

# Contextual Influences on the Use and Non-Use of Digital Technology While Exercising at the Gym

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## ABSTRACT

The use of wearable technology will become significantly more prevalent in the coming years, with major companies releasing devices such as the Samsung Gear Fit. With sensors, such as pedometers and heart rate monitors, embedded in these devices it is possible to use them for fitness purposes. However, little is known about how wearable adopters actually use wearable and existing technologies during exercise. In an exploratory situated study of technology use and non-use in the context of the gym, fitness informatics adopters showed varied practices related to distraction, appropriating technology into their routines, and information needs. We discuss this variance in relation to individual differences and the impact of the physical nature of the gym. Although further research might show other influencing factors such as the social context, we make a case for the use of situated studies to uncover tensions that lead to use and non-use of technology that arise in the different unfolding situations of using wearables in everyday life, including at the gym, which is a surprisingly complex context.

## INTRODUCTION

There has been an increase in the popularity and availability of personal informatics tools. This includes the growth of fitness mobile applications being developed for smartphone use, but also standalone wearable devices. The popularity of these technologies will continue to grow with large companies releasing smartwatches with embedded activity-tracking functionality, such as the Samsung Gear Fit. This trend has led the domains of exercise, fitness and wellbeing to be of increasing interest to the HCI community (e.g. [29]).

There has been significant emphasis on designing technology to encourage people to engage in physical

activity. This includes the design of ubiquitous computing tools [4], the development of fitness device infrastructures [23], virtual trainers [12] and interactive social computer games [27]. These HCI studies have been concerned with the user evaluation of bespoke persuasive fitness technologies. However, people who adopt personal informatics typically do not use just one type of technology; for instance, Rooksby and colleagues discovered that some people interweave their use of different activity trackers [36]. There is a dearth of exploratory research that has investigated how and why different people use and do not use various technologies during physical activity, including at the gym: a popular place for regular exercise.

Regular physical activity is essential for good health and wellbeing, bringing about a range of physical, social and mental health benefits that are important for both the individual and for society [4]. As people become more aware of these rewards, the prevalence of people who go to the gym (also known as fitness centres or health clubs) is rising, with over a hundred new facilities opening in the UK in 2013 alone, and with memberships rising to 12.6% of the UK population [20]. Although users’ behaviours and needs regarding mobile fitness technology have been investigated, there is little research on technology use at the gym and many studies use self-reported and retrospective data independent of the context of use (e.g. [19, 36]. As behavioural insights are typically obtained after the interactions occur and independent of their context, it is argued that such methods do not elicit comprehensive information about behaviour as it really happens in the world [11].

Examining interactions with technology within the context of use is crucial, as user actions are fundamentally embedded within a particular situation [39] and context is an ever-changing unfolding notion [18]. There have been exploratory situated studies investigating general technology use within contexts including the workplace [7] and the home [9]; however there has been little exploratory investigation into the use of technology in gyms. An ‘in the wild’ approach [35] is particularly appropriate for research into the use of fitness mobile applications and wearable devices, as they are designed to be used in an diversity of uncontrollable settings [28]. As fitness informatics adopters are inherently interested in the use of new technology, we

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explored how the gym context influenced their adoption, use and non-use of digital technologies for purposes ranging from tracking to entertainment during individual physical activity.

## BACKGROUND AND RELATED RESEARCH

### Physical Activity and Fitness Research

Exercise is well studied in the domains of sports psychology and behaviour change. The concepts behind some persuasive technologies to support physical activity are loosely based on health behaviour change theories, featuring elements of social support, motivation and self-efficacy.

Motivation is a key feature of exercise and can account for individual differences in behaviours, inspiring people to engage in exercise. Intrinsic motivation is described as performing a behaviour for its own sake [40]; exercising for the enjoyment of the experience. It has been shown that performance feedback and having a personal choice of the type of music to listen to influences situational motivation [40]. On the other hand, extrinsic motivation is doing something as a means to an end as opposed to for its own sake, for instance exercising for the purpose of a reward such as achieving a weight loss target [40].

