
Minutes	All	34	283.18	169.60	16	220.31	121.33
	Ret	9	196.76	104.82	3	192.30	72.90
	Reg	25	314.29	179.10	13	226.77	131.43
Days	All	34	4.41	1.54	16	3.57	1.19
	Ret	9	3.58	1.08	3	3.02	.31
	Reg	25	4.71	1.58	13	3.70	1.29
Sessions	All*	34	5.48	2.50	16	3.94	1.44
	Ret	9	4.76	3.28	3	3.22	.38
	Reg*	25	5.74	2.18	13	4.10	1.55

**indicates significant differences at p < .05 level. ** indicates significant differences at p < .005 level*

Several comparisons were statistically significant. The first was for Goal Achievement, with a Mann-Whitney U test showing that the intervention groups achieved a significantly higher percentage of their goal than the control group: $U = 134.50$, $z = -2.86$, $p = .004$, $r = .40$ (medium effect). This effect was also found when regular exercisers' and returners' results were analysed separately. For regular exercisers, the intervention groups achieved a higher percentage of their goal than the control group: $U = 94.50$, $z = -2.09$, $p = .036$, $r = .34$ (medium effect). For returners, the intervention groups also outperformed the control group for Goal Achievement: $U = 2.50$, $z = -2.04$, $p = .042$, $r = .59$ (large effect).

For Sessions, again the intervention groups outperformed the control group: t (48) = 2.290, $p = .026$, mean difference = 1.54, 95% CI: .19 to 2.90, large effect ($\eta^2 = .16$). Also, the regular exercisers with interventions had significantly better Sessions outcomes than the comparative control group: t (36) = 2.410, $p = .021$, mean difference = 1.64, 95% CI = .26 to 3.02, large effect ($\eta^2 = .14$).

Two further comparisons reached borderline significance; both concerned Days, firstly for returners and regular exercisers analysed together, and secondly for the regular exercisers. In both cases, those with interventions exercised on significantly more days than the control group. Across both groups, t (48) = 1.915, $p = .061$, mean difference = .83, 95% CI: -.04 to 1.71, moderate effect ($\eta^2 = .07$). For the regular exercisers, t (36) = 1.972, $p = .056$, mean difference = 1.01, 95% CI: -.03 to 2.04, moderate effect ($\eta^2 = .10$).

For all the completing participants, whether analysed together or separately by regular/returner group, the performance for each adherence variable was superior for the intervention groups compared with the control group, indicating that participation alone, with regular emails, instructions and survey completion, did not elicit as great an effect as also having an intervention.

6.4.5 Adherence comparisons

Differences in outcomes between the three conditions were analysed for Goal Achievement, Minutes, Days and Sessions. First, correlation analysis was used to examine relationships between the four adherence measurements: Goal Achievement, Minutes, Days and Sessions. Although most of these were strong, a few (particularly Minutes) were more tenuous, so all adherence measures were analysed. Data was analysed for all participants completing the study (*n* = 50), completing returners (*n* = 12) and completing regular exercisers (*n* = 38). The averages were taken for the first six months of participation: for regular exercisers, this constitutes the full study, while for returners, it constitutes half of the study.

Adherence correlations

Table 6.12 shows the correlations between the four adherence measurements for completing participants. Overall, there was a positive relationship between Days and Sessions and Goal Achievement. The relationship between Goal Achievement and Minutes was not significant, although there were significant correlations between the frequency and duration measurements. The correlations were slightly weaker and less significant for the returners, although all groups showed a similar pattern. Because of the variation in correlations between the adherence variables, analysis was carried out to compare each one of the four variables across the conditions.

Table 6.12: Correlations between adherence measurements

		Goal Achievement	Minutes	Days	Sessions
All (n = 50)	Goal Achievement	1	.072	.313*	.615***
	Minutes		1	.734***	.570***
	Days			1	.847***
	Sessions				1
Returners (n = 12)	Goal Achievement	1	-.040	.597*	.851***
	Minutes		1	.457	.083
	Days			1	.755**
	Sessions				1
Regular exercisers (n = 38)	Goal Achievement	1	.234	.410**	.530***
	Minutes		1	.743***	.707***
	Days			1	.925***
	Sessions				1

* $p < .05$, ** $p \leq .01$, *** $p \leq .001$

Adherence: group comparisons

Table 6.13 shows the means for the adherence variables across the three conditions for completing participants, averaged across the first six months' surveys, with figures also included for returners and regular exercisers. Outcomes for the intervention groups are, on the whole, noticeably higher than for the control group. Generally, returners' outcomes were poorer than those for regular exercisers. Tests were carried out to see whether the differences between groups were significant: those that were have been marked with an asterisk, and included the implementation intentions group achieving a superior Goal Achievement compared with the control group (the result for the music group was marginal), and the music group achieving higher Sessions compared with the control group.

Table 6.13: Adherence: medians/means for the first six months of the study

		Music			Implementation Intentions			Control		
	Key[1]	*n*	*Md*		*n*	*Md*		*n*	*Md*	
Goal Achievement	All*[a]	15	71.43		19	78.57		16	48.61	
	Ret	3	80.56		6	90.71		3	33.33	
	Reg*[b]	12	66.71		13	78.57		13	55.36	
		n	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*
Minutes	All	15	282.02	111.97	19	284.10	207.31	16	220.31	121.33
	Ret	3	255.50	138.49	6	167.38	82.47	3	192.30	72.90
	Reg	12	288.64	110.59	13	337.97	227.33	13	226.77	131.43
Days	All	15	4.76	1.26	19	4.13	1.70	16	3.57	1.19
	Ret	3	3.82	.33	6	3.45	1.32	3	3.02	.31
	Reg	12	5.00	1.31	13	4.44	1.81	13	3.70	1.29
Sessions	All*[c]	15	5.65	1.84	19	5.35	2.97	16	3.94	1.44
	Ret	3	4.24	.68	6	5.01	4.10	3	3.22	.38
	Reg	12	6.00	1.88	13	5.51	2.48	13	4.10	1.55

[1]All = all participants, Ret = returners, Reg = regular exercisers,
**indicates significant differences across the three groups at p < .05 level: [a]p = .008 between implementation intentions and control groups, and p = .022 between music and control groups (Mann-Whitney test); [b]p = .031 (Mann-Whitney test) between implementation intentions and control groups; [c]p = .030 (Games-Howell) between music and control groups.*

Goal achievement

The Goal Achievement measurement compared the number of exercise sessions carried out against the number of sessions planned in the signing-up survey. The implementation intentions intervention had the highest Goal Achievement followed by the music intervention, with the control condition recording the lowest Goal Achievement. A Kruskal-Wallis test showed a significant difference in Goal Achievement across the three conditions: (Group 1, n = 15: music, Group 2, n = 19: implementation intentions, Group 3, n = 16: control group), χ^2 (2, n = 50) = 9.043, p = .011. The implementation intentions group recorded a higher scores than the music group, with the control group scoring lowest. Post-hoc Mann-Whitney U tests showed the effect was between the implementation intentions and control groups (p = .008, r = .45, medium effect size), and between the music and control groups (p = .022, r = .41, medium effect size). Bonferroni corrections were not applied due to the low powering: Keppel, Saufley and Tokunaga (1992) also advise that in a three-way ANOVA, up to two planned pairwise comparisons are acceptable without applying Type I error correction, while Nakagawa (2004) recommends not applying Bonferroni corrections, instead reporting effect size and/or confidence intervals. Effect size has been reported here. Figure 6.3 shows median Goal Achievement across the three conditions.

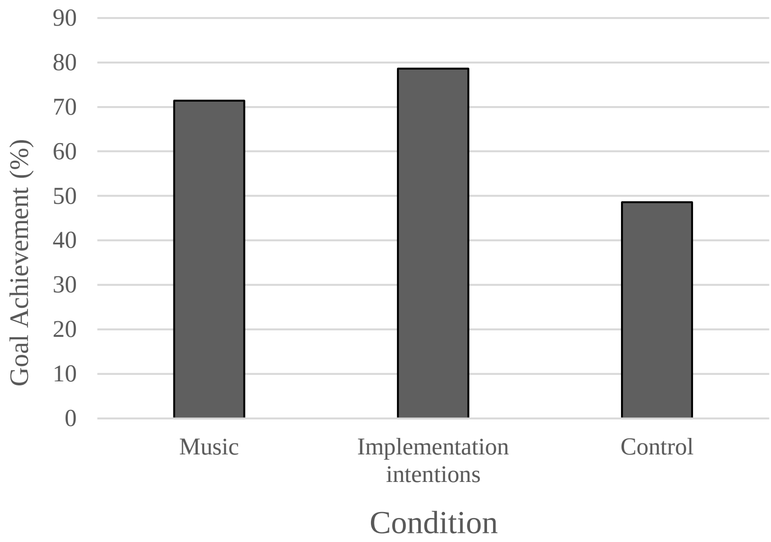


Figure 6.3: Comparison of Goal Achievement medians across the three conditions

There was also an effect for regular exercisers: (Group 1, n = 12: music, Group 2, n = 13: implementation intentions, Group 3, n = 13: control group), χ^2 (2, n = 38) = 6.418, p = .040. The implementation intentions group recorded a higher score than the music group, with the control group again scoring lowest. Post-hoc Mann-Whitney U tests showed the effect was between the implementation intentions and control groups (p = .031, r = .42, medium effect size).

Minutes

The Minutes variable refers to the average duration of exercise in a survey week. The outcomes were slightly better for the implementation intentions group than the music group, with the control group achieving the shortest durations. The effect was small, however, and there was no statistically significant difference when analysis of variance was carried out: F (2,47) = .865, p = .428, η^2 = .04.

For returners, the music group recorded the most Minutes, followed by the control group with the implementation intentions group reporting the least. There was a large effect, but no significant difference between the groups: F (2,9) = .844, p = .461, η^2 = .16. Among regular exercisers, the implementation intentions group carried out the most Minutes, followed by the music group with the control group carrying out least. The difference between the groups was not significant: F (2,35) = .827, p = .453, η^2 = .08.

Days

The Days variable allowed comparison of the average number of days per week each group exercised during the survey weeks. Across all participants completing the study, and for the returner and regular exerciser groups analysed separately, those with the music intervention exercised the most days per week, followed by the implementation intentions group, with the control group exercising on the fewest days. None of the differences was significant. For all completing participants, differences were marginal: F (2,47) = 2.691, p = .078, η^2 = .10. This was also the case for the returners: Levene’s test was significant (p = .037), indicating a violation of the assumption of homogeneity of variance (Pallant, 2010). In such cases, Pallant (2010) recommends using either Welch or Brown-Forsyth tests: Tomarken and Serlin (1986) find Welch tests superior (other than in the case of extreme means, which were not present here), so the Welch statistic has been used. Differences were marginal: F_{Welch} (2, 5.820) = 4.223, p = .074, η^2 = .10. For the regular exercisers, differences were slightly further from achieving significance: *F* (2,35) = 2.374, p = .108, η^2 = .12.

Sessions

The Sessions variable refers to the average number of workouts over the survey weeks, including multiple sessions on a particular day. Among all completing participants, and when the regular exercisers were analysed separately, the music group carried out the most sessions, followed by the implementation intentions group, with the control group carrying out the fewest. For the returners, the implementation intentions group carried out more sessions than the music group, with the control group again carrying out the fewest.

There was a significant difference between groups when the returning and regular exercisers were combined for analysis: Levene's test was significant (p = .034): $F_{\text{Welch}}(2,30.22)$ = 4.603, p = .018, η^2 = .10. The effect was between the music and control groups (Games-Howell: p = .030): the Games-Howell statistic is recommended for use with non-homogeneous variances (Field, 2009) as more usual tests are unreliable in such circumstances.

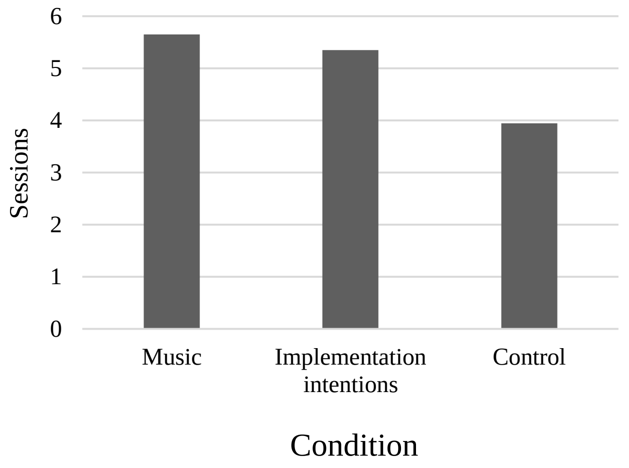


Figure 6.4: Comparison of Sessions across the three conditions

When analysed according to regular/returner status, the differences were not significant, although for the regular exercisers the result was borderline: F (2,35) = 3.039, p = .061, η^2 = .15. For the returners, F (2,9) = .342, p = .719, η^2 = .07.

Personality correlations

Correlation analysis found positive correlations between Agreeableness and Goal Achievement for all participants (r = .370, n = 49, p = .009) and for regular exercisers (r = .471, n = 37, p = .003), with the Goal Achievement means taken for the first 6 months of the study.

6.4.6 Meeting official exercise recommendations

The official UK recommendations for exercise were discussed in Section 1.5.1, and at the time of writing (2014) were 150 minutes moderate or 75 minutes vigorous activity per week for 18 to 65 year olds (NHS, 2013). Participants in this study recorded a mean of 263.06 minutes of exercise per week (SD = 157.34). Data was not collected on exercise intensity; this is difficult to measure without a researcher being present. There can be a tendency for exercisers to overestimate intensity (Shephard, 2003) but duration was certainly well in excess of recommendations.

Table 6.14 compares Minutes, Days, Sessions, and Goal Achievement for those achieving more than and less than 150 minutes of activity each week. The Personal Target figure refers to the weekly sessions planned in the sign-up survey. As can be seen, those exercising for less than 150 minutes per week set lower targets, and showed lower Goal Achievement, than those exercising for more than 150 minutes per week. The exercise sessions for those exercising for less than 150 minutes lasted, on average, 35 minutes, compared with 56 minutes for those exercising more than 150 minutes per week.

Table 6.14: Comparison: participants achieving <150 and >150 minutes of exercise per week

	Less than 150 minutes per week			More than 150 minutes per week		
Variable	*n*		*Md*	*n*		*Md*
Goal Achievement	11		50.00	39		71.43
	n	*M*	*SD*	*n*	*M*	*SD*
Minutes	11	101.35	36.69	39	308.67	147.86
Days	11	2.60	0.96	39	4.57	1.30
Sessions	11	2.87	1.15	39	5.59	2.22
Personal Target	11	5.91	3.07	39	7.39	2.60

Among the eleven participants exercising for less than 150 minutes per week, seven listed running – a vigorous form of exercise – in their plans and their activity surveys, thus the 75 minute minimum would apply.

Three participants completed less than 75 minutes of exercise per week, with a mean total duration for each week of 55.62 minutes. Table 6.15 compares those achieving more than 75 minutes of exercise per week, but less than 150 minutes, with those not achieving 75 minutes. Again, lower targets were associated with lower adherence outcomes on all four measures, and with shorter sessions: sessions lasted 34 minutes for those exercising less than 75 minutes per week, and 40 minutes for those exercising 75-150 minutes per week.

Table 6.15: Comparison: participants exercising <75 minutes and 75-150 minutes per week

	Less than 75 minutes per week			75-150 minutes per week		
Variable	*n*		*Md*	*n*		*Md*
Goal Achievement	3		48.57	8		56.63
	n	*M*	*SD*	*n*	*M*	*SD*
Minutes	3	55.62	20.33	8	118.50	23.93
Days	3	1.62	0.73	8	2.97	0.77
Sessions	3	1.62	0.73	8	3.33	0.90
Personal Target	3	3.33	1.53	8	6.88	2.99

Overall, therefore, most participants completed substantially more than the minimum recommendations. The few that did not do so (1) set lower targets than those meeting recommendations, and (2) achieved a smaller proportion of those targets.

6.4.7 Fitness measurements

Fitness measurements were recorded quarterly, and included BMI, resting heart rate (RHR), and the step test time and rate of perceived exertion (RPE) to indicate cardiovascular fitness. The step test results were less frequently reported than the BMI and RHR, and this was particularly the case for the RPE, limiting analysis of this variable. I begin by looking at the baseline measurements to compare groups, then examine the changes in measurements that took place over the course of the study.

Baseline measurements

Baseline fitness measurements were collected with the first quarterly survey, after the initial survey to sign up for the study. An outlying BMI (60.8) was removed from all BMI baseline analysis, and a step time of 3406 seconds was deleted as a likely error. Table 6.16 shows the mean fitness measurements by condition, at baseline and after six months. The implementation intentions intervention had the best outcomes for BMI and step time, while the control group had the best outcomes for fall in resting heart rate. The music intervention performed least well for RHR and step time, but the music group's BMIs decreased more than the control group's. Kruskal-Wallis tests carried out for the percent change in each fitness variable found no significant differences between groups, and the low report rates for RPE meant analysis was not appropriate. Similarly, the small numbers of completing returners meant analysis at 12 months was impractical.

Table 6.16: Fitness measurements: comparison of all completing participants at 6 months

		Baseline			After 6 months			Change	
Variable	Condition	*n*	*M*	*SD*	*n*	*M*	*SD*	Unit	%
Average BMI	Music	12	24.78	2.34	12	24.45	2.03	-0.33	-1.33
	Implementation Intentions	15	27.39	10.03	15	26.87	8.56	-0.52	-1.90
	Control	13	25.07	4.38	13	24.87	3.57	-0.20	-0.80
Average RHR	Music	11	59.55	10.87	11	59.45	8.90	-0.10	-0.17
	Implementation Intentions	14	61.64	9.44	14	58.79	9.05	-2.85	-4.62
	Control	14	61.64	9.00	14	58.14	9.51	-3.50	-5.68
Time for 20 steps	Music	12	24.14	8.76	12	22.00	5.99	-2.14	-8.86
	Implementation Intentions	10	32.76	10.44	10	27.31	6.73	-5.45	-16.64
	Control	13	25.02	4.88	13	21.81	5.69	-3.21	-12.83
RPE for 20 steps	Music	0	-	-	0	-	-	-	-
	Implementation Intentions	1	12	-	1	12	-	0.00	0.00
	Control	2	11	4.24	2	11	4.24	0.00	0.00

Note: Not all returners completing the study completed a survey at the 6 month point (for example, if it coincided with holiday, injury or illness), although this was a criterion for completing regular exercisers.

Personality correlations

Correlation analysis using the Pearson Product Moment test found several significant relationships between fitness and personality. Agreeableness correlated negatively with 6 Month Change in RHR (r = -.319, n = 39, p = .048), as did Openness (r = -.317, n = 39, p = .049) indicating positive relationships with enhanced fitness: improved cardiovascular fitness lowers heart rate. Extraversion was associated with an increase in RPE during the step test (r = .669, n = 11, p = .024). There was no significant correlation between the time taken for the step test and RPE, possibly due to the low number of participants reporting exertion levels.

For the music group, there were no significant correlations between personality traits and fitness measurements. For the implementation intentions group, there was a negative correlation between Openness and 6 month change in RHR (r = -.664, n = 14, p = .010), indicating greater improvement in fitness for those with higher levels of Openness.

In the control group, Agreeableness was positively correlated with Goal Achievement (r = .472, n = 24, p = .020) and negatively with change in RHR (r = -.609, n = 14, p = .021). Extraversion was positively correlated with change in RPE (r = .963, n = 5, p = .008). The RPE correlation indicates that Extraverts were likely to feel more exerted at the end of the study than at the beginning when undertaking the step test.

6.4.8 Interventions

Intervention use

As it was clear from the survey responses that participants did not always use their intervention, the results were explored taking this into account. Table 6.17 shows the extent to which participants used their intervention across the first six months of the study: the music intervention was used more frequently than the implementation intentions intervention, although there were no significant differences between usage of the two interventions.

Table 6.17: Medians for Intervention Use (% of possible use)

Group	Intervention	*n*	*Md*
All participants	All	34	58.57
	Music	15	80.00
	Implementation intentions	19	50.00
Returners	All	9	77.78
	Music	3	79.55
	Implementation intentions	6	63.89
Regular exercisers	All	25	57.14
	Music	12	81.66
	Implementation intentions	13	46.15

For all participants, $U = 93.00$, $z = -1.72$, $p = .086$, $r = .295$ (small effect); for regular exercisers, $U = 49.00$, $z = -1.58$, $p = .114$, $r = .316$ (medium effect); and for returning exercisers, $U = 7.00$, $z = -.516$, $p = .606$, $r = .172$ (small effect).

Correlation analysis indicated that higher Intervention Use was associated with lower Minutes: $r = -.362$, $n = 34$, $p = .036$ for participants with an intervention, and $r = -.398$, $n = 25$, $p = .049$ for regular exercisers when analysed by returner/regular status. Further analysis suggested this applied to the implementation intentions condition: for Minutes $r = -.488$, $n = 19$, $p = .034$, while for Days $r = -.464$, $n = 19$, $p = .045$, with no statistically significant relationships for the music condition. However, the implementation intentions condition was also associated with a fall in resting heart rate, indicating improved fitness, particularly for the regular exercisers: $r = -.800$, $n = 10$, $p = .005$. For regular exercisers and returners grouped together, the correlation was almost as strong ($r = -.716$, $n = 14$, $p = .004$), although it did not reach significance for the returners.

Intervention liking

Participants with interventions were invited on each study to comment whether they had found them useful. Some participants commented regularly on their interventions throughout participation, and the comments were evaluated as positive, negative or a mix, with comments that the intervention did not seem to have any effect also noted. Such evaluations are subjective, and some fields were left blank: however, the findings give some indication of how the interventions were received. The results in Table 6.18 indicate that, generally, those with interventions who responded were positively disposed towards them. Two of the music group were negatively disposed towards the intervention. Two of the implementation intentions group commented that they did not feel the intervention had an effect.

Table 6.18: Liking for intervention

	Both interventions		Music intervention		Implementation intentions	
Opinion of intervention	*n*	%	*n*	%	*n*	%
Positively disposed	23	67.65	11	73.33	12	63.16
Negatively disposed	2	5.88	2	13.33	0	0.00
Positive and negative comments	7	20.59	2	13.33	5	26.32
Felt there was no effect	2	5.88	0	0	2	10.53
Total	34	100	15	100	19	100

Intervention application

Participants in the music condition were asked to describe the music they had chosen to listen to before their workouts, and those using implementation intentions were asked what sentences they had used. The responses were then coded. The 15 participants allocated to the music condition who completed the study all described the music they listened to prior to exercising. The choices were coded according to Rentfrow and Gosling's four categories (2003: Reflective and Complex, Intense and Rebellious, Upbeat and Conventional, and Energetic and Rhythmic). The largest group was of 6 participants listening to Upbeat and Conventional music, followed by 3 listening to Intense and Rebellious music, and 1 listening to Energetic and Rhythmic music. One specified not listening to any music, while 4 listed music that was too eclectic to categorise (combinations of rock, pop and dance music). These results are shown in the chart in Figure 6.5

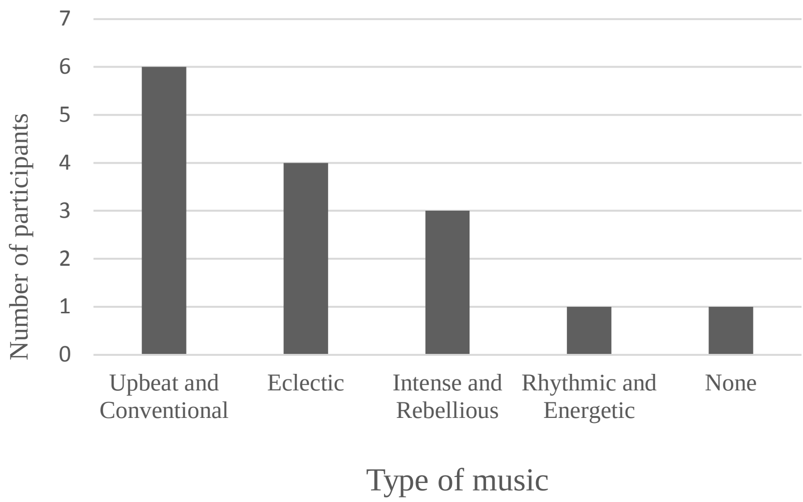


Figure 6.5: Categories of pre-exercise music preferences

The 19 participants in the implementation intentions group provided their sentences in the surveys. Sentence content is better described as carrot or stick (terminology from Stone et al., 2009: see Section 1.5.3) than positive or negative self-talk because of the extrinsic positive or negative outcomes. Around half of the sentences described were 'carrot' sentences ("if I exercise, then [something pleasant] will be the result") with the implication of extrinsic reward. Three participants used 'stick' sentences ("if I don't exercise, then [something negative] will be the result"), implying extrinsic punishment, while one used a mixture. Four participants created sentences based on "if I exercise, then it's better than nothing" while two participants created 'kind to myself' sentences, giving themselves permission to ease off or do less if they did not feel like exercising. A final participant used disconnected phrases: "If I feel like staying in bed, then I'll go for a run." These results are shown in the chart in Figure 6.6.