It has been found that tracking one's activity is beneficial for fitness behaviour change [38]. Setting goals for oneself is also a well-known strategy that has been shown to contribute towards behaviour change for fitness activity [13]. The design of many mobile fitness applications revolves around activity tracking and goal setting with the aim of increasing user's physical activity [14].

As well as the influence of individual personal goals on motivation, research has also demonstrated the motivational effects of external stimulation during physical activity. Engaging in technology for entertainment such as watching TV and listening to music has been discovered to have positive psychological and physiological effects on exercise performance [5]. In a review, Karagoris and Priest [26] summarised that during repetitive, endurance-related anaerobic activities, listening to self-selected motivational music demonstrated performance enhancing effects (e.g. an increase in stamina). Music was found to reduce perceptions of exertion; it is hypothesized that this may be due to a 'dissociation' effect through which music distracts attention away from the pain associated with the exercise [34]. Another way in which music has been shown to increase performance is through the characteristics of synchronous music, whereby the rhythm moderates movement patterns [6].

Another theoretical concept that relates to the individual's experience during exercise is 'flow' [33]. 'Flow' is a positive state of mind characterised by complete immersion and absorption in an activity [17]. Research has mentioned the positive effects of 'flow' on physical activity adherence [33].

### Interactive Technology to Aid Physical Activity

The availability of health and fitness tracking capabilities is growing with the release of new commercially available technologies [21]. In light of this, fitness tracking sensors, such as heart rate monitors, accelerometers, pedometers and GPS (to track outdoor running and cycling) are being added to mobile and wearable devices such as smartphones and smartwatches. For instance, the Samsung Gear Fit tracks everyday activity such as the number of steps, presenting values to the user such as calories burnt and distance achieved, and it interfaces with Samsung phones for GPS and to provide notifications (e.g. text messages) through the watch.

There has been some research investigating behaviour relating to the use of personal informatics technology for general health and wellbeing. Ahtinen and colleagues [2] conducted a cross-cultural field study involving a technology probe where participants recorded subjective experiences about their use of a wellness mobile app for two weeks. Findings showed that cultural and environmental factors influenced user needs and usage of the application.

Similarly, Rooksby et al. [36] explored the area of 'lived informatics' in terms of the ways in which people use health and wellbeing activity tracking devices they have already adopted. The self-reported study revealed several categories of tracking behaviour, including documentary tracking (where participants track their activity for reasons such as facilitating understanding of their activity or sharing their stories with others) and directive tracking (where participants track their activity in order to reach a goal).

### Approaches to Studying Fitness Technology

The majority of HCI research that investigates fitness technology use is for the purpose of evaluating specific fitness technologies. The Sports Tracker, a mobile outdoor sports tracking application [1], was evaluated through examining usage habits and user experience data for existing users of the application, which were collected through one-off phone interviews and text-message questionnaires lasting two weeks. Consolvo et al. [14] conducted a field evaluation of Houston, a mobile application that enables step-count tracking to enhance users' physical activity levels. A three-week in-situ evaluation study was implemented where participants used the application, were interviewed about their experiences, and completed questionnaires and daily records of step counts. Another system that was evaluated 'in the wild' was the UbiFit Garden system [15]; a mobile application along with a fitness device which displays a visualisation of the user's physical activity. The evaluation of the system was run on mobile phones that participants used and they were interviewed to examine user experiences. These studies have focused on investigating the use of specific technology, rather than looking at the range of technologies that can be and are used for personal fitness.