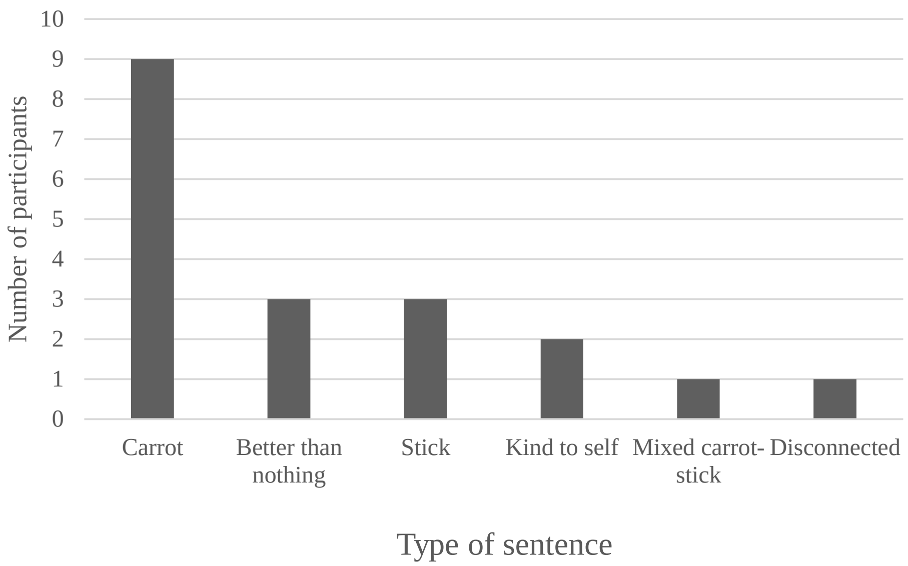


Figure 6.6: Implementation intentions sentences

6.4.9 Returners: the second 6 months

Thirty study participants were returning to exercise after a break or lapse. Eighteen of these withdrew before the end of the study, but twelve completed surveys through the year. Comparisons were made between the Minutes, Days and Sessions variables during the first half of the year and the second half of the year, and the first and final surveys were compared. Conditions were not compared because of the small number of participants (there were only three in the music condition and three in the control condition).

Eight of the twelve participants exercised for fewer minutes on average in the second half of the year than the first, seven of the twelve exercised on fewer days per week in the second half of the year than the first, and eight of the twelve completed fewer sessions per week in the second half of the year than the first, indicating that the majority of participants exercised for less time and less frequently in the second half of the year.

The medians for Goal Achievement and means for Minutes, Days and Sessions, averaged across the surveys for each period, are shown in Table 6.19. Although the means indicated a reduction in Minutes, Days and Sessions, paired-samples *t*-tests indicated that the difference was only significant Minutes: t (11) = 2.294, p = .043. The mean decrease was 37.45 minutes with a 95% CI: 1.51 to 73.39, with a large effect (η^2 = .32). A Wilcoxon signed rank test indicated that the difference in median Goal Achievement for the two periods was not significant. Also included in Table 6.19 are the corresponding outcomes for the first and final surveys. These are superior to the averages across the first and second 6-month periods respectively, suggesting an initial 'novelty effect' from taking part, and a boost from the imminent finish of the study. The differences between the first and last surveys and the averages across the corresponding periods were not, however, significant.

Table 6.19: Adherence means for months 1-6 and months 7-12, completing returners (n = 12)

	Goal Achievement	Minutes		Days		Sessions	
Period	*Md*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Months 1 to 6	60.71	195.64	94.66	3.44	0.96	4.37	2.89
Months 7 to 12	55.77	158.19	90.54	3.08	1.59	3.54	2.25
First survey	77.50	163.17	88.67	4.17	1.34	5.50	4.70
Final survey	63.33	162.83	109.45	3.83	2.17	4.50	3.18

The possibility of a novelty and ending effect among the returners suggested there might also be a similar effect among the regular exercisers. Table 6.20 shows that this pattern was evident for Goal Achievement, Days and Sessions. Differences were significant for Days and Sessions for the first survey and six month averages: for Days, there was a moderate effect: t (37) = -2.037, p = .049, mean decrease = 0.4 Days, 95% CI: -.79 to -.002, η^2 = .10. There was also a moderate effect for Sessions: t (37) = -2.183, p = .035, mean decrease = 0.79 Sessions, 95% CI: -1.52 to -.06, η^2 = .11. Differences were not significant for Goal Achievement.

Table 6.20: Adherence means for first and final surveys, completing regulars (n = 38)

	Goal Achievement	Minutes		Days		Sessions	
Period	*Md*	*M*	*SD*	*M*	*SD*	*M*	*SD*
First survey	77.35	283.47	179.21	4.76	1.78	5.97	2.90
Months 1 to 6	40.42	284.35	167.87	4.36	1.55	5.18	2.12
Final survey	59.17	302.77	186.42	4.57	1.70	5.46	2.49

6.4.10 Participants' comments

Monthly surveys

Participants were able to include comments in their survey responses, and these provided insight into the challenges of exercise adherence. Of the 71 participants who completed the first survey, twelve reported injuries or illnesses that had led them to miss or change exercise sessions,

> Sore hip. Would usually run for most of my exercise and feel quite dispirited about being unable to at the moment (Regular exerciser, female, aged 37).

> By Thursday, it became apparent that my cold was getting worse and becoming a chesty cough / possible chest infection (Regular exerciser, female, aged 46).

while 13 reported difficulties finding time to exercise because of work or family commitments.

> Getting stuck at work meant I couldn't attend as planned, and having a particularly busy social week meant I couldn't attend other sessions (Returning exerciser, female, aged 27).

> I am coming to the end of a course, with exams to take, so need time for revision and work sessions. I knew I was short of time this week (Regular exerciser, female, aged 60).

Further survey comments revealed a personal struggle for some participants:

> Taking some major exams and in bit of melt down at the moment trying to revise and since I don't physically like moving, it feels uncomfortable and hard work, it is a challenge to do what is actually very good for me and does help (Returning exerciser, female, aged 52[*]).

Tiredness was regularly mentioned, often in association with co-ordinating work with other commitments:

> Usual night shifts wreaking havoc. However, because I was up so early on Tuesday I managed to go for a run before going to work. Yet on Wednesday, after a couple of hours sleep after my last night, I felt so tired that I couldn't face a run at all (Regular exerciser, female, aged 41).

> Feeling a bit depressed about what I will be facing in the next few months with my parents, and when I feel down I don't do all the exercise/healthy eating stuff, I self sabotage. Will take a big effort to get going again (Returning exerciser, female, aged 52[*]).

These were not isolated comments: the majority of participants added comments to their surveys. There were positive comments, particularly regarding successful or enjoyable activities:

> Took my first spinning class. Extremely hard work but enjoyable. Nice friendly class and encouraging instructor made it more manageable (Returning exerciser, female, aged 55).

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[*] The comments labelled 'returning exerciser, female, 52' were from two different participants

> I'm very happy with my running sessions, no major problems, hard work but enjoying the challenge, and beneficial in many ways (Regular exerciser, female, aged 49).

Positive remarks were, however, much less frequent than reports of difficulties achieving exercise aims. Although barriers to exercise such as working hours and finding childcare were evident, it was notable that difficulties were described as current rather than ongoing. This is evident in the above comments where temporary situations such as exams, working late or having an injury disrupted what was perceived as a ‘normal’ week, yet the frequency of difficulties indicates the challenge of establishing regular exercise sessions. The comments indicate a mix of time pressure, stress and fatigue among participants; missing an exercise session may relieve time pressure and fatigue was regularly reported as a barrier, yet regular exercise may help with sleep and stress relief.

Post-study feedback

All participants completing the study were invited to complete an online feedback survey (see Appendix I): they were advised that they could remain anonymous, and did not have to give feedback if they did not wish to. They were invited to write freely in response to guidance asking about how they found their interventions, whether they had continued to use them (or used another one) and how they had found the administrative aspect of the study, with regular emails; they were also asked to comment on any other aspects they felt were relevant.

Thirteen participants completed the feedback survey: five from the music group, five from the implementation intentions group, and three from the control group. Two of the music group commented that they had used their intervention in the weeks when they were not participating in the study, while one specified continuing using music prior to exercise to ‘get in the mood’ after the study had finished. Two of the implementation intentions participants said they continued to use sentences to help motivate themselves. There were no participants who reported trying another intervention, however.

Feedback regarding the overall participation experience was positive: the only negative comments were regarding the interventions that one participant did not feel were useful. Four participants described finding that participation itself had a motivating effect. Eight participants noted that the reminders had been useful, with the frequency described as helpful and non-obtrusive, and two noted that the surveys had been straightforward and easy to complete. One participant suggested text reminders: phone contact was originally included in the survey design, but not used because some participants did not provide phone numbers, and it was felt phone calls to some participants would compromise control. Since many studies use texts rather than emails, and texting is ubiquitous, it would seem advisable to include this in future studies. The frequency of emails – one a week, three weeks out of four, plus additional reminders if surveys were not completed – seems to have been appropriate.

6.5 Discussion

The results indicate that both implementation intentions and a pre-exercise music intervention may help increase adherence. Hypothesis 1, that those with interventions would achieve more exercise, was supported for the music condition in relation to Sessions. Hypothesis 2, that those with interventions scoring higher for Goal Achievement, was supported for both the music and the implementation intentions conditions. These findings support both interventions as possible strategies for overcoming psychological barriers to an exercise session, improving adherence.

Hypothesis 3, that the outcomes for the implementation intentions intervention would be superior to those for the music intervention, was not supported: the mean for the implementation intentions intervention was slightly higher than for the music intervention for Goal Achievement, with the reverse the case for Sessions, but the differences were small and not significant. There was no clear advantage to one intervention over the other, although implementation intentions may be more practical in some pre-exercise situations since it only requires the individual's memory, while music must be played on equipment, and participants in Studies 1 and 4 reported being unable to play music in their workplaces before leaving for an exercise session. This was not reflected in the results for intervention use, however; it may be that participants enjoyed the music intervention and forgot about using their implementation intentions sentences.

Hypothesis 4, that those with an intervention would have greater improvements in fitness that those without because of greater adherence, was not supported; there was a relationship between implementation intentions and reduced heart rate, but participants in this condition also showed a negative relationship between the amount of exercise they carried out and the amount they used their intervention. Results were inconsistent for both interventions regarding fitness changes across the duration of the study. It is not clear why this might be, but it should be noted that while the fitness results relate to some extent to exercise, there are many other variables that may affect them: for example, stress affects resting heart rate, and diet affects BMI. Because the interventions were carried out in relation to exercise, rather than in relation to healthy eating or relaxation, fitness measurements were less directly related to the intervention.

Hypothesis 5, that adherence would be associated with Conscientiousness and Stability, was not supported, although there was a positive relationship between Agreeableness and Goal Achievement. Conscientiousness was nevertheless associated with exercise history, with regular exercisers having higher levels than the returners.

Returners, on the other hand, had higher levels of Extraversion than the regular exercisers, and Extraversion was significantly higher for those completing no surveys compared with part-completers and completers; this contradicts Rhodes et al. (2003), who found Extraversion was associated with higher levels of exercise, suggesting this was due to seeking the stimulation of exercise environments. Their study measured exercise for only two weeks; with the longer period of measurements in the present study, and with many participants already exercising, the novelty of the exercise environment may have been less relevant. It seems, therefore, that Extraversion has a relationship with attrition, and may also relate to a history of non-adherence. It may also be the case that Rhodes et al.’s extraverts fulfilled their social needs in exercise contexts, while participants in this study preferred to satisfy social needs elsewhere.

The adherence measurements for the first and last surveys, when compared with the averages over the corresponding 6 month periods, indicated more frequent exercise in the first survey week compared with the 6 month average for the regular exercisers, and shorter durations of exercise sessions in the second half of the year compared with the first half for returners. This may demonstrate a ‘novelty’ effect early in studies, which dissipates over time. This is an important factor to take into consideration because of the short term nature of many studies. For a study that only runs for a few weeks, the novelty effect may be pervasive in the results, and further investigation is needed here because of the large body of research that may be affected.

The negative correlation between Intervention Use and Minutes also needs more exploration. Several participants reported that listening to music before exercise increased arousal levels, leading them to exercise more intensely; the health benefits of this would help mitigate shorter durations. Duration of exercise may provide a less useful measure of adherence unless intensity data is also available. Nevertheless, it is noteworthy that the average minutes of exercise per week among participants exceeded NHS (2013) and American College of Sports Medicine (ACSM: Garber et al., 2011) recommendations of 150 minutes by 62%.

Only three participants aimed to complete fewer than three sessions of exercise per week, indicating that intentions generally corresponded to ACSM recommendations (Garber et al., 2011). There is evidence that planning exercise can help realise intentions among those who have previously been inactive (Lippke, Ziegelmann & Schwarzer, 2004). In this study, it was not made clear that the sessions each participant planned on their initial registration survey would be used as a benchmark. Had this been explained, it is possible that more conservative plans would have been made to ensure success: certainly of Rhodes et al.'s 290 participants (2003), over a third (105) aimed to complete fewer than three sessions of exercise per week, although this may also have reflected characteristics of the student cohort; few of the participants in this study were students.

Additionally, plans may have changed over the research period. This could have been overcome by requesting regular plans ahead of survey weeks, but this would have also increased the participation workload on participants. Additionally, those with interventions might have been more ambitious than those without if they expected their interventions to help them; with plans made before allocation, this was controlled for.

Data that might have been useful to define lapses further was limited. Ten completing participants (20%) submitted 25 lapse surveys (i.e. with no exercise recorded) between them. Of the five Non-completers submitting lapse surveys, two completed no further surveys. For the majority, therefore, lapses were temporary and participation in both exercise and the study continued. However, the exercise behaviour of the non-completing participants following withdrawal was largely unknown. Failure to complete surveys does not necessarily indicate failure to exercise.

Health behaviour studies often have high attrition rates. A systematic review of obesity literature found attrition rates were typically 30% to 40% over the course of studies, although at the twelve month stage, attrition ranged from 17% to 70% (Hallett, 2010). The Brickell et al. implementation intentions study previously mentioned had a 36% attrition rate over its five week duration, a relatively short period. Attrition was for this study was 60% for returners over a year and 45% for regular exercisers over six months. The groups were compared to see if any variables appeared to distinguish between those completing and those withdrawing, but there were few significant differences. Those completing no surveys were, however, more extraverted than completers and part-completers, were more likely to plan gym workouts as their main activity, and were less likely to plan to run compared with the other two groups. This may be a factor in early attrition: attending the gym requires travel, and fitting activities into gym opening times, while running can be carried out from the home with more flexibility.

There are several possible reasons for the high attrition. Firstly the duration of the study and the demands made on participants to use interventions and complete surveys may have required too much time and effort. Secondly, no incentives were provided to take part: participants were not reimbursed for the time spent completing surveys, nor were they psychology students taking part for course credit. Thirdly, there was no face-to-face contact with a researcher during the study, and this may have meant participants felt they had invested less personally in taking part: online interventions are associated with a high withdrawal rate (Eysenbach, 2005), and the online administration and instructions may have been comparable with the eHealth studies Eysenbach discussed. Fourthly, the interventions and exercise sessions were self-administered, with no supporting team of researchers, personal trainers or supply of workshops or equipment, unlike many intervention studies. Overall, the study reflected the typical scenario for members of the general public who wish to exercise, rather than delivering a support mechanism as an intervention that was then withdrawn at the end of the study. The figures are largely consistent with gym drop-out rates of 50% over six months (Weinberg & Gould, 2007): four returners withdrew after the six month point, making the six month attrition rate for returners 47%. This led to the study being unfortunately somewhat underpowered, affecting statistical significance, despite consistent differences between means for the three conditions. Further studies conducted on a larger scale would be worthwhile to establish whether the lack of significance was attributable to underpowering; if this is the case, then both music and implementation intentions could be recommended to exercisers to help them adhere to their plans

Finally, caution should be exercised because of the self-report method used to collect data. It is not clear whether participants recorded their activities accurately. However, measurement with a researcher present may affect exercise behaviour as participants are conscious of being monitored. Future studies might address both these issues by using data collected by mobile phone apps or personal fitness monitors such as FitBits, which are non-intrusive, accurate technologies.

Overall, the results of the study suggest that both music and non-music interventions may be helpful in achieving exercise adherence, with the music intervention performing favourably against the established implementation intentions intervention, indicating that pre-exercise music listening may be a useful strategy to overcome the intention-behaviour gap..

6.6 Summary

This final study of the project moved away from the focus on music during exercise to promote adherence, looking instead at music use as a tool to overcome psychological barriers to exercise. Comparison with a non-music intervention with an established record suggests that music may have potential to bridge the intention-behaviour gap and help establish and maintain regular exercise, although findings regarding any relationship with fitness outcomes were inconclusive.

This study opens up a new area for research into exercise music use. Pre-activity music in previous sports and exercise psychology research has concerned controlling arousal during competition, rather than motivating exercise participation. The indication that music may have some application, particularly for those trying to establish exercise habits, is promising. There is scope to explore this further in future research. Additionally, the simplicity of using motivating music prior to exercise, without the need for any particular expertise, indicates a potential tool to help the general public meet their exercise aims. The next chapter discusses the whole project, relating the findings here to the previous three studies, and considering the implications of the results.

Chapter 7

Discussion

7.1 Overview

This thesis began with the question: "Can music help people adhere to exercise programmes?" In the first chapter, I noted that this was a field with little existing knowledge, and the four studies documented in Chapters 3 to 6 approached the question from different angles. In Studies 1 and 2, I examined how music is used in exercise, looking at real life practices to examine the main research question and also to provide context. In Studies 3 and 4, I explored whether there was a relationship between music use and exercise adherence, comparing quantity of exercise with and without music use.

In this chapter, I summarise the key findings, then explore the discoveries in more depth, relating them to questions raised in the first and second chapters (Introduction and Methodology), including the research aims introduced in Section 2.1. I focus first on Studies 1 and 2, and discuss the thesis's contribution to knowledge regarding how exercisers engage with music in their workouts, moving on to consider the results of Studies 3 and 4, where music's relationship with adherence was tested. Next, I consider the limitations of the thesis, the effectiveness of the methodological approach, and possible future directions for research. Finally, I present my conclusions.

7.2 Overview of the studies

The four studies in the thesis covered two main areas: in Studies 1 and 2, the lack of knowledge regarding how exercisers choose and use music autonomously was addressed, with data collected on exercise music practices, music training, sporting performance, and personality traits so that relationships between them could be analysed, followed by qualitative research to elicit deeper understanding. In Studies 3 and 4, music's possible effect on exercise adherence was investigated: Study 3 focused on music played during exercise, and Study 4 on pre-exercise music. Measures of individual differences were incorporated to investigate possible relationships between exercise, music use and personality traits, with Study 3 also looking at strengths and motives.

The first two studies did not have hypotheses: instead, they were designed to identify trends and practices regarding exercise music use and to gain an insight into participants' experiences. Study 1 used an online survey to explore people's use of music in exercise, with the aim of collecting data from a substantial number of participants, from a range of backgrounds, and with varied exercise profiles, music usage and music preferences. Nearly 300 people took part. The results indicated suggested gender and music training effects: women and trained participants were more likely to use music during exercise, and women were more likely to synchronise movement to a beat intentionally. Some participants reported using music to help induce an exercising mood, while others reported not doing so simply because it had not occurred to them. This, along with motivation-related reasons for non-adherence (such as feeling tired or 'couldn't be bothered') and North et al.'s findings (2004) that music can help create the right atmosphere for exercise and is associated with enjoyment, suggested that pre-exercise music might help adherence. This was investigated in Study 4.

Study 2 involved interviewing ten of the participants from Study 1, exploring in much greater depth how music is used in exercise. Using interpretative phenomenological analysis, themes were found conveying how exercisers experience exercising with music, expanding and adding detail to the findings in Study 1. The interviews reveal much individuality in exercise music use, often related to autobiographical detail. Several commonalities also emerged from the data: reinforcement of identity, control, embodiment and exercise music literacy were important themes.

Study 3 examined relationships between individual differences, media use and exercise frequency of gym members, with a computerised exercise system allowing collection of retrospective exercise data. It was hypothesised that exercise frequency would be positively related with both music use (H1) and conscientiousness (H2); partial support was found. The results provide the first evidence of a relationship between music use and exercise frequency, with men using their own choice of music most often also exercising more frequently. No effect was found for music played over the gym's PA system, nor for women. Relationships were also found between individual differences and adherence, particularly the Acceptance motive; support for the positive role of Conscientiousness was mixed.

Study 4 explored whether pre-exercise music could help people adhere to exercise plans. The previous studies showed mixed support: in Study 1, no link between adhering to an exercise plan and music use was found, but the data collected was categorical; in Study 3, there was support for exercise music use helping adherence. Study 4 used a detailed, scalar measure with participants reporting specific exercise sessions, rather than describing general habits. Two pre-exercise interventions – one musical, one non-musical – were compared to a no-intervention control condition. There were five hypotheses: the first and second anticipated that interventions would result in more frequent exercise and a higher proportion of planned exercise being completed, and were supported. The third – that the non-musical intervention would produce better results than the music intervention – was not supported: the mean Goal Achievement was slightly higher for implementation intentions compared with music, while the reverse was the case for Sessions, but the differences were small and non-significant. There was no support for the fourth hypothesis – that interventions would lead to higher fitness levels – nor for the fifth – that there would be a relationship between adherence and the personality traits of Conscientiousness and Stability (although an effect was found for Agreeableness). These results indicate that both interventions may be useful to help adherence.

In the next section, I look in more detail at whether music can be used to help adherence, following this with sections relating the findings to music and adherence in more detail, referring back to theoretical frameworks introduced in the first chapter.

7.3 Music in exercise

The first research aim (see Section 2.1.1) was to examine the roles autonomous choices of music play in exercise. In this section, I look at the various aspects of music used in exercise using the reciprocal feedback model (Hargreaves et al., 2005; Hargreaves, 2012; see Figure 1.2) as a framework. This includes the intrinsic aspects of music (Section 7.3.1), situation and context (Section 7.3.2), and the listener (Section 7.3.3). The central area of the model (notably perception) is covered through reciprocities between perception and the outer three areas. I argue for an extension to the framework to cover technology: having noted that research has largely overlooked technology, the research findings here support my proposition that it be included.

7.3.1 Intrinsic aspects of music

Two key question in the research concerned what people were listening to during exercise, and how it was chosen (Section 2.1.2). In Studies 1, 2 and 4, participants described eclectic choices of exercise music. When the styles and genres (which reflect intrinsic details) were analysed, the music described in Study 1 fell into all four categories proposed by Rentfrow and Gosling (2003). As mentioned in Section 3.4.1, 80 of the 172 participants self-selecting exercise music chose tracks from two categories, with 20 selecting from three categories. The majority, therefore, used multiple types of music for exercise. When the first-named or predominant type of music was analysed, there were differences between pre-exercise choices (see Figure 6.5) and music played during exercise (see Figure 3.4): before exercise, Upbeat and Conventional music was preferred, followed by Intense and Rebellious music, while the reverse was the case during exercise. This may be due to the Study 4 sample being smaller than in Study 1, and being more predominantly female (men were more likely than women to prefer Intense and Rebellious music), but may also indicate a preference to evoke or complement higher arousal during exercise than during preparation. This extends knowledge beyond those studies focusing on the effects of pre-activity music on arousal and performance (Bishop et al., 2007, 2009; Forde Thompson et al. 2001).

Arousal levels were discussed by several participants in Study 2. Musical characteristics were associated with controlling arousal, consistent with the interaction between music and perception in the reciprocal feedback model. Amanda described using dance music from her exercise classes when she wanted to increase her arousal levels, for example, when feeling tired while driving. Although exercise was not involved, she wished to create the same heightened arousal level as an exercise class. This suggests that music associated with exercising can induce an 'exercise mood.' In Section 1.4 I suggested that exercise music might be selected to create a certain atmosphere, due to its 'fit' with a particular context, its influence on affect, or associations for the listener: all these factors interact in this example.

Also in Study 2, Steven chose music from films to run with because of its gradual increase in intensity (tempo or texture), which his arousal levels mirrored. Sarah discussed choosing music to avoid high arousal levels on long runs because of the risk of running too fast early on and failing to achieve the intended distance; she used spoken podcasts because she felt these were less arousing than music. Both examples reflect the interaction of intrinsic musical features and physiological and affective responses, extending Hargreaves and North's findings (2000) that music choices after exercise were arousal-moderating, while music preferred during exercise was chosen to adjust arousal to an appropriate level. Study 2 participants also described tailoring their music choice to the different intensity levels within a session, adjusting arousal during exercise rather than only afterwards. These examples are noteworthy because in previous research (e.g. North et al., 2003; 2004), participants were not made aware of music being applied to manipulate behaviour, while the participants in Study 2 were, and consciously applied the same principles as North et al. in their study designs, with the intention of benefitting their exercise.

Steven and Andrew's descriptions in Study 2 of listening to music during exercise were suggestive of flow (Csikszentmihalyi, 2002), indicating high levels of arousal and positive affect. Both described going online to search for new music fulfilling their criteria and producing the desired effect for their running, emphasising intrinsic musical qualities. The flow effects may have been heightened through integration with the 'runner's high' effect that results from the production of endogenous opiates, dopamine, adrenaline and noradrenaline by the body during exercise (Anderson, 2013), again demonstrating the interaction of music and physiology.

The results in Study 1 indicate that exercisers' priorities when selecting exercise music are firstly the tempo and secondly the style, both of which are intrinsic aspects. Tempo helps moderate arousal, while style can be associated with arousal levels through musical characteristics (Rentfrow and Gosling's category labels (2003), referring to 'upbeat', 'contemplative', or 'intense' styles, imply this), and also with identity (MacDonald, Hargreaves & Miell, 2009).

Synchronisation presented some challenges for participants, and Sarah and Katie (Study 2) expressed difficulties in matching tempo to movement. In Study 1, almost a third of participants chose tempo as the most important factor when choosing exercise music, but the majority of Study 1 participants did not purposely synchronise. There may be a perception that synchronisation is the norm, leading to Charlotte describing herself as "probably quite unusual" for not synchronising; the results of these studies do not support that. On the other hand, the importance of tempo and lack of synchronisation may indicate that asynchronous music is preferred, and that there is a correlation with heart rate; Terry and Karageorghis (2006) suggested that the preference for music of 120-140 bpm may be due to typical exercising heart rates.

The above examples show the importance of intrinsic musical characteristics in choice of exercise music, but suggest that tempo is privileged in order to manage arousal, rather than to facilitate synchronised movement to a beat. This emphasises the interaction of intrinsic characteristics and affective and physiological responses, and also demonstrates exercisers' competence at managing the latter by selecting appropriate music.