Other than Rooksby and colleagues [36] who used interviews and on-going self-reports on the use of personal informatics discussed above, there are only a limited number of studies within the HCI literature that take a more open, exploratory approach in examining general user behaviour in the domain of health. Fritz et al. [19] investigated the behaviour of long-term users of activity monitoring devices to find out how they use their devices; however they only used retrospective interview data to do so. On the other hand, Goodman [22] used more extensive methods (blog readings, interviews, diary reports for activity logging, and pedometer data) to explore people's health issues and behaviours in their daily lives, but only as a work in progress in order to discover ways in which health technology could be designed to support behaviour change. However, there have been few exploratory studies into technology use in the context of the gym.

Other than a few studies of specific technologies, many investigations looking at technology use in this review did not carry out situated research. The methods that were primarily used consisted of post-hoc interviews, diaries, experience sampling methods and logging devices [1,36]. The use of these methods undermines the pertinent role of the environment and situation of the activity in influencing interactions with technology [35]. As Brown et al. [11] argue, subtle but meaningful interactions with technology may be lost if the data is based on retrospective and self-reported information rather than the actual behaviour as it happens in the real world, during real time. Additionally, retrospective reports lack detail and may not capture every occurrence of use as they are susceptible to report bias, where recall is dependent on what the participant remembers and considers relevant [3]. Logging devices can obtain data at the point of use, but they only provide a conceptual outline of device usage and produces descriptions of only general use rather than understanding particular accounts of use [11]. Based on Brown and colleagues' rich findings on mobile phone use using situated methods, the current exploratory research warrants a situated approach to investigate technology use in the context where fitness informatics may be used: the gym.

## METHODOLOGY

### Context of the Study

The study took place in a busy London university gym, which is also open to the general public. Permission was gained from the gym to recruit members for the study. It is a relatively basic gym with regards to the facilities and technology available, in comparison to other more expensive gyms nearby. Other than a separate floor for group classes, it comprises four main areas with: machines for aerobic exercises (e.g. treadmills, cross trainers and exercise bikes), resistance machines, free weights and a mat area for stretching or floor exercises (see Figure 2, left). Aerobic exercises are activities that involve constant repetitive movements of the arms and legs, heightening



**Figure 1: Samsung Gear Fit worn on the wrist at the gym**

heart rate and respiration (e.g. running), and it can involve interval training consisting of systematic fluctuation of speed. Anaerobic exercises comprise short bursts of intense exertion (e.g. weightlifting) where recovery breaks ('deadtime') are usually taken in between exercises or 'reps'. On the wall in front of the aerobic machines are a set of mirrors and five television screens displaying various subtitled programs while loud, popular music plays through speakers around the whole gym area.

### Autoethnography

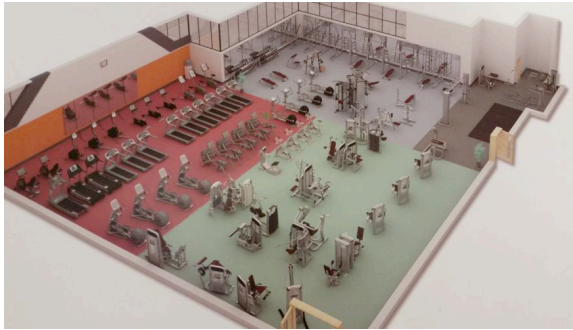
The initial phase in this research was a four-week autoethnography study by the first author with the Samsung Gear Fit (see Figure 1), as described above. The purpose of this autoethnography was to obtain an in-depth understanding of the various contexts of everyday use [30] of a fitness related wearable device. Her experiences relating to its use were documented in textual diary entries at the end of every day. The insights influenced the structure and format of the user study, and the diary entries were analysed as part of the findings.

### In-Situ User Study

#### Participants

Recruitment posters were put up in the gym and around the university campus. Participants were only recruited if they were members of the gym and currently used or had used wearable technology or fitness applications. This ensured that participants had at least some prior experience with using tracking technology and the facilities in the gym to prevent the additional extrinsic motivation of making them exercise or adding technology only for the purpose of the study [32]. Participants gave informed consent as stipulated by UCL ethical procedures and were financially compensated with £10 cash on completion of the session.