7.3.2 Situation and context

Situation affects various aspects of exercise music and response to it, particularly when comparing situations such as exercise classes, with other-chosen music, to exercise sessions where music is self-selected. An important point to note about autonomous exercisers' music use is that it can only be heard by the individual, unlike in social settings where music may express multiple listeners' shared identity and meaning. Several participants across the studies described listening to 'cheese' during exercise, suggesting the music related to a carefree, fun mood, but also that they might be wary of being judged to have poor taste: Katie in Study 2 specifically said she would be "embarrassed" if someone saw her playlist (see section 4.4.3).

Participants in study 2 seemed to experience disconnection from their everyday life while exercising: Steven described losing inhibitions, talking out loud to a celebrity sportswoman whose motivating comments were integrated with his playlist via an app, and clapping himself. His music selection boosted his confidence and helped him create an 'ideal' persona as he ran. Katie and Sarah mentioned creating bubbles and cocoons – Bull (2007) also referred to an iPod 'bubble' – and Sophie described escaping into a previous identity without the responsibilities of motherhood. These practices encapsulate the use of "music as a resource" described in the reciprocal feedback model to control a situation and one's identity within it, demonstrating interaction between music, context, affective response and listener identity.

The Study 2 participants above used music in a quite different way to its application in an exercise class, or its being broadcast in a gym. This is particularly important when comparing current findings to previous literature: Priest's exploration of the motivational appeal of exercise music (2003) involved developing a gym music policy for a major chain, and thus focused on music with broad appeal. It was also historically situated before some of the technology used by participants in these studies was available. In Study 1, around two-thirds of participants whose first-mentioned workout was in a gym used their own music, with the remaining third listening to the music played in the gym. Participants in Study 2 described using PLDs during cardiovascular gym activity, but not during resistance workouts for safety reasons so were exposed to the gym's choice of music for the latter.

The third research aim (see Section 2.1.3) was to gain a greater understanding of the role of technology in exercise music use. The 'real-life' music use of the participants in these studies was moulded by their technological environment as well as their identity, biography and exercise practices. Household penetration of MP3 players in the UK has risen from 9% in 2005 to 51% in 2013 (Statista, 2014), and their potential in terms of organising playlists, storage capacity, and accessing and downloading tracks means greater flexibility than was previously available. There were descriptions of single playlists that incorporated music from multiple genres (facilitated by MP3 players in a much more efficient way than was possible with a cassette or CDs), of selection and purchase of individual tracks (again, pertinent to MP3 technology), and of processes of exploring music online, updating playlists and managing music libraries for exercise in a way that is far more sophisticated than selecting or compiling a CD or cassette.

Although the reciprocal feedback model refers to media, the influence of technology in shaping preferences and practices has perhaps been understated. Research is increasingly recognising changing methods of dissemination: Krause and Hargreaves (2013) explored use of iTunes among 69 university students, noting that shuffle (a randomising function) was used more than playlists, although this was for general listening rather than music use in exercise. The level of control over music in exercise described by participants in Study 2 contrasts with this, suggesting different application of technology in different contexts. This extends the observation in 1.4 that choice of music differs in exercise compared with general listening (Hallett & Lamont, 2014), in contrast with, for example, drivers listening to more consistent choices when in their cars and in other general listening (Dibben & Williamson, 2007).

It was surprising that few exercisers tailored their playlists for different exercise situations; the scope to compile collections of music for specific activities and intensities is certainly available. This may be due to Study 2 being relatively small-scale, and the amount of running among the participants being high in comparison with other exercise activities. Six of the participants described using more than one exercise playlist, but only Belinda tailored hers for specific kinds of activity, using a faster or a slower playlist accordingly. For the other participants, different playlists were used to increase variety. Only three participants described using shuffle, and all three were applying it to playlists. This suggests a reversal of shuffle being used more than playlists in general listening: almost three quarters of Krause and Hargreaves' participants (2013) often used shuffle, compared to just over half using playlists with the same frequency. Heye and Lamont (2010) found that over a third of the PLD users they approached, who were often listening to music to alleviate the boredom of travelling, were using shuffle, while only 13% were listening to a playlist. This contrasts with Andrew and Sarah (Study 2) on their long runs: Andrew preferred whole albums, while Sarah who preferred podcasts to avoid raising her arousal levels and hence going too fast. Both participants seemed to like a high degree of control over their exercise listening, and this may indicate differences between exercise and non-exercise contexts.

Type of exercise affects the exercise context, and this may in turn affect how music is used. Participants in Study 2 described music as facilitating dissociation, preventing boredom, and enabling them to exercise for longer. This is in contrast to the gym members interviewed by Hallett and Lamont (2014) who reported choosing music that motivated them to work harder, appearing to prioritise intensity over duration. There are differences in the two samples: Hallett and Lamont's participants were discussing gym exercise, while the participants in the studies in this thesis were most commonly runners. Running differs from gym workouts through often taking place outdoors, with a longer period of time spent on a single cardiovascular activity, rather than using a variety of equipment for cardiovascular and resistance exercise.

Although much of the music described by participants in the thesis was of their own choosing and listened to through PLDs, music selected by other people also featured in some workouts. In Study 3, music played in the gym and self-chosen music were compared, with higher use of self-chosen music linked to increased frequency of exercise. There are several possible reasons. The radio stations played at the facility where the research in Study 3 took place provide listening for everyday activities rather than specifically for exercise, so may be less arousing than specifically selected tracks. In a gym, different users will be at different stages in their workout, so music may not correspond to these, with a track more suited to a cooldown perhaps played in the middle of an exerciser's workout, potentially decreasing arousal. Tracks may be familiar to some gym members, and less so to others, again affecting arousal levels.

Classes sometimes included music that participants did not find suitable. Charlotte and Katie in Study 2 were able to explain why a style of music was 'wrong': they had attended classes where they felt the music's characteristics were too persistent, perhaps lacking segmentation (see Section 1.3), and became overfamiliar through repetition. Nevertheless, Katie wanted some predictability in classes so she could pace herself according to anticipated levels of intensity. The balance of novelty and predictability echoes Berlyne's findings (1971; see Section 1.4), which suggest that increasing novelty in simple stimuli, or reducing novelty in complex stimuli, increases hedonic value. Complex stimuli become more pleasant with greater familiarity, while pleasure derived from unvarying stimuli declines faster than that from stimuli with more variety. This may explain the dislike for overly repetitive music, while Katie's regular attendance at Les Mills classes, where the music is changed every three months, did not lead to a lack of hedonic pleasure.

There were, however, distinctive differences between Charlotte and Amanda's response to familiar classical pieces presented as dance remixes in exercise classes, although both had high levels of formal music training. For Charlotte the arrangement felt 'wrong' because of being very familiar with the original version and disliking the variation. However, the music appealed to Amanda; it was a reference spanning both her musician and exerciser identities and connecting them. These tracks might be seen to have a level of familiarity (knowledge of the original) and novelty (new instrumental arrangement, and new context) that appealed to Amanda, but not to Charlotte. Furthermore, they appeared to 'fit' the situation for Amanda, but not for Charlotte.

These contrasting responses may be due to different self-views of identity: Deci and Ryan, whose self-determination theory (SDT) was discussed in relationship to motivation in Section 1.5.2, note that "each individual has multiple identities and that each of these identities is more or less well assimilated to the self of the individual" (2003, p.255). They suggest that a complex array of factors, including social context and external and internal motivators, and the contribution of certain behaviours to the individual's goals, all affect identity assimilation. They also propose that when particular importance is attached to identity, this can increase engagement. It seems that Amanda's musician and exerciser identities were more integrated than were Charlotte's.

This example demonstrates the complexity and unpredictability of preference and identity, and also the unintentional consequences of exercise instructors' music choices; these tracks would have been selected to appeal to the class as a whole, not to individuals within the class, and it is unlikely an instructor would have been aware of Charlotte or Amanda's musical training. Again, this demonstrates how individual differences can compromise the effectiveness of music selection for a group, and the difficulty in identifying generic exercise music to suit different exercisers.

Situation may also affect whether one's own choice of music, or any music, can be listened to, and in Chapter 1 research was identified looking at music use both during (see Section 1.3.2) and before (see Section 1.4) exercise. There was only a small body of research on listening to music before exercise or competitive sport, and one of the research aims was to explore its application (see Section 2.1.4). Although just over a third of participants in Study 1 listened to music before exercise, reporting that this was to influence their mood, ‘psych up’ and motivate themselves, the majority did not, most commonly due to lack of practicality (e.g. being unable to play music in the workplace). Nevertheless, the music intervention was widely applied by participants in the music group in Study 4, and, furthermore, the results indicated a role for music in motivating exercisers to work out, rather than missing sessions. In Study 1, it was apparent that many participants had not considered listening to music before exercise, and consciousness-raising of this application could be useful for exercisers.

Although there is support for pre-exercise music helping adherence, there are hurdles to applying the findings in everyday life, while the implementation intentions tool, used in Study 4 for comparison against music, is a viable option whatever situation the individual might be in. This may, however, be addressed with simple solutions such as ensuring upbeat music is available to play in the car on leaving work, or using a PLD on public transport. Study 4 participants did not report work environments preventing them using the intervention, and the median intervention use for those in the music group was higher than for those in the implementation intentions group, although differences were not significant. There may simply be a need to take steps to ensure music can be listened to at the point at which a decision must be made to exercise or not.

Listening situations for exercise music are highly variable according to whether music is self- or other-chosen, technology use, type of activity and environment, and whether music is being listened to before or during a workout. There are clear interactions with intrinsic elements of the music, autobiographical details, technological engagement, and social aspects – avoided or embraced – of an exercise session.

7.3.3 The listener

Two key aspects of the reciprocal feedback model were particularly pertinent to use of music in exercise and in this section I consider each in turn. Firstly, I examine the importance of memories and associations, particularly with regard to the autobiographical. Secondly, I explore relationships between music use and three individual difference variables where there appeared to be links: gender, athletic ability and personality.

Participants displayed a range of levels of engagement with music. Listening to music during exercise was widespread among participants in Study 1, with over three quarters using music. It is quite probable that those with less interest in music, and/or less likely to use it in exercise, would not have been so inclined to take part in the survey, so some caution must be exercised when generalising from the results. In Study 1, nearly a third of those who did not listen to music during exercise reported that this was so they could concentrate on the activity, although even higher numbers reported not listening for reasons of safety. None of the participants avoided exercise music through more general dislike of music; non-use does not seem to be related to disengagement with music. In Study 4, where the music element of the research was masked during recruitment, several participants struggled to engage with music prior to exercise, either due to lack of equipment, possibly reflecting relatively low interest in music, or because they felt it detracted from their focus on the exercise. Music was not mentioned during recruitment, so those who were less engaged with music may have been more likely to participate than in the other studies.

Memories and associations

In Study 1, when participants were asked what they considered most important when choosing exercise music, memories and associations were the third choice, behind tempo and style but ahead of melody, mood, rhythm and cultural fit. Associative properties of music were mentioned by several participants in Study 2, with Belinda associating particular tracks with university aerobics classes, while Sarah had tracks associated with her husband and a concert she had attended with friends, and Amanda had a more generic association between dance music and exercise.

The expression of identity through music choice is particularly noteworthy since PLD replay is private, so might be seen as self-validation rather than the display of cultural capital (the reinforcement of public social identity through cultural preferences: Bourdieu, 1984). There are echoes of this in Sophie's interview in Study 2; her playlist reflected a time of more freedom prior to having children, and she described and contrasted these periods of her life. Associations may, however, be more abstract rather than autobiographical; Steven's description of how his choice of running music increased his confidence suggests the music was being used to access a particular aspect of the self. However, Steven rarely mentioned autobiographical associations; instead, he derived meaning from the lyrical content and associations with favourite films through their soundtracks.

Nostalgia and 'memoryscapes' were very much in evidence in Study 2 with regard to the theme 'It's all about me' (Section 4.4.2). Although the music choices and memories were highly individual, there were similarities in how they were utilised by participants to construct memoryscapes linked to nostalgia (also described by Bull, 2007). However, the phenomenological sense of each transcript differed: while the themes emphasised commonalities, each participant had developed their own needs-based strategy, demonstrating an awareness of what worked *for them*. The different strategies indicate the ability to develop musical literacy through one's own endeavours, rather than being taught by or observing others. Indeed, the theme 'It's all about me' incorporated participants' beliefs that they were atypical in their use of music, emphasising the personalisation of their listening and their application of self-developed listening strategies. Only Belinda expressed any technical difficulties; these concerned transferring music to a specific device. Her previous device had worked satisfactorily, and she had a clear idea of which tracks she wanted to move to her new phone, showing musical literacy compromised by technological difficulties.

Several participants in Study 2 emphasised the importance of familiarity: Belinda rejected the idea of using specially-composed synchronous running music such as Audiofuel (www.audiofuel.co.uk) as it would not feature familiar tracks, while Amanda replaced the music on the Couch to 5k podcasts with her own choice specifically because the supplied music was unfamiliar. This is consistent with Greasley et al. (2013), who reported a relationship between preference and familiarity: unfamiliar music was less liked than familiar music. Again, familiarity relates to the individual's own experience, and association could be conceptualised as musical familiarity linking to an extrinsic factor.

Nevertheless, new tracks were also used. Steven and Andrew in Study 2 specifically described sourcing new material. The fluid nature of music preference over relatively short time spans (months rather than decades) described by Lamont and Webb (2010) was reflected in other data in Study 2. Participants described periodically updating playlists to reflect changing preferences: Sophie described her playlists as "evolving," while Charlotte reported making playlists according to her training targets and for specific races. Sarah described gradually adding tracks to playlists, but also recompiling playlists after around six months. Again, this is consistent with the reciprocal feedback model, specifically the "constant evolution and change in individual preferences and taste" in interactions between music and listener.

Participants' relationships with technology in Study 2 varied considerably, affecting preferences and playlists because of the knowledge required to source material and become familiar with it. While some participants were highly competent at finding music online and downloading it, creating playlists and tailoring their choices very specifically to their needs, Belinda described struggling to transfer music to a new phone. Almost all the Study 2 participants described frustration with hardware, which in Ruth's case had contributed towards the decision to train without music, and the development of a counting strategy to fulfil the distractive role that music provided for other participants. Charlotte, on the other hand, displayed a particular desire to explore new technology soon after its release and see how it could be applied in exercise contexts, although she returned to previous technology if a new piece of hardware was not effective at delivering what she wanted. This further supports the suggestion made earlier that the role of technology may be underemphasised in the reciprocal feedback model (Hargreaves et al, 2005; Hargreaves, 2012), although it must also be recognised that methods of accessing music are highly dynamic, and research and theory regarding their application is necessarily subject to a time-lag, hence the lack of research on recent listening practices. The influence of technology on participants' use of music supports Krause and North's argument that music and technology are interconnected (2014), and their suggestion of a music technology identity alongside a musical identity is reflected in the participants' different practices and relationships with PLDs and music dissemination.

Individual differences and music

One of the research aims was to look at whether individual differences affect music use in exercise. Analysis indicated that individual differences may also influence whether music is used at all during exercise, a question raised in Section 2.1.5: Who uses music? In Study 1, women were more likely to use music during exercise than men, but women also had, on average, more years of formal music training than men, which may have contributed to the results. Another gender difference was that in Study 1, a slightly higher percentage of men than women reported running as their main music-accompanied exercise activity, while a greater proportion of women than men stated that the gym provided their main form of exercise to music. The slower cadences of some activities in the gym may lead to easier selection of synchronous music (or its accidental selection) compared with running. Elliptical and cycling machines, for example, can be comfortably operated at 70rpm in time to 140bpm dance music, but this is too slow for running. Audiofuel, a supplier of synchronous running music, suggests a tempo in the range of 155-180bpm (http://audiofuel.co.uk/faq/index.html), depending on speed and effort level, and the track Belinda favoured for her intervals is a little over 180bpm. Katie's description of her difficulty in synchronising her running with her music indicates the challenges of finding and using appropriately-paced music for synchronous running. None of the participants when asked knew their running cadence, nor, therefore, the tempo (bpm) they required for synchronous running, although they may have been synchronising unconsciously.

Another possible reason that women were more likely than men to listen to music during exercise is the sociocultural aspect of music use, and this may also relate to their greater propensity to synchronise. Karageorghis et al. (2010) suggested that because dancing classes and dancing at social events is considered more a female activity than a male one in Western culture, synchronous movement to music is a more likely response in exercise for women than for men. This was speculative, assuming the transfer of the practice from dance to exercise contexts, although the importance of synchronisation in choreographed exercise classes such as step and aerobics may help build an association between dance and exercise to music; in Study 1, more women than men attended exercise-to-music classes. Another possibility is that there is a biological basis for differences in synchronisation between men and women, as suggested by Todd and Lee (2007), who note that women's lower metabolic rate, and/or their having a different pelvic structure to men, may contribute towards differences between men and women in studies of entrainment. Again this is speculative, relating only to the protocols used in those particular experiments. Reasons for women's more frequent synchronisation are, therefore, not clear.

In Study 3, there were clear differences between men and women: the analyses produced a number of significant findings relating to men, but not to women. Among these was a significant correlation between the amount of use of one's own music in the gym and exercise frequency, found only for men.

Those with higher 5k Performance scores were slightly less likely to listen to music during exercise than those with lower scores, but the difference was not significant. Some non-music users described preferring to focus on their activity, with music an unwanted distraction. This was evident in Andrew's transcript in Study 2: until presented with a Nike running music CD at the London Marathon Exposition, he did not consider music useful to his training. Of all the participants in Study 2, Andrew had the highest performance rating.

There was no indication that the participants in Study 1 did not listen to music at all; the reasons given for not listening to music pertained to the exercise context. There are parallels with Dibben and Williamson's study of listening behaviour while driving (2007); they found an association between being distracted and listening to music, radio or conversation, and those who preferred silence were less likely to have claimed on their motor insurance. Like some of those exercising without music, preference for silence related to a desire to focus on the activity and carry it out more safely.

Music preferences differed between men and women, with the women's preferences in Study 1 spread equally across three types of music: Intense and Rebellious, Upbeat and Conventional and Rhythmic and Energetic music (categories from Rentfrow and Gosling, 2003). Men, on the other hand, showed a clear preference for Intense and Rebellious music, and were more likely to listen to Reflective and Complex music – a category very few female participants listened to – than Upbeat and Conventional styles. In Study 4: the ten participants whose preferences could be described as Upbeat and Conventional were female, while the four men who provided details of their listening were split between indie rock (two participants) and mixes including rock, pop and electronica/dance (two participants). The trends for men to prefer "heavier" music than women, and for women to be more likely than men to listen to pop, supported Colley's similar findings in a study of undergraduates (2008), suggesting the differences extend beyond the undergraduate population, and apply to specific applications of music as well as general music listening.

The results of Study 1 highlighted several relationships between personality and music choice. Most notably, Openness correlated positively with a preference for what Rentfrow and Gosling (2003) termed 'Intense and Rebellious' music, implying that these styles are chosen for exercise because they are arousing. The findings are consistent with Hargreaves and North (2010), who suggested that arousing music in everyday life is chosen partly on the basis of sensation-seeking aspects of personality. However, as people with high levels of Openness may seek more intense forms of exercise, which may be complemented by particularly arousing music. This suggests that a complex relationship between personality and music choice.

In Study 4, Extraverts in the music intervention group were less likely to use the intervention than more introverted participants in the group. In Study 1, however, there was no support for a relationship between personality and music use, although Openness was related to musical preference for Intense and Rebellious styles, particularly for women. The current finding suggests that Rentfrow and Gosling's observation of a correlation between Openness and liking for Intense and Rebellious music (2003) might be extended to particular applications of music beyond general preferences. Notably, Rentfrow and Gosling also found a liking for Intense and Rebellious music among those with Athletic and Intelligent self-views; although self-views were not measured, the sample in Study 1 was characterised by regular exercise and high educational attainment, so Athletic and Intelligent self-views may have been a factor in music preferences.

The most significant finding here indicated that purposeful synchronisers had higher levels of Openness than non-synchronisers, and that accidental synchronisers fell somewhere in between. The findings on synchronisation in these studies are an important contribution to the literature because they provide details of behaviour patterns and of variables that may have a relationship with synchronising, expanding knowledge in an area where little was previously known.

7.3.4 Applicability of music psychology theories

The sections above demonstrate the relevance of the reciprocal feedback model, although there is a clear argument for further updating it by expanding its reference to technology. Additions are suggested and marked in italics in Figure 7.1.

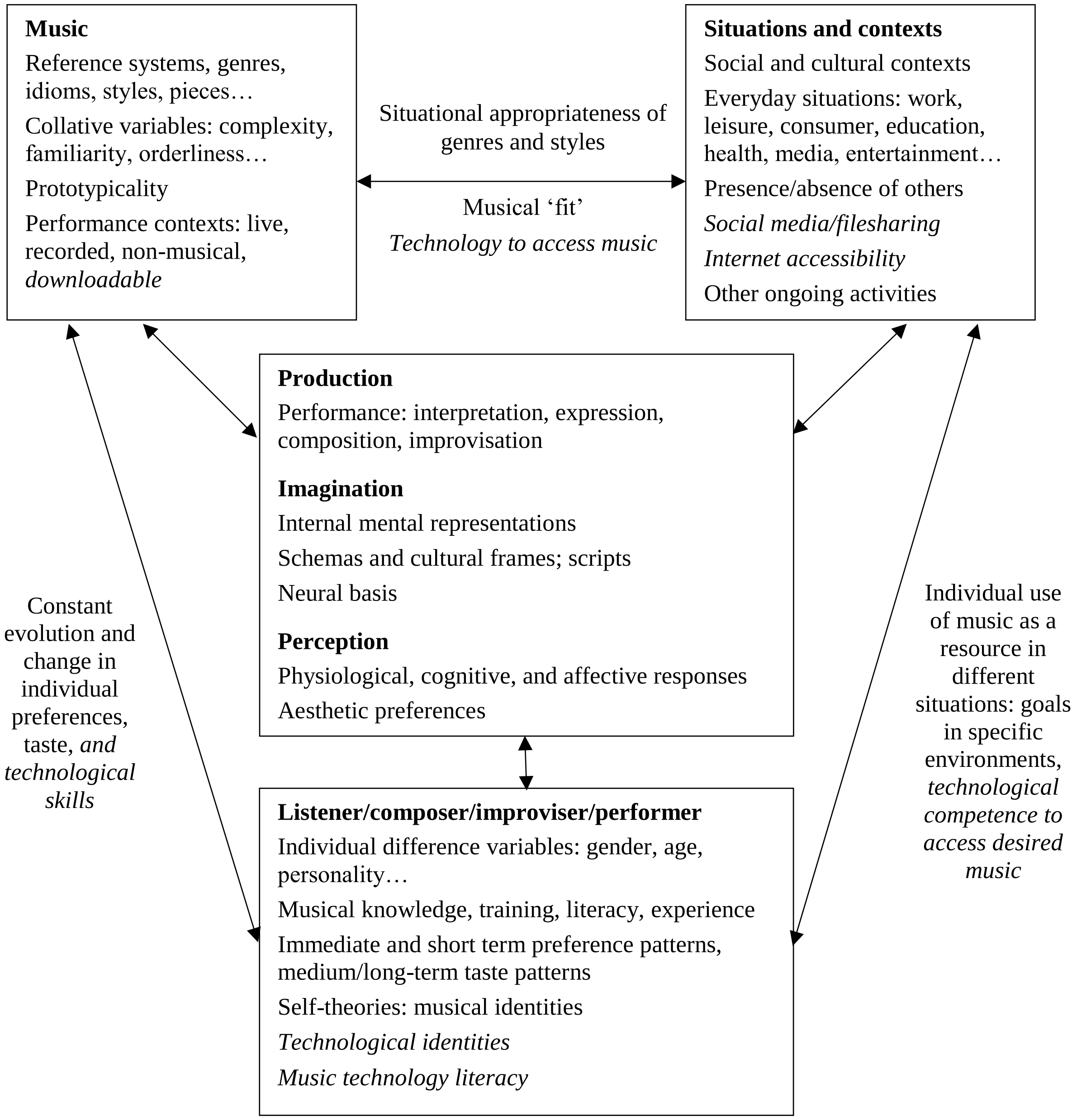

Figure 7.1: Extended reciprocal feedback model of musical response (Hargreaves et al., 2005, p. 8; Hargreaves, 2012, p.554). Additions relating to technology are marked in italics.

Sloboda's comparison of everyday and non-everyday listening (2010: see Table 1.1) presents a dichotomy that music used during exercise appeared to straddle. Steven and Andrew's usage indicated greater emotional response than Sloboda's 'everyday' listening, while other participants described music as alleviating boredom or providing a distraction, suggesting a more 'everyday' experience. The music listening might be better conceptualised as a continuum between active and passive listening, with individual differences further influencing how music is listened to in particular circumstances.

Juslin's BRECVEMA (2013: see Section 1.4) may have some applicability, and the overlap between aspects of the reciprocal feedback model suggests elements of BRECVEMA. For example, Steven's preference for film music that gradually builds in intensity implies a Brain Stem Reflex relating to tempo and crescendo interacting with the Evaluative Conditioning that deems a track suitable for exercising and the Visual Imagery he described relating to particular tracks: the resulting emotional response was of confidence-enhancing positive affect. A similar mechanism may have been operating in Study 4, with a Brain Stem Reflex response to upbeat music, Emotional Contagion where the emotional content of the music is reflected internally, and some kind of mental representation of the exercise environment.

The reciprocal feedback framework in particular seems to represent music-related findings from the studies in this thesis, catering for their complexity and the interaction of different aspects of music listening during exercise. This goes well beyond the model presented by Karageorghis et al. (1999: see Figure 1.1). Findings here support a collative representation of music use in exercise, in contrast with tools such as the BMRI (Karageorghis et al., 1999) and BMRI-2 (Karageorghis, Priest, et al., 2006). The BMRIs consider different aspects of exercise music in isolation from each other; in practice, one will affect another, with tempo, for example, influencing the 'feel' of the rhythm and the rate of melodic change. Beyond musical parameters, interaction between context, listener and the sound itself is fundamental to response, acknowledged by a collative approach.