The study involved 11 participants: four females and seven males between the ages of 21 and 35 years (mean age of 26 years). Nine participants were students and two were professionals, all living in London. Eight participants currently owned or had used a wearable device including: Fitbit3, Nike Fuelband4, Sony Smartband5, heart rate monitor and pedometer. Five participants occasionally used a smartphone application for tracking running or diet. Eight participants brought in their smartphones to the gym to listen to music, watch TV, use messaging and social media,



**Figure 2: The layout of the gym (left), and the location of the contextual interviews and in-situ coding meetings (right)**

or as a tool to record their exercise. Pseudonyms are used in the findings to preserve anonymity.

#### *User Study Procedure*

To test and refine the chosen methodology, two participants who fulfilled the recruitment criteria took part in pilot studies. Data from pilot study was not directly included in the results of the main user study as the participant observation changed significantly after their participation, but the findings did contribute to the overall analysis.

The main user study involved three different data collection phases for each of the 11 participants, conducted by the first author: entry briefing and contextual interview, participant observations and dialogue during exercise, and exit contextual interview and debrief.

The semi-structured contextual entry interviews lasted between 30 and 45 minutes and were conducted in the gym reception area next to a big window with a view of the context of use (see Figure 2, right), which can give a richer account than other types of interviews [25]. Interviews were semi-structured with the aim of developing rapport with participants and for them to feel comfortable to talk about their experiences. The purpose of the interview was to gain understanding of how they currently perceive their use of technology during exercise. An initial interview script for the first interview was generated as a product of the autoethnography and pilot interviews, and was used to guide the interview. Questions involved asking about their exercise routines (e.g. *What are your motivations for exercise; why do you attend the gym?*), participants' experience of various technologies during exercise (e.g. *What type of wearable technology or fitness applications do you use or have you used in the past?*) and how they use technology when exercising (e.g. *Do you think the use of this technology impacts on your exercise behaviour?*). Using an exploratory approach, the interview questions were adapted as relevant themes emerged from the data. The interviewer would sometimes prompt the participant to keep focus on relevant conversation. Interviews were audio recorded to facilitate transcription.

Immediately after the interview, the first author carried out participant observation whilst they performed their usual exercise regime in the gym to capture technology interaction. Participants were asked to engage in dialogue where they verbalised their thoughts and feelings to capture their experience and motivations underlying certain actions. Observations lasted for the duration of the participant's exercise routine, but no longer than one hour. The first author was dressed in workout clothing and was situated near the participant on an exercise machine in order to blend in. Observation notes were written on a smartphone, as the gym did not allow video capture.

Post-interviews were conducted immediately after the participant observations and lasted for about ten minutes, taking place in context (Figure 2, right). The researcher clarified any questions about the participant's observed behaviour, and then summarised the information gathered from the interview and observation.

#### **Data Analysis**

Iterative data gathering and analysis proceeded with the interviews being immediately transcribed and the textual observations written out in full, and then both coded for salient themes by the first author. Throughout the analysis process, emerging themes and insights were discussed between the authors in the context of the gym [31] during in-situ coding meetings (see Figure 2, right), which helped to adapt the focus of questions asked in subsequent interviews [16]. The data analysis process took part in four stages, loosely following the phases of thematic analysis [10]: immediately transcribing the data, becoming familiar with it; open coding of the data between each interview looking for salient themes from the interviews, observations, and autoethnography; and axial coding to categorise them systematically using an affinity diagram [24]. Finally, three rounds of categorisation were performed to drill down from issues with adoption, carrying and using technology, focusing on fitness and non-fitness technology, uncovering tensions leading to use and non-use that are presented in the findings. Data were also analysed through the links to previous literature [10].



## FINDINGS

The findings are arranged in three separate themes that arose from the data, but there is much overlap between topics. The themes are presented as the following use and non-use tensions: technology used for distraction vs. technology causing disruption; information needs met by technology vs. avoiding information provided by technology; and exercise influencing technology use vs. technology use influencing exercise.