7.4 Can music help exercise adherence?

The main research question in this thesis was whether music can help exercise adherence. Prior to undertaking the research, there were many questions regarding how adherence should be conceptualised in an exercise context. With the studies now completed, the additional knowledge warrants a return to these questions to reflect on possible solutions. Inconsistency in measuring levels of compliance (see the discussion of Conraads et al. (2012) and Edmunds et al. (2007) in section 1.4), emphasis on professional exercise prescriptions, and lack of definition of lapses, were all concerns. The results from the studies in this thesis, where outcomes for absolute frequency, duration and adhering to plans were measured, indicate that self-selected music relates positively to frequency of activity, has a marginal relationship with adhering to self-made plans, but no clear relationship with exercise duration. These findings are explored in the subsections below.

7.4.1 Does music affect adherence?

A key research aim was to establish whether music affects adherence (see Section 2.1.7), requiring working definitions of the term. Adherence in this study covers frequency, duration and converting specific intentions to behaviour, with music use during or before exercise possibly contributing to these outcomes, although results were mixed across the study.

In Study 3, men who listened to their own music in the gym most often exercised more frequently than those who listened to music played by the gym or used other media while exercising. In Study 4, the group listening to music prior to exercise carried out more exercise sessions per week than those in the control group, and came closer to achieving their goal number of sessions than the control group. These findings related to frequency.

There was no link between exercise duration and pre-exercise music use in Study 4. The study did not incorporate the use of music during exercise, and in Study 3, where music use during exercise was assessed, duration was not measured. Nevertheless, participants interviewed in Study 2 reported that music helped achieve longer durations of exercise, motivating them to continue an activity that might have been curtailed without it.

It was not possible to include exercise plans in the design of Study 3 for comparison of actual behaviour, as the data was retrospective. The results of Study 4 supported a link between music use and adherence to plans, and the greater frequency of exercise among those in the music intervention group indicates a possible effect on behaviour that is less clearly linked to overcoming the intention-behaviour gap (see Section 1.5.2).

In Study 2, participants described choosing specific kinds of listening material according to the purpose of their workout: Sarah chose podcasts to moderate her effort during long runs, while Steven selected tracks where he could increase his effort level in response to the music's increasing intensity, and Belinda chose a particular track to synchronise rapid footfall during high intensity intervals (examples from section 4.4.3). These indicate different ways to achieve intended behaviour, tailoring music to the aim; all reflect some aspect of adherence to a plan. Table 7.1 summarises the findings in this thesis as they relate to different measures.

Table 7.1: Relationships between music and adherence measures

	Music before exercise	Music during exercise
Frequency of exercise sessions	Supported in Study 4	Partially supported (men, own music) in Study 3
Duration of exercise sessions	No relationship found*	Self-reported relationship in Study 2
Adhering to a plan	Supported in Study 4	Self-reported relationship in Study 2

**The means/medians indicated that this may have been due to underpowering in Study 4.*

Many of the participants in Study 1 had used music from the outset when exercising regularly, and did not report conflict with focus on physical technique. Those not using music, however, gave this as a reason, and had superior 5k Performances. It is possible that for those who have always used music during exercise, it has become so integral to exercise that extricating the motivational effect of music on their workouts is difficult. In contrast, one participant in Study 2, Andrew, changed from his initial position that music was detrimental to training (see section 4.4.1). Having received a running CD at a marathon, this may have created an association between music, committed runners and extensive training.

The participants' preference rationales in Study 2 were consistent with those identified by Greasley et al. (2013); Andrew was focused on music characteristics (Greasley et al.'s first rationale), while Sarah's "happy" feelings generated by identifying personally with playlists compiled by her husband is an affective response (Greasley et al.'s second rationale). Steven combined rationales, discussing the music's characteristics but also how, through identifying with lyrics (Greasley et al.'s fourth rationale), he accessed a more confident 'alter-ego' (examples from Section 4.4.3).

The results in Study 2 suggest that music is perceived as motivational, whether or not it has a measurable effect on exercise output and/or adherence. It should be noted, though, that exercise may affect music use: frequent exercisers may be more likely to spend time on exercise strategy, including preparing playlists and sourcing suitable exercise music.

7.4.2 Can music be harnessed to assist adherence? And if so, how?

The indications from these studies are that music has a role in adherence. This leads to the last of questions raised in the eight research aims (see Section 2.1.8): can music be harnessed to assist adherence, and, if so, how? In this section I consider the results across the studies and explore possibilities arising from the findings. In addition to the indications in Studies 3 and 4 that music is associated with exercise frequency, the results in Study 1 suggested that many participants found music motivational, as reported in the qualitative data at the end of the survey. Study 2, however, demonstrated that despite some commonalities, the way in which music was used during exercise varied considerably between participants, with individual differences possibly influencing the effectiveness of different applications of music to help adherence.

Competency to obtain music to facilitate a productive, enjoyable exercise session, which I have termed exercise music literacy (see section 4.4.3), appears widespread. The criteria employed by exercisers are, however, highly individual. For example, Andrew's focus on intrinsic musical detail differed from Sarah's association-oriented approach. This questions the usefulness of tools such as the BMRI/BMRI-II (Karageorghis et al., 1999; Karageorghis, Priest, et al., 2006), which produce generalised recommendations, rated by peers and appropriate to groups defined by narrow sociodemographic profiles. The criteria applied in the BMRI-II allow for an objective rating system primarily of intrinsic qualities, yet this process seems too reductive, suited primarily to controlling music stimuli in laboratory conditions. Such environments bear little resemblance to those of autonomous exercisers, choosing their activities and selecting very specific music to accompany them. Even with a 'kindred spirit' providing playlists online matching his preferences (section 4.4.2), Steven retained fine control of his playlist, rejecting some of the tracks as unsuitable. This supports DeNora's observations that listeners are highly adept at identifying the music appropriate to their needs in a variety of situations (2000). Additionally, participants in Study 2 selected a broad range of music, corresponding to the varied choices of Lamont's participants reporting strong emotional responses to music (2011), and Salimpoor, Benovoy, Longon, Coopersock & Zatorre's participants identifying tracks that elicited chills (2009). It was evident from Study 1 that many exercisers had not considered using music before exercise to generate an appropriate 'mood' or level of arousal. The results of Study 4 indicate that pre-exercise music could be beneficial, and the comments from those in the music condition were often enthusiastic about its effect on 'getting in the mood' to exercise. This supports Bishop et al. (2007) who found young tennis players used pre-activity music to manipulate arousal levels.

Music selection might be incorporated into strategies within the Health Action Process Approach (HAPA: Figure 1.6), for use before and during exercise. Coping planning, during the motivational phase, is consistent with implementation intentions, considering ways to overcome challenges. The sentence ‘If I’m struggling to motivate myself, then I’ll play some upbeat music’ could be used, with exercise action planning involving preparing playlists in addition to planning activities.

Including music-related strategies in the planning stages of exercise relates to autonomous music choice and use. Several participants rejected music suggested as suitable for exercise by external sources, and the exerciser needs to have exercise music suited to their specific needs. Sarah described difficulties synchronising to music bought for the purpose, while Katie reported that many of the tracks on a running CD that was a gift were not suitable for her. Only Andrew, for whom Nike’s CD ignited a passion for exercising with music, described benefitting from music designed for exercise. For Sarah, associating music with her husband seemed to be more motivating than the intrinsic elements. The lyrics ‘Only losers get the bus’ amused her, but were also experienced as encouragement from her husband who chose the track for her playlist. This association was dependent on the other person’s involvement with selection; again, this indicates the limitations of generic exercise music compilations or recommendations. Developing playlists through trial and error may be a useful in the Action phase of the HAPA, helping exercisers to refine their use of music in exercise, ensuring it complements their activity. Using associations, either autobiographical (as with Sarah) or regarding ‘fit’ (as with Amanda), to elicit an emotional or mood-related response may assist goal-directed behaviour, as conceptualised by Bagozzi’s framework (1992: Figure 1.5), by bringing previous successful workouts to mind.

There was evidence that the majority of exercisers did not purposely choose synchronous music, and that in some cases individuals lacked the skills to select music with an appropriate tempo. This was evident in Katie’s descriptions of treadmill running, where she identified a ‘need’ to synchronise, but attempted this with tracks with inappropriate tempi, which sometimes led her to trip up – clearly undesirable on a treadmill because of the safety implications. The synchronous track Belinda used for interval training was an accidental find, but it is possible that with the tools to measure running cadence and beats per minute of tracks (or the use of online lists of tracks at particular tempi), identifying synchronous music could be simplified. Around a third of participants in Study 1 regularly selected synchronous music for exercise, and it can have a beneficial effect on rate of perceived exertion (RPE: see Karageorghis et al., 2009; Terry, Karageorghis, Saha & D'Auria, 2012). Asynchronous music may be better, however, for beginner treadmill users, where motion may cause disorientation, and concentration is needed to match steps to belt speed without the added cognitive load of synchronising. Steppers with belt mechanisms require even greater accuracy of bpm, since stride length is not variable. Speed of elliptical machines and stationary cycles, however, is user- rather than mechanism-controlled. They can be comfortably operated at 60-70rpm, corresponding with the 120-140bpm suggested by Terry and Karageorghis (2006) as ideal for exercise, which also matches the typical bpm of dance music.

7.5 Conceptualisations of adherence

In Chapter 1, I noted that exercise adherence has three main components: a target; the extent to which that target is achieved; and the point at which cessation constitutes a lapse. In Study 1, around a quarter of those making exercise plans reported not always achieving their aims, although it is not clear whether their targets reflected anticipated difficulties. In Study 4, regular exercisers completing the study achieved 75% of their planned sessions. These two groups were both taking part in regular exercise, but complete adherence to plans seems comparatively unusual. With this in mind, in this section I consider how the findings in this thesis relate to each aspect of adherence, before considering their application in an appropriate definition.

7.5.1 Targets

Prior to taking part in Study 4, participants were asked how often they planned to exercise during the study. An average of just under seven sessions per week was planned (for some participants, this included multiple activities on one day, such as walking to work and going to the gym). Only one in ten participants met their targets. Nevertheless, as discussed in Section 6.4.6, official recommendations (Garber et al., 2011; NHS, 2013) were exceeded. This is an important point: if recommendations are generally met, then failure to achieve exercise goals may simply indicate overambitious plans, not insufficient activity. Participants were not asked if they were aware of official recommendations for exercise: Bennett et al. (2009) found that those unfamiliar with such guidelines tended to overestimate required durations, and this may have been the case in Study 4.

Although Study 4 participants indicated how many sessions they planned to complete, they were not made aware that they were being measured against this target. Plans may have changed during the year: for example, one participant who had set weekly targets at the outset stated in a survey that she had not planned exercise for that week because her weight-loss goal was being met purely through diet.

Studies 1, 2 and 4 reflected a high level of autonomy in choosing activities, levels of participation and goals. Additionally, participants described different kinds of training sessions (e.g. for speed and for endurance), indicating technical understanding of how to achieve fitness goals. As discussed in Section 1.4, the term ‘adherence’ has been adopted in health psychology partly to reflect the active role of the patient (Ogden, 2000), and this seems particularly relevant to exercise where there may be little or no input from a health professional, as in the studies here.

Results indicated that setting higher targets may be associated with achieving more exercise. Those completing the least physical activity had set lower targets, and achieved a lower percentage of their target (see

Table 6.14 and Table 6.15). The direction of influence is not clear; the target-achievement relationship may be linked to perceived capability, and hence self-efficacy (see Section 1.5.2). This might indicate that those more likely to struggle with exercise task can be identified by the lower targets they set themselves, and given additional support to ensure initial success. Dishman, Vandenberg, Motl, Wilson and Dejoy (2010) also found that setting higher goals was associated with more activity in a 12-week workplace trial. Dishman et al.'s study (2010) and Study 4 of this thesis were both of longer durations than Rhodes et al. (2003) which found the opposite effect, with lower goals associated with greater adherence. The different results may be attributable to the novelty effect evident in the first month of data of Study 4, since Rhodes et al.'s study only lasted for a fortnight.

Returners set slightly lower targets than regular exercisers (see Section 6.4.1), and this supports self-efficacy theory (Bandura, 1977), particularly the concept of self-mastery, where experience of success generates further success. Furthermore, the findings in Study 4 support possible links between different aspects of self-efficacy in the HAPA (Schwarzer, 2008, Figure 1.6), where it related to action, maintenance and recovery; if self-efficacy is a factor in goal-setting and goal-achievement, then levels of action self-efficacy (relating to intention. i.e. goal-setting), and maintenance self-efficacy (relating to taking action i.e. embarking on goal achievement) and recovery self-efficacy (relating to ongoing maintenance i.e. achieving a goal) appear to be linked with goal-related processes. The HAPA already synthesises multiple models and theories, so this suggestion is in keeping with its approach.

Choice of benchmark, and definition of what percentage of the benchmark constitutes adherence, must incorporate the purpose of exercise. Regular exercisers in Study 4 wanted to improve their aerobic fitness, while returners wanted to lose weight. This is consistent with Markland and Medley's finding that weight loss was the most common motive to begin regular exercise (1998). While fitness and weight loss might be related to improved health, neither goal directly corresponds to the aims of the government to increase activity levels to reduce sickness levels, NHS costs and lost working days.

Notably, regular exercisers emphasised aerobic fitness goals, but recommendations do not do so. This may, in part, be due to the difficulty matching recommendations to target fitness levels because of variations in factors including genetic make-up (Lippi, Longo & Maffulli, 2010): it is far easier to prescribe doses of exercise that will go some way to achieving them. The literature is inconclusive on exercise, mortality and fitness; Byberg et al. (2009) found a negative correlation between physical activity amount and mortality rate, while Fogelholm's review (2010) suggested outcomes rather than behaviour were key.

It is important that general targets are relevant however exercise is measured, and a sessions/days per week target may be the most appropriate; asking participants in Study 4 to provide these aims in their plans did not appear to present any difficulties, eliciting detailed information. Individuals may target themselves using desired outcomes, and returning exercisers in Study 4 were particularly likely to cite weight loss as a motivating factor to exercise (section 6.4.1), which is consistent with other studies (see, for example, Markland & Medley, 1998). The reasons behind wishing to lose weight are complex: Cheskin and Friedman Donze (2001) note that health concerns, rather than appearance, motivate individuals to lose weight, but that these priorities are reversed for women. The majority of the sample in Study 4 was female, particularly the returning exercisers. Fitness targets may, therefore, incorporate weight-loss aims. For example, with the facility on many cardiovascular machines to count calories burned, and websites and apps such as MyFitnessPal (www.MyFitnessPal.com) enabling easy measurement of calorie intake and expenditure, calorie goals for exercise sessions may be preferred by some exercisers to time goals.

7.5.2 Percentage of target achievement

As discussed above, participants in Study 4 setting lower goals achieved a smaller percentage of those goals than those setting higher goals. Nevertheless, only six participants reported exercise levels that not only fell short of their own plans, but also failed to meet official recommendations. Three of the six completed the study, regularly submitting surveys. Based on this group, possible definitions of non-adherence, relating to possible health implications, would be less than 50% of intended exercise, or struggling to complete two sessions per week, or completing less than half the recommended minimum. This figure is somewhat different from Conraads et al.'s three levels, (<20% adherence, 20-80% adherence, and 80+% adherence: 2012) and Edmunds et al.'s five levels (completing 4 weeks adhering fully, completing 4 weeks with <100% adherence, or withdrawing at the 3, 2 or 1 week stage, 2007) described in Section 1.4. In both these studies, the second level definition was too broad for a longer term evaluation of adherence. Additionally, both studies used professionally-prescribed exercise sessions, yet Study 4 of this thesis demonstrated that self-made plans related to much higher activity levels; even 75% adherence to a self-made plan provides considerable health benefits. If adherence is to be conceptualised in an ecologically-valid way, then it needs to reflect these findings.

7.5.3 Defining lapses

In Study 3, adherence was measured by exercise frequency, but data also showed different patterns in the frequencies. It was suggested in Chapter 1 that not exercising for over a week might constitute a lapse, as this would be the earliest point at which fitness would begin to be adversely affected. Over two thirds of the participants in Study 3 had at least one period of eight days or more where no exercise was recorded, although it is possible they were exercising outside the gym and not logging it on Fitlinxx.

It was not feasible to identify similar detail of lapses in Study 4, largely because a number of people withdrew from the study without indicating whether they were continuing to exercise.

Lapse surveys – where a participant completed a survey but recorded no activity for that week – became the best indicator, but there were comparatively few completed. They did not necessarily precede withdrawal from the study: of the fifteen lapse surveys returned, only two directly preceded withdrawal. However, there may have been periods between surveys, or when a survey was not completed, where lapses may have occurred and not been identified.

It is challenging to record lapses during a study, and the retrospective data collection in Study 3 had clear advantages. Study participation may decrease lapse rate, although participants informally raised concerns in Study 4 when they lapsed because they felt they might be 'spoiling' the results. Some who withdrew may have felt this to be the case but did not communicate their concerns. However, although retrospective data helped identify lapses, it was not possible to ascertain the reasons. Some Study 4 participants who completed lapse surveys indicated underlying reasons: these most frequently related to high work or study loads, or where exercise was curtailed due to the illness of either the participant or relatives.

7.5.4 Revisiting the definition of adherence

The term 'adherence' is used to describe regularity of a behaviour that is adequate to achieve certain outcomes. It is important that regular exercise is sufficient to lead to a higher level of fitness than if the individual remained sedentary. Official guidelines indicate the required levels in terms of minutes, with a minimum of ten minutes in a session (NHS, 2011). Online guidelines (NHS, 2013) do not indicate a minimum number of sessions per week. Of the 99 participants in Study 4, however, only four described intentions to exercise fewer than three times per week.

As noted in Section 7.5.2, exercise levels below recommendations corresponded with lower goals and lower proportion of goals achieved. Failing to meet target duration was linked to failing to complete target number of sessions, rather than carrying out short sessions, suggesting that the challenge for exercisers relates to starting, rather than completing, a workout. This was apparent from the ‘exercuses’ in Study 2 as well as the analyses in Study 4. Sessions per week appears to be a more useful target than minutes per week, and comments posted to the NHS exercise recommendations webpage (NHS, 2013) suggest some readers found the advice confusing.

If exercising three times per week generally meets recommendations, the implications are that fewer exercise sessions will not do so, giving three potential levels of non-adherence: two, one and zero sessions per week. For example, the survey data from the first week of Study 4 indicated that of those who completed the study, two carried out one session, two carried out two sessions, while the remaining 46 participants carried out three or more sessions over the week. While this does not allow the subtleties of analysing percentages of exercisers’ target workouts, it does offer a parsimonious measurement. It may also be advisable to extend the period of ‘lapse’ to beyond a week, since lapses measured in Study 3 tended to be substantially longer, and eight days was a conservative measure. This might also help limit the impact on analysis of illness, holiday and short-term injury, where usual exercise activities are not possible despite wishing to carry them out.

7.5.5 Adherence, music and the health behaviour models

The findings in the studies in this thesis indicate that music may be helpful in achieving adherence when used both during a workout and before exercise. In Study 3, men who listened to their own music during gym exercise were found to exercise more frequently. In Study 4, those listening to music before exercise were more frequent exercisers than the control group and were more likely to achieve their exercise frequency goals (men and women, although the majority of the sample was female).

Study 4 may suggest a stronger connection between pre-exercise music and adherence than between music during exercise and adherence, since the Study 3 findings only applied to men. However, the study designs were very different. Study 3 used a frequency figure based on largely automated retrospective data, while Study 4 relied completely on self-report. Study 3 data was not, therefore, affected by participation, but offered less detail. Study 4 data may have been affected by participation, and may have been exaggerated by a social desirability effect, with participants wanting to provide ‘good’ results (Creswell, 2009; see also Bond et al.’s study of exercise, 2010). Those who were less successful may have been more inclined to withdraw due to concerns they were adversely affecting the study. Since interventions are intended to assist adherence, a participant’s belief that they are ‘bad’ may disproportionately affect control groups and hence their reporting and attrition. However, any over-reporting of exercise is likely to have applied in all conditions, therefore the study design should have mitigated for these effects. Over-reporting was not, therefore a confounding factor, but there may have been a lack of data from those struggling to adhere; this would mean adherers were disproportionately represented, were more likely to be in intervention groups, resulting in smaller variances, with statistical analysis therefore less likely to find effects. These factors further support the effectiveness of both the music and non-music interventions in Study 4.

The two main aspects of the research in this thesis to consider in relation to health behaviour models are (1) the role of music during exercise in leading to repeat behaviour and (2) the potential of pre-exercise music to help bridge the intention-behaviour gap. While the pre-exercise music intervention aimed to do so by increasing motivation by inducing an exercising ‘mood,’ results were marginal for Goal Achievement, and significant only for Sessions; the former measure incorporates intention and behaviour, the latter only behaviour.

Music’s effect during exercise is less clear. In Study 2, participants indicated wide use of music to help achieve longer durations of activity, possibly contributing to the sense of mastery described by Bandura (1977) and hence self-efficacy. The HAPA (Schwarzer, 2008) specifically refers to maintenance self-efficacy as relating to optimistic thoughts; positive past experiences of enjoying music while exercising may promote optimism prior to exercising. It is likely that a combination of mechanisms contribute towards music’s effect in exercise, and the many preferences and strategies described by participants in Study 2 indicated wide variety across the sample. There was evidence of possible relationships between several individual differences and exercise- and music-related variables, as summarised below.

Some relationships were evident between exercise adherence and personality, although these were not consistent across the studies. This has also been the case with previous research. Study 4 found a negative relationship for Extraversion and adherence, while Rhodes et al. (2002; 2003) found Extraversion had a positive effect on converting intention into behaviour, and Rhodes and Courneya (2003) found that Extraversion positively influenced exercise behaviour. Study 3 found relationships for Conscientiousness and Stability, while Rhodes et al.'s studies have been inconsistent regarding findings for Conscientiousness and adherence, and have not found a relationship for Stability. The inconsistencies are not only between the current studies and Rhodes and colleagues' work, but also within Rhodes and colleagues' work; their studies, although short, were well-powered. This indicates the influence of other factors on outcomes, including activity, exercise environment, and populations, all of which varied across the studies.

Findings in Study 3 suggested that Reiss's motives (2004) could be a useful measurement of individual differences, particularly regarding self-efficacy, as in the case of Acceptance (of the status quo). Acceptance was related to low exercise frequency, suggesting a relationship with self-belief in achieving change. Motives are also useful because they are directly related to behaviour, although similar behaviour may be the result of different motives in different individuals. The grounding of motives in previous research, where they have been applied in varied situations, indicates they may be useful in understanding individual differences in exercise behaviour. However, comparisons with other findings for motives was not possible because there has been so little application of the measure in sport or exercise; Reiss et al.'s study of athleticism (2001) looked at quite different measures (see Section 1.5.3) with considerable limitations.

The measure used in Study 3 for motives had 96 questions, and several participants commented informally that they had found the survey overly long. This may have affected response rate, or led to some questions being left blank. Because of the practical challenges of the measure, the risk of non-completion, and the low alpha scores for some motives, it was not used in the other studies. Additionally, correlation analysis in Study 3 showed no significant relationships between motives and members listening to either the gym's or their own music. Overall, motives may offer some useful measurements for individual differences in exercise, particularly Acceptance. However, further refinement is needed regarding the constructs it considers, given the low alpha scores, and a brief version would be a more practical tool.

The Strengths measure (Seligman, 2011) was not found to be useful, partly because the two-question design was difficult to validate, and partly because, had it been valid, there was only one strength – Playfulness and Humour – for which a relationship with exercise frequency was found. Additionally, its length may have been a factor in incomplete surveys, and it was therefore not used further. In Section 1.5.3, I noted its limitations, and lack of comparable studies looking at possible relationships between strengths and health behaviours. An attempt to reduce the measure to a more manageable construct, identifying five virtues through factor analysis (Furnham & Ahmedoglu, 2014) was published as the final study in this thesis was completed: the virtues were Transcendence, Fortitude, Temperance, Interpersonal and Cognitive (see Section 1.5.3), but the study did not go beyond identifying these, nor was a virtues measurement tool suggested or tested. At present, therefore, refined measures of strengths need further work before they can be reliably applied, and previously available measures have limitations in terms of practicality and validity.

Health behaviour models were useful in providing frameworks to consider steps from intention to behaviour. They are, however, generalised for a range of health behaviours, and their main role here was to identify areas where music might be usefully incorporated. Music psychology frameworks were perhaps more useful because they recognise the complexity and individuality of music response, helping identify relevant psychological mechanisms which might be applied to increase exercise motivation. The health behaviour models present the challenge of the intention-behaviour gap, while the reciprocal feedback model and BRECVEMA indicate how it might be bridged using music, with the data in the studies supporting this.

7.6 Evaluation of approach and methods

The studies in this thesis used a range of methods, the bases for which were set out in Chapter 2. In this section, I consider successes and limitations of the studies relating to the online research approach, sampling, self-report and general study design. I also discuss the attrition of participants from Study 4, comparing this with other studies.

7.6.1 Online research

Much of the research relied on online data collection. The exception was Study 3, where participants had the option of completing hard copy questionnaires, although the majority accessed the online survey. The advantage of online surveys is that participants can complete them at their convenience, at their preferred pace, and can contemplate answers for longer than might feel comfortable in a face-to-face interview (James & Busher, 2009). It is also straightforward for participants to edit responses while they complete a survey. There are disadvantages in that clarification of questions and answers needs an interviewer present. Participants may also tailor their responses to try to please a researcher, or respond in way they feel is socially acceptable, rather than giving honest answers; this is not restricted to online research, and is considered further in Section 7.6.3 on self-report.

Technology offers low cost, detailed data collection, collating data in electronic formats that are easily transferred to software such as SPSS for analysis. The challenge is on how best to use technology to maximise the effectiveness of the research design while remaining accessible for participants. During recruitment for Study 4, I approached members of an over-50s exercise group, who declined to take part because of lack of familiarity with the internet. Several seemed uncomfortable at the idea of using it. This particular demographic group, therefore, may be excluded from such studies, narrowing the breadth of the sample. This is not ideal for research that aims to recruit participants across a wide age range.

A similar issue arises regarding the use of mobile phone technology: this was an option for Study 4, and participants reported in their feedback that texts would have been helpful. Emails were used because of easy manageability and the ability to send detailed messages (not possible to non-Smartphones), and these were accessible by Smartphone for those with devices. Alternative methods could have utilised Smartphone technology. The Experience Sampling Method, for example, is ideal for Smartphone owners who can immediately access an internet survey from the device on which they receive a text. In 2013, the year in which most of the Study 4 data was collected, only 51% of UK adults had a Smartphone, while 77% of 16-24 year olds owned a Smartphone, compared with just 11% of 65-74 year olds (Ofcom, 2013). In 2014, this had risen to 61% of UK adults, 88% of 16-24 year olds and 14% of 65-74 year olds respectively (Ofcom, 2014). Although this is a substantial increase, there is still challenges delivering an ESM study: younger participants are more likely to be able to access an online survey close to the event they are required to record, therefore the detail given is more likely to be accurate. Nevertheless, an ESM study, with texts sent at the end of randomly selected days, asking participants to report on the day’s exercise, would have less chance of influencing behaviour during the study than the request made to participants in Study 4 to record their activity for a specific week each month, given in advance. The pre-exercise request for information, however, means exercise can be noted at the time it is carried out, rather than participants having to remember detail of a workout they had not anticipated being asked to record.

In addition to text alerts and participants accessing online surveys from phones, apps increasingly offer the potential to record activity and present it in a manageable format. While accelerometers have been widely used in research, analysing and interpreting data collected by accelerometers is a complex process, and device costs are high. Developments in mobile phone technology and fitness tracking devices aimed at the general public present convenient, low-cost alternatives.

Online technology allowed participants from a wide geographical base to take part, and for straightforward procedural management using standardised emails including links. Furthermore, being able to access the study and complete consent forms without face-to-face meetings made recruitment easier, and many participants were reached through social media. The regular administration required, however, needed internet access at regular points during the week for the duration of the study, in order to keep data collection requests as consistent as possible, and ensure that those signing up to take part were allocated to a condition and began participating in a timely manner. A schedule was used to keep the study moving on a rolling basis, with participants grouped by start date, and emails were personalised with reference codes and different links according to which one of six surveys participants needed to complete. Participants also contacted me regularly with problems such as being ill and unable to take part, or being unable to access surveys, for example due to server problems or temporarily limited internet access. Although the study was delivered efficiently, the process was at times somewhat complex, and the design ideally required more automation and/or more researchers. Nevertheless, the delivery of such a study without online technology would be very much more difficult.

7.6.2 Sampling

The sampling methods varied for each study. For Study 3, the design was somewhat unusual because of the incorporation of a gym’s computerised workout system to access retrospective exercise data. As the system is not widely used, and data collection relied on my personal knowledge and experience of using it as an instructor at the facility, the population from which the sample could be drawn was limited to the membership of one specific gym. The facility has around 1000 members, although as with many such facilities, the number of regular users is substantially smaller. There is a dearth of information on the frequency of gym use among members, although a study of over 7000 New England gym members found average attendance was fewer than four times per month (DellaVigna & Malmendier, 2006). The top 5% of attendees in the New England study averaged 11.78 visits per month, equating to 2.72 visits per week, fewer than the average 3.16 visits per week among Study 3 participants. Since participants were recruited by posters and flyers in the gym, and by direct approach in the gym, it was inevitable that participants would represent the more frequently exercising members. Nevertheless, several participants had very infrequent usage patterns, while others exercised very frequently, allowing analysis to take account of frequency variables. Had the behaviours been more homogeneous, effects would have been difficult to detect, therefore recruitment of infrequent exercisers, although harder than recruitment of regular attendees, was highly necessary.

For Study 1, the sample consisted of regular exercisers. A variety of sports were represented, although running was particularly well-represented: this is due in part to the popularity of running, and also the ease of publicising the study through running communities I am involved with (running clubs, an online forum, and parkrun). The snowballing recruitment method, by which the researcher publicises the research and also encourages participants to pass on information, proved effective at recruiting nearly 300 participants. Its downside is that participants are likely to be sociodemographically similar to the researcher, and the number of runners, above-average educational attainment and frequency of formal musical training may have resulted from this. Results could have been different if other sports had had greater representation, since running is a high intensity activity with widespread music use. Nevertheless, there was a broad range of demographic backgrounds and fitness levels among participants that, as with Study 3, allowed comparisons to be made between subsets of the sample. The purpose of Study 1 was to identify trends relating to exercise music in a larger population. There was sufficient variety among participants to carry out a range of comparative analyses and identify areas for future research.

For Study 2, attempts were made to recruit from both genders across a range of ages, but although around half of the participants in Study 1 gave their email address in consent to being approached for an interview, some of those selected as ideal participants (through their representation of certain practices and groups within the data) did not respond to emails. The purpose of an IPA approach is not, however, to recruit a controlled sample, but rather to be able to investigate the various ways in which a phenomenon is experienced, finding commonalities across several interviews. The sample produced highly individualised responses regarding music use in exercise; each interview revealed new and different practices. Alongside the rich descriptions from each participant, similarities between them could also be identified, achieving the study aims.

Study 4 proved the most difficult to recruit for, probably because of the level of participant commitment required due to the longitudinal design. Although the initial intention had been to recruit only those new to exercise or returning after a break (returners), the study was extended to include regular exercisers due to concerns over sample size. The strategy to recruit returners included snowballing, along with personal approaches made in gyms during January, a peak time for people to begin exercise programmes. Approaches were made to several organisations running beginner exercise sessions, but these were not fruitful, and there was little response to local press coverage achieved through a press release. The most successful approaches were through organisations I had been involved with for several years and where I was known to participants; it was beneficial to recruitment to have a range of such sources already in place, and inclusion of regular exercisers achieved a much larger sample size. As a result of trying various recruitment strategies, my understanding of the most effective approaches increased: personal connection was central, even if this was only through an online presence.

Overall, despite some challenges with recruitment, the studies attracted a wide range of participants of different ages, fitness levels and demographic backgrounds. This was greatly assisted by the use of online resources alongside face-to-face recruitment, which extended the sources of participants geographically, resulting in an international sample.

7.6.3 Self-report

Methodological issues relating to self-report methods were discussed in Section 2.5.3: although they may lead to biases through over- or underreporting, online self-report is associated with greater disclosure than in face-to-face interviews, and decrease in pressure to please a researcher (Fricker & Schonlau, 2002), so may carry advantages. Procedures were included to minimise misreporting: for example, in Study 4 participants were asked to record exercise over the forthcoming week, rather than relying on memory when the survey became due. Additionally, the Step Test used in Study 4 and the TIPI used in all studies have been previously validated, so should have provided reliable measures. All surveys included fields for additional comments: participants in Study 4, for example, had space to provide reasons for completing less exercise than intended, ensuring that they could explain their results if they felt their data needed explaining.

In Study 1, many of the questions required open-ended responses: for example, participants were asked to describe what music they listened to during exercise, and responses were then coded. This ensured consistency through the coding procedure, rather than providing a limited selection of style or genre choices for participants to select the closest suitable description, possibly disagreeing over categorisations. Music listened to during exercise, described by participants in Study 1 (Section 3.4.1), could also be compared to music listened to prior to exercise, described by participants in Study 4 (Section 6.4.8). Using the same basis for coding, the during-exercise and pre-exercise music choices could be compared. Open-ended responses also enable participants to respond in a way that reflects their priorities, and this detail was useful beyond reductive categorisation for analysis: it provided a starting point to explore musical preferences in the interviews carried out in Study 2.

Additional measures of plans may have been desirable in Study 4. There are two points to note here: firstly, over time, plans may change periodically, perhaps due to season or target events, and no attempt was made to record this. Secondly, participants were not made explicitly aware that their performance would be measured against these intentions, and it is not clear whether they had made formal plans regarding exercise activities, or whether an estimate was produced for the questionnaire and subsequently forgotten. The study may have been improved by including a short section in each monthly survey regarding intentions for the following month, which would have allowed comparison of reported exercise to recently-made plans rather than to an older plan that had been forgotten or superseded. However, rather than providing more accurate data, such measures could affect behaviour (Sniehotta, 2009) and would represent an additional intervention. This leads to a possible need for a fourth group if the impact of planning is to be acknowledged: a control group who did not update their plans.

Nevertheless, self-report in Study 4 had additional benefits, with several participants commenting that they found regular reporting helped them achieve their exercise aims. This is important to note because of the implications for results being affected by the act of participation (Orne, 1962), and underlines the importance of control conditions. However, it also indicates possible applications for returning exercisers: regular requests by gym instructors for new members to fill in similar surveys, for example, might help encourage adherence. At no point during Study 4 data collection were participants contacted regarding the content of their surveys, so it appears the effect arises through the activity of reporting and the accountability this entails, rather than subsequent support.

7.6.4 Attrition

Study 4 was the only study where attrition needed to be taken into account, because of its longitudinal design. Withdrawal rates were high, as discussed in Chapter 6, at 60% for returners and 45% for regular exercisers: rates in the health intervention literature vary widely. Hallett (2010) in a review of obesity intervention literature, found attrition rates across a range of short- to long-term studies were typically 30% to 40%, but the range for 2-year studies was from 17% to 70%. Eysenbach (2005) notes a much higher attrition rate is often found in eHealth research, where online interventions are assessed, with some studies reporting attrition as high as 99%. Study 4 might be viewed as a hybrid because of the extensive use of online instructions and surveys, even though the interventions themselves were not internet-based. The majority of participants who withdrew from the study did so early on, with most completing one or no surveys. In 35 of the 49 instances, no reason was given for withdrawal. Of those who provided a reason, there was an almost even split between injury and being too busy to take part. The only significant difference found between those who did and did not complete the study were that the latter had higher levels of extraversion.

The attrition might have occurred for a number of reasons. Firstly, although the surveys were kept as short as possible, the onus to report monthly was demanding, and the period of participation for returners in particular was long. The online aspects may have meant that participants felt less obligation to take part because of lack of face-to-face contact, and the study may have been perceived to have less credibility than one associated with a well-known organisation, such as the NHS, because of my student status. What is also not clear is whether those withdrawing without giving a reason were continuing to exercise.

Attrition is unfortunately widespread in longitudinal studies. While it clearly affects sample size and thus the powering of a study, group comparisons could be made at various levels, and analysis carried out to examine the data of those who completed the study or those who only part-completed. The results of Study 4 (Chapter 6) make it clear which participants were included in which analyses.

Of the 50 participants who completed Study 4, 22 did not complete every survey asked for, typically because of being on holiday or being ill, preventing them carrying out their usual exercise plan. Among those who completed the study, regular exercisers completed an average of 90.61% of seven surveys, and returning exercisers 88.58% of thirteen surveys, an average of 90.12% across the two groups. Among those completing the study, therefore, the vast majority of surveys requested were completed. Attrition was anticipated, and as large a sample as possible recruited to minimise its effects. It was also expected that holidays and temporary injury or illness would lead to many participants not completing every survey, and analysis took account of this. Some level of attrition in longitudinal studies appears unavoidable, but actual levels are difficult to predict, therefore strategies such as those above were applied to minimise its effects.

7.6.5 Study design

All the studies included in this thesis used designs with some novel elements, because the main research question covers an area of research with few precedents. There were some methods of data collection that have not been widely used previously; the retrospective data in Study 3 is one such example. This relied on my personal knowledge and experience of using Fitlinxx as an instructor and being aware of how gym members interacted with it, with some logging large amounts of non-gym activity while others engaged with it minimally. As technology advances, the scope for collecting data during a study with minimal intrusion increases, and it may be possible to access detailed retrospective data from individuals through web-based training logs. Researchers' own use of exercise recording systems offers the potential to both become familiar with the detail that can be accessed, and for system knowledge to inspire creative study designs that improve the reliability of data in comparison to older methods.

The mixed methods approach was ideal for the exploratory nature of the research. In addition to the varied analyses within the studies, cross-study comparisons could be made of, for example, personality and music preference. Statistical evidence and significant findings could be integrated with individual experiences taken from Study 2. Studies 3 and 4 both looked at exercise behaviour over time, rather than a brief snapshot of behaviour in a short programme put together purely for research. Throughout the studies here, the focus has been on what exercisers do in the field, and researching behaviour relating to this.

7.7 Reflexivity

Principles of reflexivity were discussed in Section 2.6, where it was argued that although reflexivity is most often associated with qualitative research, it is also relevant to quantitative approaches, with Walker et al. (2013) applying it in mixed methods research. I also suggested that Willig's personal and epistemological reflexivities (2008) provided a useful framework to examine my influence on the research, and will consider reflexivity under the relevant headings below.

7.7.1 Personal reflexivity

I came to the study as a transdisciplinarian: in addition to psychology, I have studied music theoretically at postgraduate level, and have vocational fitness qualifications and experience in teaching exercise to music classes, gym instruction and personal training. I frequently run and visit the gym in my spare time. I am not, however, a talented sportsperson, and had negative experiences of sport while growing up; this may explain my preference for activities where I compete primarily against myself, and my interest in research in exercise among the general population rather than elite sports participation. My decision to study psychology arose partly because, as a fitness instructor, I wanted to understand clients' motivation – or lack of it.

Much of the research in this thesis has needed distance from my theoretical knowledge, and my own practices, so that I am receptive to other exercisers' descriptions of practices that may be very different from my own. I am aware that I am drawing extensively on specialist knowledge when I exercise because I remember how vocational training affected my exercise planning and practices.

However, like many of my participants, I sometimes struggle with motivation and music has been important to help me deal with this. I use music during most of my exercise: the exceptions are when running with others or where it would be dangerous (for example, running along a narrow, winding country lane where I need to be aware of approaching traffic). Over the last ten years, I have used portable CD players, moving to MP3 players with the capacity to hold around 100 tracks, and three years ago to an iPod with storage for approximately 6000 tracks. I also use Spotify when Wi-Fi is available, and have created playlists since first being able to do so with an MP3 player. I use an app (Seconds Pro) for interval training which I set up to change the music for different timed sections of the workout (e.g. warmup, intense sections, recovery sections, cooldown).

My playlists include music for different speeds and durations of running, for resistance training, and for using various cardiovascular machines in the gym: these selections are mostly synchronous, with the exception of a distance running playlist. My training to teach exercise to music included identifying suitable beats per minute for different sections of a workout, and analysing tempi by tapping to a stopwatch, and this may have increased my awareness of tailoring tempi to activities (I use the BPM app to measure tempi). Interviews carried out during my MSc research (Hallett and Lamont, 2014) suggested that the extent to which I manage my exercise music is unusual compared with gym members, and Study 2 further supported this, although it may reflect my training to teach exercise to music. It was important to anticipate that other people's practices would probably be very different from my own, and that I needed to suspend expectations as much as possible in order to avoid making assumptions and instead explore what participants were describing.

My approach to the research was to pursue my curiosity. My own practices meant I was familiar with technologies and could understand the processes being described, which helped me explore them further and ask questions, but I also needed to find out what participants did and why: IPA, used in Study 2, was a particularly useful approach because I was conscious of the hermeneutics involved trying to understand the phenomenal experiences of participants, characterised by individuality. As I already had survey information from each interviewee, I was able to think about their responses and prepare tailored questions prior to the interviews.

During the three year period of research, I have had many informal conversations with friends and family about music use in exercise. Anecdotes and descriptions that were not part of the formal research have increased my awareness of the variety of practices and preferences among exercisers, and have also indicated that this is fertile ground for further research as well as being of interest to exercisers generally.

7.7.2 Epistemological reflexivity

Although I tried to suspend assumptions as much as possible during the research, my knowledge and background inevitably affected research design. To some extent, this was advantageous: without the experience of using Fitlinxx, for example, I would not have had the idea to utilise it in a study design, nor had the knowledge to access and explore the data it provided. Familiarity with the specific gym where the research took place also meant I knew the facilities, was aware of members' use of a variety of media, and the various levels of engagement with Fitlinxx, ranging from those who focused on free weights and used it very little, to those who logged every possible activity and aimed to secure a position in a monthly points table.

However, my familiarity with Fitlinxx may have led to me overlooking other potential methods. Activity reports are frequently shared on specialist sites and through social networking, and these may offer ways of carrying out studies with a much more varied sample in terms of age, geography and activity type. Studies 3 and 4 could have been further enhanced by the inclusion of phone apps, which are increasingly able to log activity with relatively little effort on the part of the user, offering considerable potential for the research community looking for practical, affordable technology to collect accurate data.

In Study 1, the outcomes were influenced by the tendency of snowballing recruitment to recruit participants with similar profiles to me, compared with the general population. The survey focused on measurements of formal music training, and it would be useful to explore music use in exercise through also including engagement with music that is not related purely to traditional instrumental lessons. My background of musical training may have led to the focus in the study; in retrospect, it would have been beneficial to ask participants if they had had training in dancing, or enjoyed dancing socially, which it has been suggested has a close relationship with exercising to music (Karageorghis et al., 2010).

Recruitment for Study 2 was influenced by my geographical location. Although I carried out two phone interviews, I found the quality made transcription difficult, and interaction with interviewees was more challenging. Six of the ten participants were known to me personally, although they were acquaintances at the time of the interviews, and I knew little about them, minimising the extent to which the interviews were shaped by my personal knowledge. Because of shared interests in running and music, I found the interviews enjoyable, but there were disadvantages in that I was familiar enough with some aspects of these subjects to hold assumptions. Charlotte talked about the Nottingham marathon, which has a section around the 20 mile point that many runners struggle with psychologically (myself included), but Charlotte enjoyed this section. It was an important reminder that the purpose of using IPA as a method was to make sense of the experiences of others, and that these may be very different from one's own even when there are commonalities.

In Study 4, again, a number of participants were known to me: I had met 26 participants previously (although most were acquaintances rather than friends), and had had online-only contact through running forums with five participants. The sample was, therefore, in part shaped by my social networks. However, my experience in the fitness industry, where classes and gyms were exceptionally busy in January, led me to overestimate the ease of recruiting returning exercisers. Having recruited a large number of people for the online survey in a short period of time, I failed to recognise how different the level of commitment demanded by Study 4 was.

My fitness background appears to have been the most influential personal factor, and while it provided inspiration for some of the design, I did not make sufficient allowances for the change in my role from instructor to researcher, and no longer being immersed in fitness environments nor viewed as an instructor; recruitment was more difficult for these studies than for my MSc research in 2011, when I was still a casual gym staff member (I used the same venue for my MSc research and Study 3), and knew many of the participants.

The research methods were inevitably influenced by my professional background and experiences, and carrying out the research was to some extent affected by my geographical location and social networks. Where possible, I tried to minimise possible effects on the research; however, samples inevitably reflected a bias towards participants with similar backgrounds to my own, and where this may have affected results (such as in levels of education and music training in Study 1) this has been acknowledged.

7.8 Future research

Although the studies reported in this thesis indicate positive relationships between music and exercise frequency, these need further exploration to understand the direction of the relationship and how music might achieve its apparent effect. A number of findings suggest various directions in which to extend the research, and these are outlined below.

7.8.1 Verification and exploration of thesis findings

There is scope for research comparing music listening before and during exercise, or a combination of the two. Indeed, adherence relating to either has had very little empirical study. The findings in the thesis suggest both pre-exercise music and music during exercise may help adherence, but these results come from relatively small studies, and future research needs to expand on these. Additionally, studies are needed to explore possible mechanisms by which music might be having these effects.

The most important study findings for those returning to exercise after a break, or beginning for the first time, relate to pre-exercise music's potential to induce positive affect and help create an 'exercising mood.' Beginner exercisers are often apprehensive about attending a class or going to the gym, and also anxious about carrying out activities such as jogging in public. There is scope to explore the feelings that pre-exercise music might help generate: participants noted feeling motivated, and arousal levels appeared increased, but more specificity is needed. Can, for example, particular choices of music help boost confidence through association? Future studies might investigate whether music that has autobiographical associations with confidence is a useful pre-exercise intervention to reduce apprehension: Juslin, Harmat & Eerola (2013) found that happiness and nostalgia could be evoked by using music with associations, although all participants were played the same pieces of music, which may have led to a smaller effect than playing music chosen for specific individual associations. Associations with confidence were not explored.

Beyond music's effects on adherence, more research is needed to investigate lapse patterns and underlying reasons. If, for example, an individual lapses for a fortnight due to temporary work demands, returning to their programme as soon as they are able to, this is quite different to someone who lacks motivation and instead stays at home to watch TV. The evidence from the studies suggested external time pressures were more likely to form barriers to exercise than internal psychological reasons. Although 'can't be bothered' was given as a reason for sometimes missing exercise sessions by participants in Study 1, it is not clear whether this was 'one-off' behaviour, or a lapse of a week or more. Future research might, therefore, use the ESM method to see if participants carried out intended exercise, alongside measures of external barriers such as workloads or internal barriers such as self-motivation. The results could indicate, for example, whether psychological interventions (such as music use, or implementation intentions) are compromised by work cultures, and whether addressing the latter might be a better use of resources.

7.8.2 Longitudinal studies of music and exercise practices

Study 1 provided a snapshot of music use among exercisers in late 2012. The role of technology became particularly evident in Study 2, where participants discussed their PLDs, music sources and the way in which they controlled their exercise music. Had this study been carried out ten years previously, the technology would have been very different, with far less use of MP3 players. As Bull notes, developments have had significant cultural impact:

> iPod culture represents a world in which we all possess mobile phones, iPods or automobiles – it is a culture which universalises the privatisation of public space, and it is a largely auditory privatisation (2007, p.4).

Use of PLDs in exercise should be recognised as part of a broader shift in music listening practices, and as technology develops further, it is likely that these practices will also evolve. A periodic survey of exercise music use, perhaps carried out every three to five years, could provide an insight into these changes and how they relate to age and life stage, not investigated here because of a focus on adherence. Hallett and Lamont's study of gym music use (2014) did, however, raise the question of whether changes in exercise music practices across the lifespan related to general life stage or the lack of PLDs during adolescence and young adulthood for older participants. As fitness maintenance post-60 is particularly important to maintain independent living, adherence among this age group is worthy of study and possible differences in music engagement that might affect adherence need to be investigated.

The scope to integrating music into exercise is constantly improving through technological advances. Frustration with hardware was a recurrent theme in Study 2, with headphone wires mentioned several times, which could be addressed with wireless headphones, for example. To maximise the application of research findings, understanding preferences and frustrations regarding music and technology use is key, and may help develop interventions and technologies to improve adherence.

Furthermore, understanding of engagement with music in exercise was studied using formal music training as a variable. The recent development of a Musical Sophistication Index at Goldsmiths University (the Gold-MSI: Müllensiefen, Gingras, Musil & Stewart, 2014) offers an inventory for gauging musical skills and expertise in the general population, including those who are highly engaged with music on a creative level but have not had formal training. The researchers have made the materials available for others to use. Future research might therefore include an online study as used in Study 1 to explore technology use in more depth, incorporating the Gold-MSI, administered periodically, with or without follow-up interviews.

7.8.3 Laboratory-based experiments

The self-report data in Study 1, and the descriptions given in Study 2, indicate synchronous exercise outside choreographed classes is a minority activity. This finding is worth testing empirically as there is little research currently in this area, yet the indications are that synchronous activity is more efficient than asynchronous activity in terms of VO_2, the standard measurement of aerobic capacity (Bacon, Myers & Karageorghis, 2012). There is scope for lab-based studies of synchronisation to test the findings from self-reported data in these studies: do people who believe they are synchronising actually doing so? Are people’s preferred tracks for certain activities used synchronously? Are people aware when they synchronise to an unfamiliar track? Experiments to test this through researcher observation and measurement, rather than self-report, would be a useful extension to see whether behaviour matches participants' self-assessments of their synchronising.

7.8.4 Field-based experiments

Field-based experiments offer a way of looking at music's effectiveness as an adherence tool in real-life settings. The pre-exercise music intervention in Study 4 performed well compared with the established implementation intentions intervention, particularly for the returners. However, the sample size and attrition rate led to a somewhat underpowered study. It would be worthwhile to run the study with a larger sample, perhaps using ESM methods.

In addition to these interventions, a study comparing PLD use to non-use during exercise would be a useful follow-up to Study 3, where there was some evidence for greater exercise frequency among men using their own music in the gym. To expand the sample, and record activity levels in different environments more accurately, accelerometers or mobile phone apps may be appropriate, although Smartphone use has low penetration among the over-65s, potentially limiting recruitment of older participants. Further intervention studies might involve music-and-exercise apps such as Seconds Pro, or initiatives to help participants select synchronous music suitable to their activities.

7.8.5 Qualitative studies

The individual tailoring of exercise music was found extensively in the studies in this thesis, but there is substantial evidence of sharing preferences online e.g. through Spotify playlists, or in specifically-convened forums, such as the Guardian's series on exercise music recommendations (se Anon, 2013, for the first of the series). Further work is needed to understand more about public recommendations in the context of the identity work evident in Study 2, where music choice was not necessarily shared. Qualitative research exploring this would be worthwhile. There is already a substantial amount of data in the public domain on review websites such as Amazon, and the Guardian newspaper recently invited readers to recommend tracks to run to in various different genres (for the first in the series, see Anon, 2013).

The variety of responses from interviewees indicate the likelihood of practices beyond those described by the participants. A grounded theory approach, where interviews continue until saturation (that is, when no new theories are suggested by further interviews: Corbin & Strauss, 1990), could be useful to explore these. Also, diary studies could offer participants scope to reflect on their music use during exercise through reflexive practice over a period extending to weeks or months, rather than an hour-long interview. This might be a useful method to collect exercise music data and gain insight into different levels of motivation and the effectiveness of music as a tool to overcome motivational issues. Diary studies could be run in conjunction with interventions to promote musical engagement, such as listening to music before exercise, or sourcing new music.

Finally, qualitative data was frequently provided by participants in Study 4, and while this has been discussed (see Section 6.4.10), a thorough analysis of it using qualitative methods (thematic analysis, for example) may be fruitful to gain further understanding of issues arising with adherence among the sample.