### Distraction vs. Disruption

There were many cases where participants used technology to distract themselves from the task at hand: exercising. On the other hand, there were situations where technology used for non-fitness reasons caused disruption to exercise, so participants actively avoided it.

#### Technology Used for Distraction

Six participants were observed using technology as a source of distraction: they got immersed in watching videos, listening to music or audio books, or looking at the machine display. This diverted their attention away from thinking about the exercise towards the distraction technology. Participants suggested that they required distraction from concentrating on performing certain exercises in the gym as this reduced the intensity of their perception of the pain, effort and tiredness experienced during exercise (cf. [34]).

*(Referring to the machine display and music) "Having something else to concentrate on takes my mind away from pain and tiredness"* (Andy, interview)

*"I try not to think about what I am doing so I watch TV on my phone. Distraction is my key. When I cannot use my phone I have to concentrate on it and I feel every second of it"* (Juliette, observation and dialogue)

The need to divert attention meant that some participants used any technology they could to distract them. One participant watched TV to distract her from her cross trainer exercise, regardless of the value of entertainment it provided.

*"I would watch TV just to take my mind off what I'm doing, even though I don't really like what's on"* (Helen, observation and dialogue)

This need to use technology for distraction was mainly observed for participants performing aerobic exercises that did not necessarily require attention on the activity or the machine display in order to achieve performance, such as running at a steady pace on the treadmill. This type of exercise allowed participants to disengage their attention from the exercise and to direct it towards something else. However, when participants performed interval training or weight training, many did not use technology for the purpose of distraction.

*"I only watch TV on my phone when I'm doing aerobic exercises like on the elliptical machine, but I don't on the resistance machines"* (Juliette, observation and dialogue)

#### Technology Use Causing Disruption

One of the reasons that participants didn't make as much use of technology during anaerobic exercises as they did for aerobic exercises was because many preferred to mentally count the number of repetitions they were performing to keep track of their exercise progress and therefore needed to direct their attention towards the task.

*"I would stop listening to music and focus on counting the reps in my head instead, so I know how many I can manage to do today"* (Sammy, observation and dialogue)

Unlike aerobic machines, the resistance machines did not provide automatic activity tracking functionality and so participants were required to manually count their repetitions. This need for concentration on counting repetitions inhibited the use of any technology that might disrupt this, even when participants would have preferred to use it for distraction purposes. Three participants would have still preferred to use their phones to watch TV and listen to music during weight training, but they did not, because it conflicted with their need to count their repetitions.

*"It would be great if the machine or my [wrist] Fitbit could automatically count my reps so I could listen to my music properly"* (Sammy, observation and dialogue)

Even for aerobic exercise, disruption could be unwelcome and technology could be avoided to minimise it. When the smartphone notification feature was active on the Samsung Gear Fit during the first author's activity on the cross trainer, it disrupted her concentration. She found this constant disruption frustrating and eventually disabled that feature for the rest of the duration of her exercise sessions.

*"The notifications made me lose concentration of what I was doing and I had to slow down just to read the message which was annoying, so I turned it off"* (autoethnography diary)

Another reason why people avoided disruption stems from their beliefs about the relationship between exercise and technology use. Some participants believed that exercise is an opportunity to focus on the mind and body: to be immersed in the experience of exercise. The deep concentration may be related to a sense of 'flow'; a state characterised by complete immersion and absorption in an activity [17].

*"I think exercise should be a time to get away from unnecessary technology and distractions and just focus on exercising and being in the zone, that's why I don't even bring my phone with me"* (Kevin, interview)

*Summary of the Distraction/Disruption Tension*

The findings show that unintentional disruption to concentration can consequently impact performance, enjoyment, or even the ability to exercise, which can be viewed negatively and lead to disengagement. For the design of technology that might be used in the gym, this must be balanced with people's desire to dissociate from the exercise through distraction, as entertainment can motivate people to exercise more often and for longer.