7.9 Implications

The studies in this thesis present a number of important findings that extend knowledge in the field of music use in exercise. These have implications for researchers, the fitness industry, and individual exercisers.

7.9.1 Music may help adherence

The most important implication relates to the main research question: it appears that music **can** help adherence in terms of overall frequency of exercise, with significant results for music within exercise and before it. In the conceptual framework proposed by Karageorghis et al. (1999: see Figure 1.1), simple mechanisms were proposed, relating only to asynchronous music. The findings here broaden out those criteria considerably, particularly in relation to autobiographical associations. The framework suggested arousal control, reduced rate of perceived exertion and improved mood all contributed to adherence through positive exercise experience. Again, the findings here expand on this suggestion by indicating that adherence is not merely related to positive in-exercise experience, but may also be enhanced by playing music beforehand. Controlling arousal, providing distraction and improving mood were all cited by participants as important applications for exercise music, but there were also suggestions of helping focus, improving confidence and the 'lure' of being able to listen to music while exercising helping to instigate a session. Furthermore, these factors were highly individualised, and there were interactions between the different aspects of situation, listener background and intrinsic musical qualities.

7.9.2 Music associated with exercise may induce an exercising mood

Amanda's description of her use of exercise music in Study 2 presented a clear conditioning effect: exercise music heightened her arousal levels, even when used in other circumstances. The indications from Study 4 were that pre-exercise music was increasing the frequency of exercise among those using it because of its effect on mood, and feeling a greater inclination to exercise.

7.9.3 Exercise music literacy levels are high, but difficulties are sometimes experienced

The participants in Study 2 who described how they chose music to exercise to were, in general, highly competent at being able to source music meeting their criteria and transfer it to a PLD, and were able to describe their criteria for selecting music and what kind of music was less successful for them. The reported challenges with synchronisation suggest that guidance is needed. There are two elements to this: firstly, identifying a suitable bpm for an activity, and secondly, identifying corresponding tracks. While there are internet sources for the latter, information on the former is lacking, with frequent associations being drawn between running cadence and speed that ignore the importance of stride length as a variable (see Section 4.5). The interviews suggested that several participants wanted to synchronise their movements to the beat, particularly for running, but were not able to identify suitable music; Katie’s attempts to synchronise her running cadence on the treadmill to music of unsuitable tempo also raises safety issues. Difficulties synchronising, and transferring desired music to a PLD, indicate some limitations to exercise music literacy.

7.9.4 The way in which music is used autonomously by exercisers is highly varied

Studies 1, 2 and 4 showed a range of music types being listened to during and before exercise, and Study 1 showed exercisers prioritise different criteria. This was highlighted further in Study 2, with participants describing often highly personal reasons for their choice of listening. There are implications here for researchers. Although laboratory studies have attempted to maximise the motivational power of the music selected for experiments while simultaneously tightly controlling conditions through tools such as the BMRI-2, the extent to which the ‘one-size-fits-all’ approach emulates real-life exercising is questionable. It is likely that two different pieces of music are needed to produce the same maximal motivational effect in two different individuals and hence match the experienced condition. Extrapolating from studies where all participants use the same piece of music requires caution. Nevertheless, the different practices in Study 2 offer a starting point to identify a range of strategies for music use in exercise and perhaps identify particular kinds of ‘user,’ building a fuller theory of individual applications of music in exercise.

7.9.5 New technological developments are widely applied by exercise music users

Participants described the ability to source music from a variety of websites, sometimes for free, to download tracks and organise them on a PLD, to use streaming, to compile playlists and to rip tracks from CDs to MP3 formats. These practices represent relatively new ways of accessing music, offering considerable flexibility for the technologically-adept. Most participants were able to access music in a variety of ways, with some taking a more exploratory stance than others; most also described some level of frustration with hardware. The important finding here was that the potential for music in exercise depended not only finding suitable tracks, but on access to technology and the ability to apply it.

It is not clear whether PLD use in exercise has increased in recent years, nor whether the preference for using devices rather than listening to music provided by gyms is a recent development. The challenge for fitness facilities is how to provide liked background music and classes where music is motivational for participants, and to avoid music becoming an irritant by, for example, being so loud it interferes with PLD audibility, particularly in budget gyms which are 'zoned' rather than having enclosed studio space for classes. As music usage habits change over time, fitness providers need to focus beyond the kind of music they play and also consider situational aspects that make broadcast music more or less desirable.

7.9.6 Exercising typically exceeds minimum recommendations

Even when participants in Study 4 did not achieve the number of workouts they had originally planned, the duration of their exercise was, on average, substantially more than the minimum level recommended. There were very few exceptions, and target duration was exceeded through three workouts per week. This led to my suggestion that a four-level adherence measure of 3+, 2, 1 or 0 workouts per week would be a simple measure of exercise adherence that could be standardised across studies in a variety of contexts, with or without formalised plans incorporated.

This also extends health behaviour models. The TRA and TPB focus on initial behaviour rather than maintenance, while the stage models (the TTM and HAPA, for example) recognise action and maintenance (and lack of maintenance), but are not clear as to what constitutes a lapse. One or two workouts might be conceptualised as a stage between maintenance and lapse.

7.9.7 Novelty effects may affect data, particularly in shorter studies

In the first and final weeks of participating in Study 4, participants showed increased levels of exercise. Averaging exercise across the duration of the study helped to mitigate for these effects. However, shorter studies may be particularly prone to them because the 'novelty effect' of participation is present throughout. Longitudinal studies may also need to take into account a change in performance towards the end of the study, and it may be desirable to exclude behaviour data from the beginning and end of a study and instead focus on that collected over the mid-period.

These findings extend knowledge, particularly regarding the application of music to exercise adherence, and the highly individualised nature of exercise music usage. There are particular implications for researchers designing studies to look at the effects of exercise music, and for individuals who enjoy music and might be applying it to their exercise in ways beyond their current practices.

7.10 Summary

The thesis has contributed to the understanding of music use in exercise and its relationship with adherence. Findings indicate a possible relationship between music and frequency of exercise, when music is used either before or during exercise. This has many possible applications both for experienced exercisers and those who have recently embarked on an exercise programme and may be struggling to maintain it.

The concept of adherence itself has been explored in the context of exercise, and suggestions made for a more standardised approach to measuring exercise adherence, supported by study findings. This has the potential to make different interventions across studies much easier to compare, and to identify when individuals are finding it difficult to take part in regular exercise.

The research has gone beyond establishing possible connections through quantitative approaches: the qualitative strand of the mixed methods approach has provided considerable insight into the very varied and personal ways in which exercisers use music, how they engage with the rapidly evolving technology that can help them utilise extensive music libraries, and the reasons they select particular soundtracks to accompany their physical activity. These findings create a greater awareness of different strategies that exercisers can use with their listening, and may also help improve the ecological validity of future research by recognising the many different approaches possible with music use in exercise.

Combined, these studies indicate the potential for music to help exercisers adhere to exercise plans, with positive inferences for health outcomes, but also helping make exercise an enjoyable experience. There are implications for future researchers and how they use music in experimental work; for the fitness industry in strengthening the appeal of their facilities; for fitness professionals advising exercisers on how to achieve their goals; and for exercisers themselves, who may not have considered possible applications of music that could help them meet their targets. All these groups need to be engaged with, and there are many opportunities for all to apply the findings to help improve take-up and enjoyment of regular exercise.

Overall, this thesis presents a clear argument in favour of music's role in facilitating exercise adherence, opens up the field for further research, and marks a move to a new level of understanding of the power and potential of using music in exercise.

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Appendices

Appendix A: Study 1 Survey

[Preceded by survey information and consent]

Age (over 18s only) ___
Sex M ☐ F ☐

Where do you currently live? If you live in more than one place, please indicate where you consider yourself resident.

Country _______________ Area _________________________
Occupation: ____

Your general and musical education

What education have you have received? (tick all that apply)
☐ Secondary (11-16)
☐ College/sixth form
☐ University undergraduate/HND
☐ University postgraduate (eg Masters, PhD)
☐ Vocational

Have you had individual tuition on a musical instrument?
☐ No
☐ Yes, for under 2 years
☐ Yes, for 2-5 years
☐ Yes, for 6-10 years
☐ Yes, for over 10 years

If you had instrumental tuition, did you take grades/exams on your instrument?
☐ Yes
☐ No
☐ I didn’t have tuition

If you took grades/exams, please enter the highest level you achieved in the space below.

____

Have you studied music as a subject at school or college beyond age 16?
☐ Yes

☐ No

Have you studied music at University?
☐ Yes
☐ No

Your exercise habits

How long have you been exercising regularly (without breaks of more than a few weeks)?

Years __________
Months (if less than 1 year) _______________

What's the fastest approximate time you can complete 5km (3.1 miles) running/walking?
- If using a race time, please round to the nearest minute
- If you don't know, please leave the answer blank

Minutes ________________

Preferred exercise activities (tick as many as you like)
☐ Cycling
☐ Exercise-to-music classes
☐ Gym: cardio (treadmills, bikes etc)
☐ Gym: weights
☐ Pilates
☐ Running
☐ Skating/rollerblading
☐ Skiing
☐ Swimming
☐ Team sports
☐ Walking
☐ Yoga
☐ Other (please state) ____

Are you a member of a sports club or team? ☐ Y ☐ N
Are you a member of a gym? ☐ Y ☐ N
Have you competed/played sport at an elite level?
☐ No
☐ No, but I have competed (eg running events, triathlons, matches with other teams)
☐ Yes, county level
☐ Yes, national level
☐ Yes, international level

Do you have exercise buddies/team mates with whom you often play sport/exercise?
☐Y ☐N

Do your friends and family support you exercising regularly?

☐Y ☐Sometimes ☐N

About your sport and exercise activities

[1] Do you have a plan to exercise on certain days?

Yes [skip logic: go to 1b] No

[1b] Do you manage to stick to this plan?

Yes [skip to 4] Sometimes No

[2] If you miss a sport/exercise session you've been intending to go to, what are the most likely reasons? (list up to 3)

a ______________________________

b ______________________________

c ______________________________

[3] For each of the reasons listed above, can you describe the point does the decision not to exercise occur? (eg when I drive past the gym on the way home, when I start watching TV, when my train is late).

1 ______________________________

2 ______________________________

3 ______________________________

[4]

Personality

Here are a number of personality traits that may or may not apply to you.

Please tick a box beneath each statement to indicate the extent to which <u>you agree or disagree with that statement</u>.

You should rate the extent to which the pair of traits applies to you, even if one characteristic applies more strongly than the other.

I see myself as:

	Disagree strongly	Disagree moderately	Disagree a little	Neither agree nor disagree	Agree a little	Agree moderately	Agree strongly
Extraverted, enthusiastic.	☐	☐	☐	☐	☐	☐	☐
Critical, quarrelsome	☐	☐	☐	☐	☐	☐	☐
Dependable, self-disciplined	☐	☐	☐	☐	☐	☐	☐
Anxious, easily upset	☐	☐	☐	☐	☐	☐	☐
Open to new experiences, complex.	☐	☐	☐	☐	☐	☐	☐
Reserved, quiet	☐	☐	☐	☐	☐	☐	☐
Sympathetic, warm	☐	☐	☐	☐	☐	☐	☐
Disorganized, careless.	☐	☐	☐	☐	☐	☐	☐
Calm, emotionally stable.	☐	☐	☐	☐	☐	☐	☐
Conventional, uncreative	☐	☐	☐	☐	☐	☐	☐

Music during sport and exercise

For your most frequent sport/exercise activity where you or someone else plays music, please answer the following questions

What's the activity? ___________________________

Do you choose the music for this activity? ☐ Y [skip to Qs from list A] ☐ N [Skip to Qs from list B]

[List A]

What sort of music do you choose most often for this activity? (genre/style/description) ________________
____
____

Can you give some examples of your favourite tracks for this activity? ______________________________
____
____

Do you choose tracks where you can synchronise your activity (eg you are moving precisely in time to the music) ?

☐ Usually
☐ Sometimes
☐ I don't choose them, but sometimes I find they are in time with what I'm doing
☐ No, I don't synchronise

What's the most important factor when selecting music for this activity? (choose one)

☐ The speed/tempo (beats per minute)
☐ The style
☐ The rhythm
☐ The melody
☐ The harmony
☐ Memories/associations
☐ It's the right kind of music for someone with my social/cultural background
Other (field to state what)

What other factors are important when selecting music for this activity? (choose as many as you like)

☐ The speed/tempo (beats per minute)
☐ The style
☐ The rhythm
☐ The melody
☐ The harmony
☐ Memories/associations
☐ It's the right kind of music for someone with my social/cultural background
Other (field to state what)

[List B]

Who chooses the music? ____

What sort of music is it (genre/style/description) __________________________

Can you name any of the tracks? ______________________________

Do you find it's appropriate for the activity? ☐ Y ☐ N

Why do think this is? ____

[End of lists A and B]

Please select

☐ I take part in other activities where I play music or music is played [repeat the above fields on a new page]

☐ That's all my sport/exercise using music covered [skip to choosing music for exercise]

Do you listen to music before a workout or training session?

☐ Always

☐ Sometimes

☐ Occasionally

☐ No

☐ NA

Do you listen to music before a competition?

☐ Always

☐ Sometimes

☐ Occasionally

☐ No

☐ NA

Have you ever obtained music specifically designed to train to the beat i.e. so that you are moving in time with the beat of the music? (e.g. Podrunner, Audiofuel, music recorded for exercise classes with 32-beat phrasing)

☐ Y ☐ N

Do you sometimes decide not to use music during your activity?

☐ Y [skip logic to b] ☐ N

(b) Why? [open field]

Have you used music during a competition eg at a Parkrun?

☐ Y [skip logic to b] ☐ N ☐ Not applicable

(b) Did you feel you performed better with music? ☐ Y ☐ N

Did you feel you enjoyed the event more with music ☐ Y ☐ N

How long have you been using music regularly during your exercise?

____________yrs __________[months]

Has the way you've used music changed in that time?

☐ Y [skip logic to b]　　☐ N

(b) Can you describe how your use of music has changed?

The survey is almost complete.

If there is anything else you feel is important, please use the field below to tell us.

____ [big field]

Would you be prepared to be contacted about participating in a follow-up study? If so, please give your email address in the box below. This doesn’t commit you to taking part in any further research.

Yes, I’m happy for a researcher to contact me about taking part in a further study.
[email address] ____

Thank you for taking part.

Appendix B: Study 2 generic interview schedule

These basic questions were used as a starting point to construct each participant's schedule for carrying out semi-structured interviews.

Exercise generally

- what you do
- sticking to plans
- what happens without music if you normally use it
- how music fits in, level of priority

Talk about music in exercise

- how it feels to exercise with it
- era, style, bpm, associations, different sports
- selection process
- playlist – what's on it? Why? What effect does each track have on you?

Dissociation or focus?

Shared references in classes?

Where other people choose it

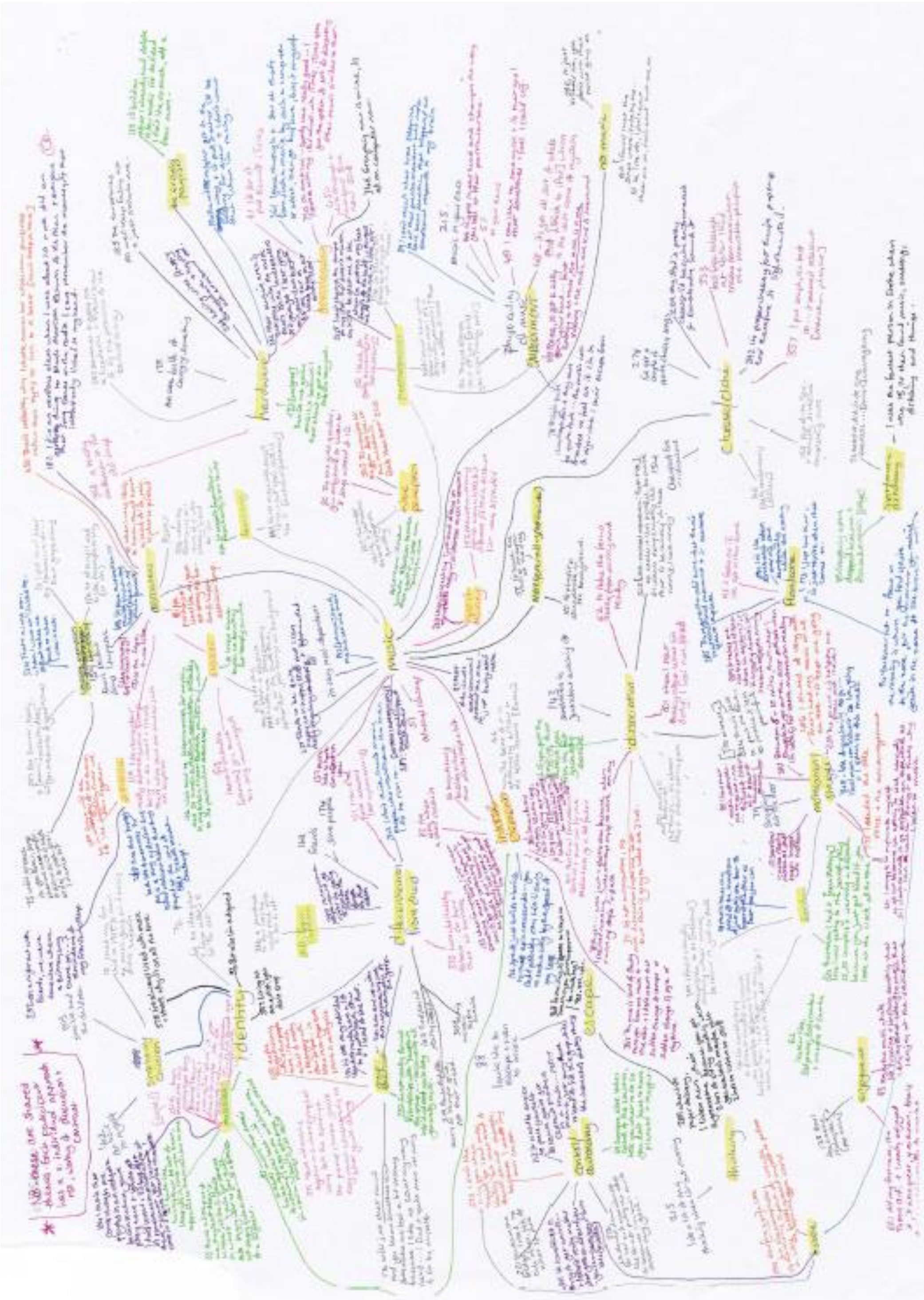
Where it's worked particularly well

Where it hasn't worked particularly well

Music outside exercise – is it different?

Appendix C: IPA process

(i) Themes mindmap



Key: Sophie Charlotte Belinda Ruth Sarah Amanda Steven Katie Andrew Martin

(ii) Example of collated quotes

Quote	Name	Theme	Subtheme	Notes
513C if I did 514 just do the playlist and just play it each time, so the same each time then I think that I'd, I don't 515 think that would work as well for me. Um especially if you know there are hills and things and you 516 think this song means my hill and stuff	C	Association	Associated with some aspect of exercise	Consciously avoiding doing this
38B I still can't hear the 39 Communards, I start grapevining	B	Association	Associated with some aspect of exercise	
117C the Take That example is a classic example because we went to see them whenever it 118 was, July, not the July that's just gone but the one before um and that was, that song in particular I 119 do remember really distinctly some things being in the crowd at that concert and I think that's why 120 that one makes such an impact really	C	Association	Episodic	

(iii) Grouping and linking possible themes

Theme	**Subtheme**	**Participants**
Association	Episodic	Charlotte, Sarah, Steven
Association	People	Belinda, Sarah, Katie, Martin
Associations	Associated with some aspect of exercise	Sophie, Belinda, Amanda, Katie
Associations	Cliché	Sophie, Charlotte
Associations	Phase of life	Belinda, Sophie, Steven
Associations	Olympics (tie in with cliche ??)	Steven
Autonomy		Steven
Bubble		Sarah, Katie
Cheese		Sophie, Charlotte, Belinda, Katie
Dissociation	General	Sophie, Sarah
Dissociation	Boredom	Charlotte, Belinda, Amanda, Steven
Dissociation	Distraction (too much)	Sophie, Andrew
Dissociation	Distraction from PA (unclear which aspect)	Amanda
Dissociation	Distraction from effort	Charlotte, [Ruth]
Dissociation	Distraction from tiredness	Charlotte
Dissociation	Distraction from duration	Sarah, Amanda
Dissociation	From everything	Sophie
Dissociation	Meditation	Ruth
Dissociation	Pain/discomfort	Belinda, Sarah, Steven
Dissociation	Wanting to stop because you don't need to do it	Ruth
Embodiment	Music in ears	Sophie, Charlotte, Amanda
Embodiment	Music is part of you	Belinda, Andrew
Embodiment	Music player is part of you	Charlotte
Embodiment	Physical effect of music	Charlotte, Belinda, Steven, Andrew
Embodiment	Synchronising	Charlotte, Belinda, Sarah, Katie
Embodiment	Emotion	Steven, Andrew
Environment	Gym=negative	Belinda, Katie (also Ruth but don't seem to have included)
General music use	It's for doing stuff to	Belinda
General music use	Location	Belinda, Ruth, Amanda
Hardware	Hassles	Sophie, Belinda, Ruth, Amanda, Steven, Katie, Andrew
Hardware	Sourcing music	Charlotte, Steven, Andrew
Hardware	Tangibility	Martin
Identity	Contrast with previous life	Sophie, Belinda, Martin
Identity	Differentiation	Sophie, Charlotte, Belinda, Ruth, Steven , Katie, Andrew, Martin
Identity	Generation/age	Belinda
Identity	Musician	Charlotte, Amanda, Katie, Martin (arts/music lover)
Motivation	Targets	Ruth, Andrew
Music choice	Always always	Charlotte
Music choice	Bad music	Charlotte, Belinda, Ruth, Katie
Music choice	Energy	Charlotte
Music choice	Familiarity	Belinda, Amanda, Katie
Music choice	Personal meaning	Sarah
Music choice	From youth	Charlotte
Music choice	Intrinsic details	Charlotte, Steven, Katie, Andrew, Martin
Music choice	Mood-based	Sophie, Katie
Music choice	Not always always	Belinda, Sarah, Steven
Music choice	Playlist v album	Sophie, Charlotte
Music choice	Shutting out extraneous music (gym especially)	Belinda

Theme	**Subtheme**	**Participants**
Music choice ✱	Time perception	Charlotte, Belinda, Ruth, Sarah, Amanda
Music choice ✱	Training type	Charlotte, Belinda, Sarah
Music choice 🔴	Historical context	Martin
Music-exercise dichotomy ✱		Ruth, Amanda, Martin
Psychological strategies 🟢	Visualisation	Belinda, Ruth
Psychological strategies 🟢	Singing to self if music not available	Sarah
Purpose of music 🟢	To get me out there	Andrew
Purpose of music	habit	Sarah
Purpose of music ✱	To keep going on long(er) runs	Sarah, Steven, Andrew
Purpose of music 🟢	Comfort/companion	Sarah
Purpose of music 🟢	Stimulation level	Sarah, Martin
Purpose of music 🟢	Psyching yourself up/psychological effect	Steven, Andrew
Purpose of music 🟢	Structure to classes	Katie
Purpose of music	To make it fun/enjoyable	Katie, Andrew
Purpose of running 🟢	Escape	Sophie
Purpose of running 🟢	Thinking time	Sophie
Purpose of running 🔵	Social	Sarah
Purpose of running 🔴	Time to myself	Sophie
Purpose of running	Enjoyment	Andrew
Purpose of running 🟢	You just feel that you need to	Andrew
Purpose of running ♬	Time to listen to music	Martin
Ritual 🟢		Ruth
Running/exercising with others 🟢		Ruth, Sarah, Amanda, Katie
Self-deprecation		Sophie, Belinda
Struggling ✱	Get to the end of the song	Charlotte
Struggling to get started 🟢		Sophie, Andrew
Struggling 🟢	With motivation	Andrew
Technology	Playlists	Sophie, Charlotte
Technology 🟢	Training log	Sophie
Technology	Types of player	Charlotte
Time limitations		Sophie
What I don't do 🔵		Sophie, Ruth, Amanda
Zone 🟢		Charlotte, Steven, Andrew
Surrendering control or getting it 🟢		Amanda, Katie
Classes 🔵	Group or individual feel?	Amanda, Katie
Enjoyment v competency		Andrew (perhaps Sophie too?)
Legitimisation of music		Andrew
Narratives		Martin (but Sarah and Katie and Steven have some of this too, which I didn't include)

Key (annotated by hand in the original)

🔴 Phase of life
✱ Time perception
🟢 Control/autonomy/personal ritual
✱ Embodiment
🔵 Identity
♬ Music 'nuts and bolts'