**Information Needs vs. Avoiding Information**

Many participants wanted to use technology to monitor their practices and to motivate themselves by reviewing their fitness information. Unfortunately, these information needs sometimes conflicted with their need to avoid demotivating information, both in the gym and outside it.

*Information Needs Met by Technology*

Nine participants primarily used the measures of time, distance, calories and heart rate on the fitness tracking displays on aerobic machines. Using these measurements, participants monitored their current progress, set themselves goals and moderated their level of exertion to reach their goal. This goal directed tracking behaviour relates to the 'directive tracking' style [36]. For example, two participants were concerned with maintaining their heart rate within a certain range and therefore during aerobic exercises they constantly focused their attention on the heart rate display, moderating their exertion level to achieve their target heart rate.

*"I look at the heart rate monitor, if it is lower than my target then I speed up to try and reach it"* (Kevin, observation and dialogue)

It was observed that participants used different aspects of performance feedback values to motivate their activity, and this was dependent on the exercise as well as what part of the exercise they were at. For instance, four participants found seeing that there was little time remaining of their workout motivated them to increase exertion.

*"When I see there is only 40 secs left I think to myself, 'come on you can do it!'"* (Marie, observation and dialogue)

As well as for motivational purposes, activity monitoring is sometimes required for particular exercises. The three participants who performed interval training exercises used the information on the machine display as a way to structure their workout. They explained that they used the time display as an indicator for when they needed to adjust their speed control.

*"I'm looking at the time so I know that every two minutes I need to change my speed"* (Marie, observation and dialogue)

In contrast, some participants chose to focus on less reliable information; two participants focused on the calorie counter

on the machine display as an aid for exercise motivation. Although they knew this was an inaccurate measure, it was satisfying for them just to know that calories were being burned as their exercise goals were related to weight loss and body shape. This was also observed for the Nike Fuelband where there was satisfaction gained by reaching the 'next full number' on a constantly ascending or descending value, such as aiming to achieve 3000 Fuelpoints rather than stopping at 2800.

*"I would never stop before I reach a full number, even though I don't really know what the Fuelpoints are based on"* (Harry, observation and dialogue)

Participants reviewed performance data logged by the activity tracking technology after they had exercised at the gym. Eight participants described that they enjoyed looking at their performance data from wearable devices to facilitate a better understanding of their fitness behaviour ('documentary tracking' [36]).

*"Data is knowledge when you look at it in the right way"* (Nigel, interview)

One reason why participants used fitness technology outside of the gym was to motivate exercise behaviour in the gym. Martin claimed the Fuelband data motivated him to exercise in order to not break the streak of goal achievement he had developed; the motivation stemmed from the disappointment of the thought of not meeting the goal. This shows the powerful motivational effect that tracking fitness and goals setting can have on the participant's behaviour.

*"I was addicted to meeting my daily goals; once you develop streaks, you don't want to break it."* (Martin, interview)

*Avoiding Information Provided by Technology*

Conversely, some participants suggested that they avoided information to evade the feelings of shame and disappointment of not being able to meet a goal. Harry explained that he avoided wearing his Nike Fuelband device on certain days where he knew that he would not go to the gym in order to avoid the negative affect associated with seeing an unmet goal. This may relate to the participant self-identity as *"somebody who always reaches his goal"* and so he avoids behaviour that would violate that perception.

*"When I am too busy to exercise as much, I don't wear the Fuelband. I don't like to see that I have not reached my goal so would rather not wear it at all on some days"* (Harry, interview)

Avoiding looking at certain measures of fitness tracking was observed and some participants explained that they found it demotivating during their exercise. For constant aerobic fast paced, high intensity exercises (e.g. running on

the treadmill), six participants consciously avoided looking at the time on the machine display.

*Juliette placed her phone on the display pad, deliberately covering the time during use of the elliptical machine* (Juliette, observation notes)

*"I avoid looking at the time when I'm running, it makes my goal seem further away"* (Nigel, observation and dialogue)

A reason for this was because participants believed that watching the clock increases their perception of their effort and tiredness, and reduces the perceived speed of time. This distortion of perception of time could have a negative effect on some participants' motivation and consequently affect their performance.

*"When I am tired I avoid constantly looking at the time, it makes it feel like more effort and time seems to go slower!"* (Marie, observation and dialogue)

As well as the time measure, participants avoided looking at other values that also indicated low performance progress. Two participants did not look at the progress display near the beginning of their workout when progress was low because they found it de-motivating. This highlights that the use of technology is influenced by certain temporal stages within a workout.

*"I don't want to look at calories at the beginning because it is low and I think I am not doing well"* (Sammy, observation and dialogue)

Similarly, it was observed that some participants avoided viewing their performance data until after their workout session as opposed to during. One reason for this is because seeing a larger achievement at the end provided a greater sense of accomplishment and surprise rather than viewing smaller increments of progress.

*"I prefer to see my data after exercise because I feel good when I have seen that I have burnt 500 calories in one go, it is a nice surprise when I see I have done well"* (Juliette, interview)

#### **Summary of the Information Needs Tension**

Our findings suggest that there is a fine line to be walked with regards to fitness information presented to people at the gym. Information at the time of exercise helped participants to monitor and adjust performance, but it could also be demotivating if it showed low progress. Even arbitrary data points can motivate people if they are shown positive results, but people can also avoid the use of fitness technology altogether if they expect there to be negative results.

#### **Exercise Shaping Tech Use vs. Tech Use Shaping Exercise**

Another tension that arose from the data was caused by the physical nature of the context: the exercises influenced the

use of digital technology, but the technology could also influence people's exercise at the gym.

#### **Exercise Influencing Technology Use**

One factor that influenced the use of technology was the restrictions imposed by physical characteristics of the exercise. Exercise involves dynamic body movements, which then limit the types of digital technology that can be used. An example of this was the impracticality of using technology that required sustained visual attention, such as reading when running. Harry stated that he would have liked to use his mobile phone but the physicality of running does not make this possible, forcing him to not use the technology as desired.

*"I would like to read from my phone when I'm running, but it's difficult when I'm moving around so I have to wait until the breaks"* (Harry, observation and dialogue)

Additionally, the specific aspects of exercising in the gym limited the functionality that was useful on wearables. The Samsung Gear Fit was unable to track the first author's use of the bicycle machine in the gym because the smartphone was required for the GPS distance tracking function, which went against her expectations of just using a wearable device during exercise without the need of a phone.

*"I was excited to be able to use the 'cycle' tracking function at spin class. However I discovered that this feature only works when the phone is nearby for GPS detection. I felt disappointed"* (autoethnography diary)

The physical set up of the equipment also restricted the participants being able to use technology in their desired way. For example, Juliette usually prefers to watch TV on her phone and the elliptical trainer allows her to do this because the machine also provided a shelf to place her phone. In contrast, the resistance machines did not afford a physical space to place a phone and so she was unable to watch TV during that exercise. She described that this limitation consequently affected her experience of the exercise as she was forced to focus on her performance, thus increasing her awareness on the feelings of pain. Having this repeated experience contributed to her losing motivation for this exercise and she stopped using resistance machines altogether.

#### **Technology Use Influencing Exercise**

The desire to use some technology during exercise proved to be strong enough to actually impact the way participants exercised in the gym. Juliette adapted the way she used the elliptical trainer in a way to minimize interaction with the display: she exercised at a constant speed and set the time to the maximum workout length to watch a TV program on her tablet.

*"I guess I want to keep at a steady pace so I can concentrate on watching TV and not have to think about changing my speed or playing with the display [...] I don't*

*really want to be distracted from my distraction!”* (Juliette, observation and dialogue).