(iv) Refining

Meta	Theme	Subtheme	Participants	
Phase of life identity etc	Association	Episodic	Charlotte Sarah Steven	It's all about me - Differentiation from others - Where I am in my life - My connections with others - What it means to me
	Association	People	Belinda Sarah Katie Martin	
	Associations	Phase of life	Belinda Sophie Steven	
	Identity	Contrast with previous life	Sophie Belinda Martin	
	Identity	Generation/age	Belinda	
	Music choice	From youth	Charlotte	
	Music choice	Historical context	Martin	
	Music choice	Personal meaning	Sarah	
	Classes	Group or individual feel?	Amanda Katie	
	Identity	Differentiation	Sophie Charlotte Belinda Ruth Steven Katie Andrew Martin	
	Identity	Musician	Charlotte Amanda Katie Martin (arts/music lover)	
	What I don't do		Sophie Ruth Amanda	
Control autonomy personal ritual	Dissociation	Boredom	Charlotte Belinda Amanda Steven	Getting control - Dealing with challenges (external) - Dealing with challenges (internal) - Managing exercise perceptions
	Dissociation	Distraction from duration	Sarah Amanda	
	Music choice	Time perception	Charlotte Belinda Ruth Sarah Amanda	
	Purpose of music	To keep going on long(er) runs	Sarah Steven Andrew	
	Struggling	Get to the end of the song	Charlotte	
	Autonomy		Steven	
	Dissociation	Meditation	Ruth	
	Environment	Gym=negative	Belinda Katie (Ruth)	
	Motivation	Targets	Ruth Andrew	
	Music choice	Always always	Charlotte	
	Music choice	Not always always	Belinda Sarah Steven	
	Music choice	Shutting out extraneous music (gym especially)	Belinda	
	Psychological strategies	Singing to self if music not available	Sarah	
	Psychological strategies	Visualisation	Belinda Ruth	
	Purpose of music	Comfort/companion	Sarah	
	Purpose of music	Psyching yourself up/psychological effect	Steven Andrew	
	Purpose of music	Stimulation level	Sarah Martin	
	Purpose of music	Structure to classes	Katie	
	Purpose of music	To get me out there	Andrew	
	Purpose of running	Escape	Sophie	
	Ritual		Ruth	
	Running/exercising with others		Ruth Sarah Amanda Katie	
	Struggling	With motivation	Andrew	

Meta	Theme	Subtheme	Participants	
	Struggling to get started		Sophie Andrew	
	Surrendering control or getting it		Amanda Katie	
	Technology	Training log	Sophie	
	Zone		Charlotte Steven Andrew	
embodiment	Associations	Associated with some aspect of exercise	Sophie Belinda Amanda Katie	Embodiment - How music affects the body - Internalisation - Body-music interaction - Hardware hassles – when there's an antagonism between the physical and the musical/mental
	Bubble		Sarah Katie	
	Dissociation	Distraction from effort	Charlotte [Ruth]	
	Dissociation	Distraction from PA (unclear which aspect)	Amanda	
	Dissociation	Distraction from tiredness	Charlotte	
	Dissociation	Pain/discomfort	Belinda Sarah Steven	
	Embodiment	Emotion	Steven Andrew	
	Embodiment	Music in ears	Sophie Charlotte Amanda	
	Embodiment	Music is part of you	Belinda Andrew	
	Embodiment	Music player is part of you	Charlotte	
	Embodiment	Physical effect of music	Charlotte Belinda Steven Andrew	
	Embodiment	Synchronising	Charlotte Belinda Sarah Katie	
	Hardware	Hassles	Sophie Belinda Ruth Amanda Steven Katie Andrew	
	Music choice	Bad music	Charlotte Belinda Ruth Katie	
	Music choice	Energy	Charlotte	
	Music choice	Mood-based	Sophie Katie	
	Music choice	Training type	Charlotte Belinda Sarah	
	Music-exercise dichotomy		Ruth Amanda Martin	
Music nuts and bolts	Associations	Olympics (tie in with cliche ??)	Steven	The nuts and bolts of music - The intrinsic details of the music - Hardware sourcing - Talking about music in a way that is relatively disconnected from exercise or embodiment
	Associations	Cliché	Sophie Charlotte	
	Cheese		Sophie Charlotte Belinda Katie	
	General music use	Location	Belinda Ruth Amanda	
	Hardware	Sourcing music	Charlotte Steven Andrew	
	Hardware	Tangibility	Martin	
	Technology	Types of player	Charlotte	
	Music choice	Familiarity	Belinda Amanda Katie	
	Music choice	Intrinsic details	Charlotte Steven Katie Andrew Martin	
	Technology	Playlists	Sophie Charlotte	
	Music choice	Playlist v album	Sophie Charlotte	

(v) Grouping

Meta	Theme	Subtheme	Participants	
Phase of life identity etc	Association	Episodic	All	It's all about me - Differentiation from others - Where I am in my life - My connections with others - What it means to me
	Association	People		
	Associations	Phase of life		
	Identity	Contrast with previous life		
	Identity	Generation/age		
	Music choice	From youth		
	Music choice	Historical context		
	Music choice	Personal meaning		
	Classes	Group or individual feel?		
	Identity	Differentiation		
	Identity	Musician		
	What I don't do			
Control autonomy personal ritual	Dissociation	Boredom	All	Getting control - Dealing with challenges (external) - Dealing with challenges (internal) - Managing exercise perceptions
	Dissociation	Distraction from duration		
	Music choice	Time perception		
	Purpose of music	To keep going on long(er) runs		
	Struggling	Get to the end of the song		
	Autonomy			
	Dissociation	Meditation		
	Environment	Gym=negative		
	Motivation	Targets		
	Music choice	Always always		
	Music choice	Not always always		
	Music choice	Shutting out extraneous music (gym especially)		
	Psychological strategies	Singing to self if music not available		
	Psychological strategies	Visualisation		
	Purpose of music	Comfort/companion		
	Purpose of music	Psyching yourself up/psychological effect		
	Purpose of music	Stimulation level		
	Purpose of music	Structure to classes		
	Purpose of music	To get me out there		
	Purpose of running	Escape		
	Ritual			
	Running/exercising with others			
	Struggling	With motivation		
	Struggling to get started			
	Surrendering control or getting it			
	Technology	Training log		
	Zone			
embodiment	Associations	Associated with some aspect of exercise	All	Embodiment - How music affects the body - Internalisation - Body-music interaction - Hardware hassles – when there's an antagonism between the physical and the musical/mental
	Bubble			
	Dissociation	Distraction from effort		
	Dissociation	Distraction from PA (unclear which aspect)		
	Dissociation	Distraction from tiredness		
	Dissociation	Pain/discomfort		
	Embodiment	Emotion		
	Embodiment	Music in ears		

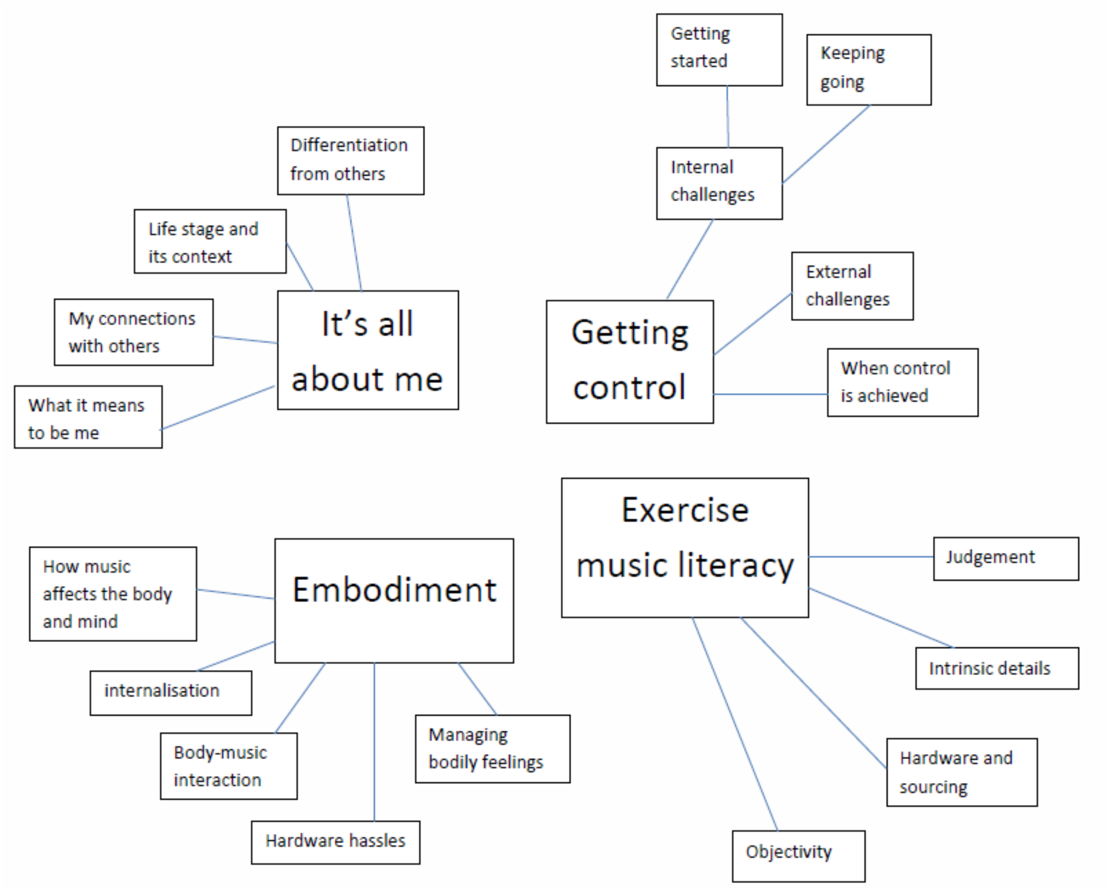
Meta	Theme	Subtheme	Participants	
	Embodiment	Music is part of you		
	Embodiment	Music player is part of you		
	Embodiment	Physical effect of music		
	Embodiment	Synchronising		
	Hardware	Hassles		
	Music choice	Bad music		
	Music choice	Energy		
	Music choice	Mood-based		
	Music choice	Training type		
	Music-exercise dichotomy			
Music nuts and bolts	Associations	Olympics (tie in with cliche ??)	All except Sarah	The nuts and bolts of music - The intrinsic details of the music - Hardware sourcing - Talking about music in a way that is relatively disconnected from exercise or embodiment
	Associations	Cliché		
	Cheese			
	General music use	Location		
	Hardware	Sourcing music		
	Hardware	Tangibility		
	Technology	Types of player		
	Music choice	Familiarity		
	Music choice	Intrinsic details		
	Technology	Playlists		
	Music choice	Playlist v album		

(vi) Further refining

Theme name	Summary	Subthemes	Includes (themes identified in earlier analysis stages)
It’s all about me	Phase of life, identity etc	Differentiation from others	Identity: differentiation What I don’t do
		Where I am in my life *life stage & its context	*Assocations: Phase of life *Identity: Contrast with previous life *Identity: Generation/age *Music choice: from youth *Music choice: historical context
		My connections with others	Associations: people Classes: group or individual feel?
		What it means to be me	Association: episodic Music choice: personal meaning Identity: musician
Getting control	Control autonomy personal ritual	Dealing with internal challenges * starting -duration issues #strategies	*Purpose of music: psyching yourself up *Purpose of music: to get me out there *Struggling: with motivation *Struggling: to get started -Dissociation: boredom -Dissociation: distraction from duration -Music choice: time perception -Purpose of music: to keep going on longer runs -Struggling: get to the end of the song #Psychological strategies: visualisation #Purpose of music: comfort/companion #Purpose of music: stimulation level
		Dealing with external challenges	Environment: Gym=negative Music choice: shutting out unwanted music (esp. at gym) Psychological strategies: no music, so creating your own Purpose of music: structure to classes Purpose of running: escape Running/exercising with others
		When control is achieved	Autonomy Dissociation: meditation Motivation: targets Music choice: always always (or not always) Ritual Surrendering or achieving control Technology: training log Zone (in it – control achieved)
Embodiment	How the mind and body interact with the music	How music affects the body	Associations: music associated with exercise Embodiment: physical effect of music Embodiment: emotion Music choice: bad music Music choice: energy
		Internalisation	Embodiment: music in ears Embodiment: music is part of you Embodiment: music player is part of you
		Body-music interaction	Music choice: mood based Music-exercise dichotomy Embodiment: synchronising
		Hardware hassles	Hardware: hassles Bubble (when hassles are overcome and hardware facilitates the bubble)

		Managing exercise perceptions – generally *physical discomfort	*Dissociation: distraction from effort *Dissociation: distraction from tiredness *Dissociation: pain/discomfort Dissociation: distraction from PA (not clear which aspect)
The nuts and bolts of music	An objective, functional approach to music	Judgement	Associations: Olympics Associations: cliché Cheese
		Intrinsic details	Music choice: intrinsic details Music choice: playlist v album
		Hardware, sourcing	Hardware: sourcing music Hardware: tangibility Technology: types of player Technology: playlists
		Talking about music in a more disconnected way (no embodiment/exercise)	General music use: location Music choice: familiarity

(vii) Final mindmap



Appendix D: Study 3 Questionnaire

About You

1. Sex M ▢ F ▢

2. Age

I am aged 18 or over ▢ (please tick box: participants must be aged 18 or over)

3. 5 digit Fitlinxx Login Code* ▢▢▢▢▢

* Please note: the researcher cannot collect data for you without the correct code, and your questionnaire responses cannot be used in the research if this is the case. Providing the code constitutes permission for the researcher to access your Fitlinxx data to collect information on how often you use the gym. Data will be collected from the period 1/3/11 to 29/2/12.

4. (a) How long approximately have you been a member of this facility?

years

(b) Were you exercising regularly before joining? Yes ▢ No ▢

(c) If yes, for how long? years

5. (a) Do you do exercise outside your gym sessions, such as attending classes, walking, running, cycling, team sports etc.? Yes ▢ No ▢

(b) If yes, do you log this exercise on Fitlinxx?

Always ▢ Sometimes ▢ Occasionally ▢ Never ▢

(c) How many exercise sessions per week do you take part in outside the gym?

Less than 1 ▢ 1-2 ▢ 3-4 ▢ 5 or more ▢

6. Do you use media while you're exercising in the gym?

	Frequently	Sometimes	Rarely	Never
I listen to the music that's played in the gym	☐	☐	☐	☐
I bring in my own music to listen to	☐	☐	☐	☐
I watch TV with subtitles, not listening	☐	☐	☐	☐
I watch TV listening through headphones	☐	☐	☐	☐
I read magazines/books	☐	☐	☐	☐

7. Outside the gym, how often do you listen to music on a portable player (MP3, iPod, Walkman etc)?

Frequently ☐ Sometimes ☐ Rarely ☐ Never ☐

8. Is there anything you think the researcher should take into account when looking at your gym attendance e.g. injuries/illness that stopped you exercising for more than a fortnight?

9. If you could come to the gym as often as you liked, with no other activities or commitments to prevent you attending, how many times a week would you use the facility?

The questionnaire follows and should take around 15-20 minutes to complete. Please tick the first response you think of, and don't spend time thinking about your answer. Your first instinct is most likely the best response. Some of these questions are quite personal: if you would prefer not to answer any of them, please leave the boxes for that question blank.

Personality

Here are a number of personality traits that may or may not apply to you. Please tick a box beneath each statement to indicate the extent to which you agree or disagree with that statement. You should rate the extent to which the pair of traits applies to you, even if one characteristic applies more strongly than the other.

I see myself as:

	Disagree strongly	Disagree moderately	Disagree a little	Neither agree nor disagree	Agree a little	Agree moderately	Agree strongly
Extraverted, enthusiastic.	☐	☐	☐	☐	☐	☐	☐
Critical, quarrelsome	☐	☐	☐	☐	☐	☐	☐
Dependable, self-disciplined	☐	☐	☐	☐	☐	☐	☐
Anxious, easily upset	☐	☐	☐	☐	☐	☐	☐
Open to new experiences, complex.	☐	☐	☐	☐	☐	☐	☐
Reserved, quiet	☐	☐	☐	☐	☐	☐	☐
Sympathetic, warm	☐	☐	☐	☐	☐	☐	☐
Disorganized, careless.	☐	☐	☐	☐	☐	☐	☐
Calm, emotionally stable.	☐	☐	☐	☐	☐	☐	☐
Conventional, uncreative	☐	☐	☐	☐	☐	☐	☐

Motives

Please answer the following blocks of questions using the same scale as the previous section.

	Disagree strongly	Disagree moderately	Disagree a little	Neither agree nor disagree	Agree a little	Agree moderately	Agree strongly
I’m not as secure as most people	☐	☐	☐	☐	☐	☐	☐
I find it difficult to handle criticism	☐	☐	☐	☐	☐	☐	☐
People tell me I'm inconsistent	☐	☐	☐	☐	☐	☐	☐
I perform consistently across different activities	☐	☐	☐	☐	☐	☐	☐
I have a "can do" attitude	☐	☐	☐	☐	☐	☐	☐
I am self-confident	☐	☐	☐	☐	☐	☐	☐

	Disagree strongly	Disagree moderately	Disagree a little	Neither agree nor disagree	Agree a little	Agree moderately	Agree strongly
I think about and analyse things more than other people do	☐	☐	☐	☐	☐	☐	☐
My ideas are very important to me	☐	☐	☐	☐	☐	☐	☐
I would describe myself as a thinker	☐	☐	☐	☐	☐	☐	☐
I'm a practical person	☐	☐	☐	☐	☐	☐	☐
I don't usually think about theories that I can't use	☐	☐	☐	☐	☐	☐	☐
Study bores me	☐	☐	☐	☐	☐	☐	☐

	Disagree strongly	Disagree moderately	Disagree a little	Neither agree nor disagree	Agree a little	Agree moderately	Agree strongly
I really enjoy eating	☐	☐	☐	☐	☐	☐	☐
I have a tendency to be overweight	☐	☐	☐	☐	☐	☐	☐
I know a lot about gourmet foods	☐	☐	☐	☐	☐	☐	☐
I’m a fussy eater	☐	☐	☐	☐	☐	☐	☐
I have a tendency to be underweight	☐	☐	☐	☐	☐	☐	☐
I don’t generally look forward to meals	☐	☐	☐	☐	☐	☐	☐

	Disagree strongly	Disagree moderately	Disagree a little	Neither agree nor disagree	Agree a little	Agree moderately	Agree strongly
My children are everything to me	☐	☐	☐	☐	☐	☐	☐
I like to be around children	☐	☐	☐	☐	☐	☐	☐
I spend a lot of time with my family	☐	☐	☐	☐	☐	☐	☐
I find children boring	☐	☐	☐	☐	☐	☐	☐
I don’t/didn’t particularly want to have children	☐	☐	☐	☐	☐	☐	☐
I am often too busy to spend time with my family	☐	☐	☐	☐	☐	☐	☐

	Disagree strongly	Disagree moderately	Disagree a little	Neither agree nor disagree	Agree a little	Agree moderately	Agree strongly
I make it a point to do my duty	☐	☐	☐	☐	☐	☐	☐
I am very loyal to those around me	☐	☐	☐	☐	☐	☐	☐
My word is my bond	☐	☐	☐	☐	☐	☐	☐
I would lie in order to keep my job	☐	☐	☐	☐	☐	☐	☐
I often cancel arrangements because something crops up	☐	☐	☐	☐	☐	☐	☐
I like to grab every opportunity I can	☐	☐	☐	☐	☐	☐	☐

	Disagree strongly	Disagree moderately	Disagree a little	Neither agree nor disagree	Agree a little	Agree moderately	Agree strongly
I'm compassionate towards the poor and the sick	☐	☐	☐	☐	☐	☐	☐
I admire those who work with the needy	☐	☐	☐	☐	☐	☐	☐
I give generously to charities	☐	☐	☐	☐	☐	☐	☐
I don't think it's my responsibility to help the downtrodden	☐	☐	☐	☐	☐	☐	☐
I try to avoid getting involved with other people's troubles	☐	☐	☐	☐	☐	☐	☐
I don't often get outraged by social injustice	☐	☐	☐	☐	☐	☐	☐

	Disagree strongly	Disagree moderately	Disagree a little	Neither agree nor disagree	Agree a little	Agree moderately	Agree strongly
I like to be self-reliant	☐	☐	☐	☐	☐	☐	☐
I'm a stubborn person	☐	☐	☐	☐	☐	☐	☐
I prefer to do things my way	☐	☐	☐	☐	☐	☐	☐
I value 'touchy-feely' experiences	☐	☐	☐	☐	☐	☐	☐
I am more of a conformist than most people I know	☐	☐	☐	☐	☐	☐	☐
I'm comfortable relying on my family or spouse for support	☐	☐	☐	☐	☐	☐	☐

	Disagree strongly	Disagree moderately	Disagree a little	Neither agree nor disagree	Agree a little	Agree moderately	Agree strongly
I'm well-organised	☐	☐	☐	☐	☐	☐	☐
I have very high standards of cleanliness	☐	☐	☐	☐	☐	☐	☐
I'm not keen on change	☐	☐	☐	☐	☐	☐	☐
People often say I'm disorganised	☐	☐	☐	☐	☐	☐	☐
I like to do things on the spur of the moment	☐	☐	☐	☐	☐	☐	☐
I tend to have several balls in the air at once	☐	☐	☐	☐	☐	☐	☐

	Disagree strongly	Disagree moderately	Disagree a little	Neither agree nor disagree	Agree a little	Agree moderately	Agree strongly
Exercising is important to my happiness	☐	☐	☐	☐	☐	☐	☐
When I was young, I was picked for an athletic team more than once	☐	☐	☐	☐	☐	☐	☐
Being fit is very important to me	☐	☐	☐	☐	☐	☐	☐
I have a reputation for avoiding physical activities	☐	☐	☐	☐	☐	☐	☐
I try to keep away from vigorous exercise	☐	☐	☐	☐	☐	☐	☐
I am unfit	☐	☐	☐	☐	☐	☐	☐

Disagree	Disagree	Disagree	Neither agree	Agree	Agree	Agree

	strongly	moderately	a little	nor disagree	a little	moderately	strongly
I have a reputation as a self-starter	☐	☐	☐	☐	☐	☐	☐
I like to be in charge of other people	☐	☐	☐	☐	☐	☐	☐
I often give others unasked-for advice	☐	☐	☐	☐	☐	☐	☐
I avoid challenges	☐	☐	☐	☐	☐	☐	☐
I don’t like telling other people what to do	☐	☐	☐	☐	☐	☐	☐
I have a reputation for being laid back	☐	☐	☐	☐	☐	☐	☐

	Disagree strongly	Disagree moderately	Disagree a little	Neither agree nor disagree	Agree a little	Agree moderately	Agree strongly
I usually dress attractively	☐	☐	☐	☐	☐	☐	☐
Sex is important to my happiness	☐	☐	☐	☐	☐	☐	☐
I'm impressed by people who can attract lots of romantic partners	☐	☐	☐	☐	☐	☐	☐
Lots of things are more important to me than sex	☐	☐	☐	☐	☐	☐	☐
I don't feel confident in the bedroom	☐	☐	☐	☐	☐	☐	☐
I rarely think about romance or sex during an average day	☐	☐	☐	☐	☐	☐	☐

	Disagree strongly	Disagree moderately	Disagree a little	Neither agree nor disagree	Agree a little	Agree moderately	Agree strongly
I mend old rather than buy new replacements	☐	☐	☐	☐	☐	☐	☐
I hate throwing things away	☐	☐	☐	☐	☐	☐	☐
I have a reputation for being frugal	☐	☐	☐	☐	☐	☐	☐
I don't take as much care as I should of things I own	☐	☐	☐	☐	☐	☐	☐
I often exceed my monthly budget	☐	☐	☐	☐	☐	☐	☐
People often tell me I'm being wasteful	☐	☐	☐	☐	☐	☐	☐

	Disagree strongly	Disagree moderately	Disagree a little	Neither agree nor disagree	Agree a little	Agree moderately	Agree strongly
I am good at social networking	☐	☐	☐	☐	☐	☐	☐
I have a reputation for being friendly	☐	☐	☐	☐	☐	☐	☐
I have a more active social life than most people I know	☐	☐	☐	☐	☐	☐	☐
I'm not very approachable	☐	☐	☐	☐	☐	☐	☐
I spend more time alone than most people I know	☐	☐	☐	☐	☐	☐	☐
I find it difficult to make small talk	☐	☐	☐	☐	☐	☐	☐

	Disagree strongly	Disagree moderately	Disagree a little	Neither agree nor disagree	Agree a little	Agree moderately	Agree strongly
People find me quite formal	☐	☐	☐	☐	☐	☐	☐
I usually buy the best brand I can afford	☐	☐	☐	☐	☐	☐	☐
I'm impressed by wealth	☐	☐	☐	☐	☐	☐	☐
Celebrities don't impress me	☐	☐	☐	☐	☐	☐	☐
I'm informal	☐	☐	☐	☐	☐	☐	☐
I don't worry about what others think of me	☐	☐	☐	☐	☐	☐	☐

	Disagree strongly	Disagree moderately	Disagree a little	Neither agree nor disagree	Agree a little	Agree moderately	Agree strongly
I am a worrier	☐	☐	☐	☐	☐	☐	☐
I have panic attacks	☐	☐	☐	☐	☐	☐	☐
I can't tolerate pain	☐	☐	☐	☐	☐	☐	☐
I have a reputation for being cool under pressure	☐	☐	☐	☐	☐	☐	☐
I am a dare-devil	☐	☐	☐	☐	☐	☐	☐
I have a reputation for being brave in the face of danger	☐	☐	☐	☐	☐	☐	☐

	Disagree strongly	Disagree moderately	Disagree a little	Neither agree nor disagree	Agree a little	Agree moderately	Agree strongly
I often get into arguments	☐	☐	☐	☐	☐	☐	☐
I have a reputation for being a fighter	☐	☐	☐	☐	☐	☐	☐
Winning is very important to me	☐	☐	☐	☐	☐	☐	☐
I often act as a peacekeeper	☐	☐	☐	☐	☐	☐	☐
I avoid confrontation if I can	☐	☐	☐	☐	☐	☐	☐
Violence turns me off	☐	☐	☐	☐	☐	☐	☐

Strengths

For each comment, please indicate which response most applies to you by ticking a box.

	Very much unlike me	Unlike me	Neither like me nor unlike me	Like me	Very much like me
I am always curious about the world	☐	☐	☐	☐	☐
I am easily bored	☐	☐	☐	☐	☐
I am thrilled when I learn something new	☐	☐	☐	☐	☐
I never go out of my way to visit museums, historical sites or libraries	☐	☐	☐	☐	☐
When the topic calls for it, I can be a highly rational thinker	☐	☐	☐	☐	☐
I tend to make snap judgments	☐	☐	☐	☐	☐
I like to think of new ways to do things	☐	☐	☐	☐	☐
Most of my friends are more imaginative than I am	☐	☐	☐	☐	☐
No matter what the social situation, I am able to fit in	☐	☐	☐	☐	☐
I am not very good at sensing what other people are feeling	☐	☐	☐	☐	☐
I am always able to look at things and see the big picture	☐	☐	☐	☐	☐
Others rarely come to me for advice	☐	☐	☐	☐	☐
I have taken frequent stands in the face of strong opposition	☐	☐	☐	☐	☐
Pain and disappointment often get the better of me	☐	☐	☐	☐	☐
I always finish what I start	☐	☐	☐	☐	☐
I get sidetracked when I work	☐	☐	☐	☐	☐
I always keep my promises	☐	☐	☐	☐	☐
My friends never tell me I’m down to earth	☐	☐	☐	☐	☐
I have voluntarily helped a neighbour in the last month	☐	☐	☐	☐	☐
I am rarely as excited about the good fortune of others as I am about my own	☐	☐	☐	☐	☐
There are people in my life who care as much about my feelings and well-being as they do about their own	☐	☐	☐	☐	☐
I have trouble accepting love from others	☐	☐	☐	☐	☐
I work at my best when I am part of a group	☐	☐	☐	☐	☐
I hesitate to sacrifice my self-interest for the benefit of groups I am in	☐	☐	☐	☐	☐
I treat all people equally, regardless of who they might be	☐	☐	☐	☐	☐
If I do not like someone, it is difficult for me to treat him or her fairly	☐	☐	☐	☐	☐
I always get people to do things together without nagging	☐	☐	☐	☐	☐
I am not very good at planning group activities	☐	☐	☐	☐	☐
I control my emotions	☐	☐	☐	☐	☐

	Very much unlike me	Unlike me	Neither like me nor unlike me	Like me	Very much like me
I can rarely stay on a diet	☐	☐	☐	☐	☐
I avoid activities that are physically dangerous	☐	☐	☐	☐	☐
I sometimes make poor choices in friendships and relationships	☐	☐	☐	☐	☐
I change the subject when people pay me compliments	☐	☐	☐	☐	☐
I often brag about my accomplishments	☐	☐	☐	☐	☐
In the last month, I have been thrilled by excellence in music, art, drama, film, sport, science or mathematics	☐	☐	☐	☐	☐
I have not created anything of beauty in the last year	☐	☐	☐	☐	☐
I always say thank you, even for little things	☐	☐	☐	☐	☐
I rarely stop and count my blessings	☐	☐	☐	☐	☐
I always look on the bright side	☐	☐	☐	☐	☐
I rarely have a well-thought-out plan for what I want to do	☐	☐	☐	☐	☐
My life has a strong purpose	☐	☐	☐	☐	☐
I do not have a calling in life	☐	☐	☐	☐	☐
I always let bygones be bygones	☐	☐	☐	☐	☐
I always try to get even	☐	☐	☐	☐	☐
I always mix work and play as much as possible	☐	☐	☐	☐	☐
I rarely say funny things	☐	☐	☐	☐	☐
I throw myself in to everything I do	☐	☐	☐	☐	☐
I mope a lot	☐	☐	☐	☐	☐

Thank you very much for taking part in this research

If you have any questions or would like to know more about the research, please contact Rachel Hallett

at r.j.hallett@ilcs.keele.ac.uk or on 01782 734402.

Appendix E: Rewordings of Reiss Questionnaire

All questions were changed from second person to first person. Many were reworded either to simplify and/or to use language more typical of UK English. A few questions were considered insensitive and were 'toned down'. For acceptance, curiosity, eating, honour, independance and social contact, self-focus was increased by rewording from 'I have a reputation for being…' to 'I am…' This arguably constitutes greater departure from the original and may have given a different meaning – however, the highest alpha score was for acceptance, with social contact also scoring highly, indicating consistency within the measure. Curiosity and independence were particularly low with eating and honour below desirable levels, but to less extent. Vengeance and saving, where having a reputation was reworded as "People say" for simplification, had alpha scores of .670 and .553, somewhat below the threshold of acceptability (.7). This may need looking at more closely: describing oneself is quite different to assessing what others think of one, and feeling understood or misunderstood by others may add another facet to a motives profile.

Study version	Motive	Original version	Reason for change
I'm not as secure as most people	Acceptance	You are noticeably more insecure than most people are	Simplification
I find it difficult to handle criticism	Acceptance	You have more difficulty than most people handling criticism	Simplification
People tell me I'm inconsistent	Acceptance	You have a reputation for being inconsistent in your performance	Simplification
I perform consistently across different activities	Acceptance	You have a reputation for consistency in your performance	Simplification/self focus
I think about and analyse things more than other people do	Curiosity	You have a reputation for being analytical or thoughtful	Simplification/self focus
I would describe myself as a thinker	Curiosity	You have a reputation as a thinker	Simplification/self focus
I'm a practical person	Curiosity	You have a reputation for being a practical person	Simplification/self focus
I don't usually think about theories that I can't use	Curiosity	You rarely think about theories you cannot put to use	Simplification
Study bores me	Curiosity	School bored you	Adapted to relate to present
I really enjoy eating	Eating	You derive a lot of pleasure from eating	Simplification
I'm a fussy eater	Eating	You have a reputation for being a fussy eater	Simplification/self-focus
I don't generally look forward to meals	Eating	You rarely look forward to meals	Made more idiomatic
I find children boring	Family	Children bore you	Made more idiomatic
I don't/didn't particularly want	Family	When you were a young adult,	Made more present

to have children		you did not want children	
I am very loyal to those around me	Honour	You have a reputation for loyalty	Self-focus
I would lie in order to keep my job	Honour	You will tell lies if it means keeping your job	Simplification
I often cancel arrangements because something crops up	Honour	You might break prior commitments when circumstances change	Simplification
I like to grab every opportunity I can	Honour	You have a reputation for being opportunistic	Simplification/self-focus/made more idiomatic
I'm compassionate towards the poor and the sick	Idealism	You have compassion for poor and sick people	Simplification/made more idiomatic
I admire those who work with the needy	Idealism	You admire people whose work benefits humanity or the needy	Simplification/made more idiomatic
I don't think it's my responsibility to help the downtrodden	Idealism	You believe it is not your responsibitliy to help the downtrodden	Simplification
I try to avoid getting involved with other people's troubles	Idealism	You “look the other way” rather than get involved in other people’s troubles	Made less critical (‘Look the other way’ is somewhat loaded).
I don't often get outraged by social injustice	Idealism	Social injustice rarely outrages you	Simplification/made more idiomatic
I like to be self-reliant	Independence	It is very important to you to be self-reliant	Simplification
I'm a stubborn person	Independence	You have a reputation for being stubborn	Simplification/self-focus
I prefer to do things my way	Independence	You have a reputation for doing things your way	Simplification/self-focus
I'm well-organised	Order	You have a reputation for being well organised	Simplification/self focus
I have very high standards of cleanliness	Order	You have a reputation for cleanliness	Self-focus (cleanliness is an expected standard in society, thus reputation for being so may be unusual)
I'm not keen on change	Order	You have difficulty adapting to change	Simplification
People often say I'm disorganised	Order	You have a reputation for being disorganised	Simplification
Exercising is important to my happiness	Physical activity	Working out is important to your happiness	Made more idiomatic
When I was young, I was picked for an athletic team more than once	Physical activity	Twice you made an athletic team (high school plus college combined)	Simplified/made less American
I have a reputation for avoiding physical activities	Physical activity	You have a reputation for being lazy physically	Made less accusatory
I try to keep away from vigorous exercise	Physical activity	You tend to avoid physically rigorous activities	Simplified
I like to be in charge of other	Power	You seek leadership roles	Made more idiomatic

people			
I often give others unasked-for advice	Power	You have a tendency to give others unsolicited advice	simplified
I don't like telling other people what to do	Power	You dislike telling others what they should do	Simplified
I usually dress attractively	Romance	You dress attractively almost every day	Simplified
Sex is important to my happiness	Romance	Sex is essential to your happiness	Toned down
I'm impressed by people who can attract lots of romantic partners	Romance	People who attract many sex partners impress you	Toned down
Lots of things are more important to me than sex	Romance	You rarely have sex (significantly less than once a week)	Alternative question as original considered too intrusive
I don't feel confident in the bedroom	Romance	You lack confidence in your sexual skills	Simplified/made more idiomatic
I don't take as much care as I should of things I own	Saving	You do not take care of the things you own	Made less accusatory
I often exceed my monthly budget	Saving	You often bust your monthly budget	Made more idiomatic
People often tell me I'm being wasteful	Saving	You have a reputation for being wasteful	Simplified
I'm not very approachable	Social contact	You have a reputation for being unapproachable	Simplified/ self-focus
I spend more time alone than most people I know	Social contact	You spend a lot of time alone (more than most people you know)	Simplified
I find it difficult to make small talk	Social contact	You have difficulty making "small talk"	Simplified
People find me quite formal	Status	You have a reputation for being a formal person	Simplified/ self-focus
I usually buy the best brand I can afford	Status	You usually buy the most prestigious items you can afford	Simplified/ self-focus
I'm impressed by wealth	Status	You are impressed with wealthy people	Simplified
Celebrities don't impress me	Status	You are unimpressed with celebrities	Simplified
I'm informal	Status	You are an informal person	Simplified
I don't worry about what others think of me	Status	You pay little attention to what other people think of you	Simplified
I can't tolerate pain	Tranquility	You have little tolerance for pain	Simplified
I often get into arguments	Vengeance	You get into many quarrels, arguments or fights	Simplified
I have a reputation for being a fighter	Vengeance	You have a reputation for being a competitor or a fighter	'Competitor' removed because of sporting context of survey, where competitive sport may not involve vengeance

I often act as a peacekeeper	Vengeance	You have a reputation for being a peacekeeper	Simplified/ self-focus
I avoid confrontation if I can	Vengeance	You go out of your way to avoid confrontation	Simplified/ self focus
Violence turns me off	Vengeance	You are turned off by violence	Simplified, made active

Appendix F: Motives scores in Study 3 calculated using Reiss's tick system

Table F.1: Motive score frequencies for the full sample (*n* = 60)

	High	Low	-3	-2	-1	0	1	2	3
Acceptance	1	18	7	11	7	34	-	1	-
Curiosity	6	3	-	3	2	35	14	5	1
Eating	7	-	-	-	2	34	17	6	1
Family	20	-	-	-	4	26	10	12	8
Honour	16	-	-	-	3	24	17	7	9
Idealism	13	-	-	-	1	33	13	13	-
Independence	14	1	-	1	2	29	14	11	3
Order	12	2	1	1	5	29	12	12	-
Physical Activity	29	-	-	-	-	20	11	11	18
Power	2	-	-	-	2	48	8	2	-
Romance	1	3	-	3	6	40	10	-	1
Saving	2	1	-	1	6	46	5	1	1
Social	18	1	-	1	4	36	1	11	7
Status	-	5	-	5	14	35	6	-	-
Tranquillity	1	7	2	5	6	36	10	1	-
Vengeance	4	13	3	10	14	22	7	3	1

Table F.2: Motive score frequencies for women (*n* = 30)

	High	Low	-3	-2	-1	0	1	2	3
Acceptance	1	7	3	4	3	19		1	
Curiosity	3	1	-	1	1	18	7	2	1
Eating	4	-	-	-	2	14	10	3	1
Family	10	-	-	-	4	10	6	6	4
Honour	7	-	-	-	2	11	10	3	4
Idealism	9	-	-	-	-	13	8	9	-
Independence	9	-	-	-	2	12	7	7	2
Order	5	2	1	1	4	11	8	5	-
Physical Activity	13	-	-	-	-	10	7	5	8
Power	2	-	-	-	2	24	2	2	-
Romance	-	3	-	3	5	20	2	-	-
Saving	1	1	-	1	3	23	2	1	-
Social	9	-	-	-	3	17	1	6	3
Status	-	-	-	-	7	20	3	-	-
Tranquillity	1	4	-	4	1	15	9	1	-
Vengeance	1	9	3	6	6	11	3	1	-

Table F.3: Motive score frequencies for men (*n* = 30)

	High	Low	-3	-2	-1	0	1	2	3
Acceptance	-	11	4	7	4	15	-	-	-
Curiosity	3	2	-	2	1	17	7	3	-
Eating	3	-	-	-	-	20	7	3	-
Family	10	-	-	-	-	16	4	6	4
Honour	9	-	-	-	1	13	7	4	5
Idealism	4	-	-	-	1	20	5	4	-
Independence	5	1	-	1	-	17	7	4	1
Order	7	-	-	-	1	18	4	7	-
Physical Activity	16	-	-	-	-	10	4	6	10
Power	-	-	-	-	-	24	6	-	-
Romance	1	-	-	-	1	20	8	-	1
Saving	1	-	-	-	3	23	3	1	-
Social	4	1	-	1	1	19	5	4	-
Status	-	5	-	5	7	15	3	-	-
Tranquillity	-	3	2	1	5	21	1	-	-
Vengeance	3	4	-	4	8	11	4	2	1

Appendix G: Study 4 sign-up survey

1	I confirm that I have read and understand the information sheet for the above study and have had the opportunity to ask questions.	❑
2	I understand that my participation is voluntary and that I am free to withdraw at any time.	❑
3	I agree to take part in this study.	❑
4	I understand that data collected about me during this study will be anonymised before it is submitted for publication.	❑
5	I agree that my responses during the study can be quoted	Yes ❑ No ❑

[SmartSurvey was set so that the participant could not complete the survey without giving consent]

Name ____

DOB ____

Sex ▢M ▢F

Email address ____________________@____________________

What activities [Returners] are you planning to do? [Regular exercisers] will you be doing?

Please note: It is important that you consider your personal safety and security with regard to your activities. Please do not subject yourself to unnecessary risk while taking part in this research. Please do not exercise if you are ill or injured (you can temporarily suspend your participation in the research and rejoin when you are fit to do so) and take common-sense precautions if exercising in an unsupervised environment e.g. avoid being alone in unlit areas at night-time.

Activity	Number of times per week you plan to do this activity

Physical Activity Readiness Questionnaire

Has your doctor ever said that you have a heart condition and that you should only do physical activity recommended by a doctor?	▢Yes ▢No
Do you feel pain in your chest when you do physical activity?	▢Yes ▢No
In the past month, have you had chest pain when you were not doing physical activity?	
Are you taking any prescribed medication for blood pressure or a heart condition?	▢Yes ▢No
Do you have any joint or bone problems that could be made worse by a change in your physical activity?	▢Yes ▢No
Do you ever lose your balance because of dizziness or do you ever lose consciousness?	▢Yes ▢No

Have you recently had surgery? ☐Yes ☐No

Are you pregnant? ☐Yes ☐No

Have you given birth in the last 3 months? ☐Yes ☐No

Are you aware of any other reason why you should not do physical activity? ☐Yes ☐No
If yes, please state ……………………………………………………………………….
………………………………………………………………………………………………
[if any of these are answered positively, the participant may need to be excluded]

Exercise history and aims

We are asking these questions to try to understand participants' exercise histories and [Returners] plans [Regulars] aims: [All participants] your answers won't prevent you from taking part.

What are your aims for exercising?

☐ Lose weight
☐ Improve muscle tone
☐ Increase aerobic fitness (e.g. walking, running, cycling speed and stamina)
☐ Increase strength
☐ Other (please state) ____

[Returners only] How long is it since you last exercised regularly (at least once a week)?

☐ Less than 6 months
☐ 6 months to a year
☐ 1-5 years
☐ 5-10 years
☐ Over 10 years
☐ I have never exercised regularly before

If you've exercised in the past, for what reason(s) did you discontinue?______________________
____
____

[Regulars only] How long have you been exercising regularly (at least once a week)?

☐ Less than 6 months
☐ 6 months to a year
☐ 1-5 years
☐ 5-10 years
☐ Over 10 years

[All participants] Are there factors which may make it difficult to exercise at times over the coming period?____
____
____

Your Personality

Previous studies in this project have found that exercise habits appear to relate to personality and so we would be grateful if you could complete this section so that we can see whether participants' personalities might be having some effect on the results of this study.

Here are a number of personality traits that may or may not apply to you. Please tick a box beneath each statement to indicate the extent to which you agree or disagree with that statement. You should rate the extent to which the pair of traits applies to you, even if one characteristic applies more strongly than the other.

I see myself as:

	Disagree strongly	Disagree moderately	Disagree a little	Neither agree nor disagree	Agree a little	Agree moderately	Agree strongly
Extraverted, enthusiastic.	☐	☐	☐	☐	☐	☐	☐
Critical, quarrelsome	☐	☐	☐	☐	☐	☐	☐
Dependable, self-disciplined	☐	☐	☐	☐	☐	☐	☐
Anxious, easily upset	☐	☐	☐	☐	☐	☐	☐
Open to new experiences, complex.	☐	☐	☐	☐	☐	☐	☐
Reserved, quiet	☐	☐	☐	☐	☐	☐	☐
Sympathetic, warm	☐	☐	☐	☐	☐	☐	☐
Disorganized, careless.	☐	☐	☐	☐	☐	☐	☐
Calm, emotionally stable.	☐	☐	☐	☐	☐	☐	☐
Conventional, uncreative	☐	☐	☐	☐	☐	☐	☐

References

The questions in the section entitled 'Your Personality' are taken from the following source and replicate the measure developed by its authors:

Gosling, S., Rentfrow, P. and Swann, W. (2003) A very brief measure of the Big-Five personality domains *JOURNAL OF RESEARCH IN PERSONALITY, 37,* 504-528

The Physical Activity Readiness Questionnaire is based on Central YMCA Qualifications (2005) Training in Different Environments: A Resource for Candidates (London: Central YMCA Qualifications) p.10 *with questions added regarding surgery and pregnancy*.

Appendix H: Study 4 monthly and quarterly surveys

[Section 1: Quarterly surveys only]

[Music group only]
Your pre-workout music: ____
When did you play this?[i.e. at what point before workout did you listen to the music e.g. in my bedroom getting changed, in the car on the way home from work via the gym]:

____

[Implementation intentions group only]
Please list your 'if…then' sentences:

If ____
then ____

If ____
then ____

If ____
then ____

[All groups]
Your height (feet/inches or metres/centimetres) ____________
Your weight this week: ______________________
Your resting heart rate this week: _________
Were you able to complete the step test? Yes ☐ No ☐
Time taken for 20 steps: ________________
Perceived exertion during the 20 steps (choose from 6-20, using the scale below) _______

6
7 very, very light
8
9 very light
10
11 fairly light
12
13 somewhat hard
14
15 hard
16
17 very hard
18
19 very, very hard
20

[Section 2: Monthly and quarterly surveys]

Day	Number of minutes exercised	Activity(s)	Did you do all that you intended to?	If you missed a planned workout, or cut it short, what were the reasons?	Did you listen to music beforehand?	Did you use your 'if…then' sentences?
Monday						
Tuesday						
Wednesday						
Thursday						
Friday						
Saturday						
Sunday						

General questions about this week:

How many workouts did you intend to do this week?
Were there any particular challenges you faced with your exercise programme this week?

[Music group only]
What effect, if any, do you think playing music before your workout had?
Have you been playing music before workouts in the three weeks you weren't asked to report on?

[Implementation intentions group only]
What effect, if any, do you think your 'if…then' sentences had?
Have you been using your 'if…then' sentences in the three weeks you weren't asked to report on?

[All participants]
Is there anything you'd like to describe in more detail?

Appendix I: Study 4 feedback survey

1) Thank you for taking part in the Exercise Adherence study.

Before completing this survey, please make sure you have read the information sheet about the feedback survey, which is available here [link to information webpage].

Please could you mark the appropriate boxes here to indicate you consent to taking part in this collection of study feedback.

☐ I confirm that I have read and understand the information sheet regarding study feedback and have had the opportunity to ask questions*
☐ I understand that providing feedback on the study is voluntary, and I am free to withdraw at any time*
☐ I agree to take part in providing feedback*
☐ I understand that if I give permission for my comments to be quoted in published material (see section below), they will be anonymised prior to publication*
☐ I agree to be contacted about possible participation in future research projects (please leave blank if you do not want to be contacted)

Before you give your feedback, please make sure you've marked below whether you are happy for your comments to be quoted. *
☐ I am happy for my comments to be quoted in published material, and understand I will not be named or identified if I am quoted
☐ Please do not quote my comments

2) Name (You can leave this blank if you prefer to comment anonymously. Please note that your name won't be included in any published material):

[Page break: participants could not move forward to complete and submit the survey unless there were responses to the asterisked questions in section 1) above indicating consent.]

3) Please give any feedback below. I'm particularly interested in how you found your intervention (if you had music or sentences), whether you've tried the other option(s) since you finished the study, or whether you've carried on with your intervention. I'd also like to know whether the system of emails, links and reminders worked for you or if you can think of ways to improve it. Anything at all would be helpful for me to know, so don't feel you have to stick to these topics.

[large field for response]

4) Would you like to be emailed a summary of the study's findings?

☐ Yes ☐ No

5) If you would like to be contacted about participation in Rachel's future research studies, please enter your email address below. This does not oblige you to take part in any research you do not wish to.

Appendix J: Ethical approval letters

Studies 1 and 2 (applied for in one application, since Study 2 consisted of follow-up interviews with Study 1 participants)

Keele University

RESEARCH AND ENTERPRISE SERVICES

28th September 2012

Rachel Hallett
Room DH1.23
Dorothy Hodgkin Building

Dear Rachel,

Re: 'Personal music use, personality and adherence in sport and exercise'

Thank you for submitting your revised project for review.

I am pleased to inform you that your project has been approved by the Ethics Review Panel.

The following documents have been reviewed and approved by the panel as follows:

Document	Version	Date
Application Form	Version 2	
Summary of Proposal	Version 2	04/10/2012
Survey	Version 2	04/10/2012
Information Sheet/Consent Forms	Version 2	04/10/2012
Questionnaire	Version 2	04/10/2012
Promotional Materials	Version 2	04/10/2012

If the fieldwork goes beyond the date stated in your application (28 February 2013), you must notify the Ethical Review Panel via Hannah Reidy.

If there are any other amendments to your study you must submit an 'application to amend study' form to Hannah Reidy. This form is available from Hannah (01782 733588) or via http://www.keele.ac.uk/researchsupport/researchethics/

If you have any queries, please do not hesitate to contact Hannah Reidy in writing to h.reidy@keele.ac.uk

Yours sincerely

Dr Nicky Edelstyn
Chair – Ethical Review Panel
CC RI Manager, Supervisor

Research and Enterprise Services, Keele University, Staffordshire, ST5 5BG, UK
Telephone: + 44 (0) 1782 734466 Fax: + 44 (0) 1782 733740

Study 3

Keele University

RESEARCH AND ENTERPRISE SERVICES

1 March 2012

Ms Rachel Hallett
School of Psychology
DH1.23
Dorothy Hodgkin Building
Keele University

Dear Rachel

Re: 'Individual differences and adherence to gym exercise programmes'

Thank you for submitting your revised project for review.

I am pleased to inform you that your project has been approved by the Ethics Review Panel.

If the fieldwork goes beyond the date stated in your application (30 September 2012) you must notify the Ethical Review Panel via Michele Dawson.

If there are any other amendments to your study you must submit an 'application to amend study' form to Michele Dawson. This form is available from Michele (01782 733588) or via http://www.keele.ac.uk/researchsupport/researchethics/

If you have any queries, please do not hesitate to contact Michele Dawson in writing to m.dawson@uso.keele.ac.uk

Yours sincerely

M. Dawson

pp **Dr Nicky Edelstyn**
Chair – Ethical Review Panel

CC RI Manager, Supervisor

Research and Enterprise Services, Keele University, Staffordshire, ST5 5BG, UK
Telephone: + 44 (0) 1782 734466 Fax: + 44 (0) 1782 733740

Study 4: main study

Keele University

18th March 2013

Rachel Hallet
Room 1.23
Dorothy Hodgkin Building

Dear Rachel,

Re: Study of the effects of (musical and non-musical) interventions on exercise adherence

Thank you for submitting your application amendment for review.

I am pleased to inform you that your amendment has been approved by the Ethics Review Panel.

If the fieldwork goes beyond the date stated in your application 30th September 2014, you must notify the Ethical Review Panel via the ERP administrator at uso.erps@keele.ac.uk stating ERP2 in the subject line of the e-mail.

If there are any other amendments to your study you must submit an 'application to amend study' form to the ERP administrator stating ERP2 in the subject line of the e-mail. This form is available via http://www.keele.ac.uk/researchsupport/researchethics/

If you have any queries, please do not hesitate to contact me via the ERP administrator on uso.erps@keele.ac.uk stating ERP2 in the subject line of the e-mail.

Yours sincerely

Dr Bernadette Bartlam
Chair – Ethical Review Panel

CC RI Manager
Supervisor

Research and Enterprise Services, Keele University, Staffordshire, ST5 5BG, UK
Telephone: + 44 (0)1782 734466 Fax: + 44 (0)1782 733740

Study 4: feedback survey

Keele University

RESEARCH AND ENTERPRISE SERVICES

18th December 2013

Rachel Hallett
School of Psychology
Dorothy Hodgkin Building

Dear Rachel,

Re: Collection of feedback on exercise adherence study participation from participants

Thank you for submitting your revised application for review. I am pleased to inform you that your application has been approved by the Ethics Review Panel. The following documents have been reviewed and approved by the panel as follows:

Document	Version	Date
Summary of Proposal	1	13/11/13
Letter(s) of Invitation	1	13/11/13
Information Sheets	1	13/11/13
Questionnaire – inc consent	1	13/11/13

If the fieldwork goes beyond the date stated in your application, you must notify the Ethical Review Panel via the ERP administrator at uso.erps@keele.ac.uk stating ERP2 in the subject line of the e-mail. If there are any other amendments to your study you must submit an 'application to amend study' form to the ERP administrator stating ERP2 in the subject line of the e-mail. This form is available via http://www.keele.ac.uk/researchsupport/researchethics/

If you have any queries, please do not hesitate to contact me via the ERP administrator on uso.erps@keele.ac.uk stating ERP2 in the subject line of the e-mail.

Yours sincerely

Dr Bernadette Bartlam
Chair – Ethical Review Panel

CC RI Manager
Supervisor

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