There were some situations where participants wanted to use technology for performance tracking but the functionality of technology led to a change in the physical activity. Juliette wanted to monitor her performance on the elliptical trainer but her Fitbit did not capture her strides when she held onto the handlebars, so she chose not to hold on to the handlebars as a way of gaining stride information.

*“It’s annoying that the Fitbit doesn’t count my gym activity [...] I don’t hold onto the handlebars so my strides can count towards my daily step count. It looks stupid and makes the exercise harder”* (Juliette, observation and dialogue)

It was uncovered that this same participant had a strategy of avoiding the use of non-fitness related technology outside of the gym in order to motivate her to exercise: Juliette refrains from watching TV and films on Netflix at home and sets herself a rule that she can only watch TV at the gym. This motivates her to go to the gym to exercise as it allows the opportunity to watch her favourite programs.

*“I feel less guilty when I’m bingeing on Netflix at the gym. I promised myself I would only watch them here [in the gym] and not at home”* (Juliette, observation and dialogue)

#### Summary of the Exercise/Technology Tension

The findings indicate that the physicality of the gym impacted the ways people were able to use technology, leading to issues of frustration. The need to use technology impacted exercise negatively in some cases, but its active avoidance could also motivate exercise. Technology impacting exercise and exercise impacting technology use led to disengagement and engagement with both the technologies and the exercises.

#### DISCUSSION

‘Going to the gym’ can be perceived as a singular activity in a box; people going in, exercising and coming out. However, the findings of this situated exploratory study show that this is not the case; the gym is a complex and dynamic environment. This includes variety in the physicality of exercises, the physical design, and the facilities as well as how an exercise changes over its course. The most dominant factor is the difference in types of exercise performed in the gym influencing the use and non-use of digital technology: exercises are inherently different in the way that they are performed and what they demand from the individual. For example, the physicality of the context of exercising at the gym meant a participant was looking for distraction on their smartphones during the ‘deadtime’ between reps or when they were bored on the treadmill, but were very frustrated by any disruption when they were concentrating on form or particularly when counting reps on non-digital resistance machines. Across the data set, exercise was found to influence the occupation

of physical space, the physical equipment and how people were feeling in the moment, and therefore influenced the technologies available and participants’ use and non-use of technology.

Beyond the complexity of the environment, we found that the people who go to the gym can have very different technology needs. There are many available technology choices in the gym and participants used and adopted them in different ways. This variety in use was related to participants’ motivations for exercise, their health goals, how they valued exercise, their individual preferences towards certain technologies, and simply their personal taste. For example, intrinsic motivation to exercise meant that participants monitored in-the-moment heart rate information or avoided technology altogether to achieve a sense of ‘flow’, but extrinsic motivation meant that other participants actively avoided low performance values on a Fuelband or prioritized watching TV on their phone for distraction and therefore did not use resistance machines. With regards to fitness technologies, we found there were differences in the way that individuals used the activity tracking technology, in line with Rooksby et al. [36].

Rather than independently determining behaviour, the complexity of the environment and the complexity of individual differences are intertwined in how they influence the use and non-use of technology in the gym. Non-use has been gaining attention in the HCI domain in recent years (e.g. [8]). Satchell and Dourish [37] talk about different types of non-use of technology such as active resistance, disenchantment, and disinterest, but these categories do not cover the non-use that we found among the fitness informatics adopting participants. Our participants opted in and opted out of using technology based on the type of exercise they were doing, the physical space afforded near that exercise, and the point they were at in a particular exercise. This opting in and opting out of technology use was also closely linked to people’s individual differences, particularly their values, motivations, and preferences.

This study took a step towards expanding our understanding of the influence that context of use can have on the rhythms/routines of the gym visit and rhythms/routines of technology use. However, even with this targeted scope, it did not access the complete complexity of the gym context. This study involved a limited amount of participants, focused on working out alone at the gym and participants may have been influenced by the presence of a researcher observing them, which influence its representativeness. If the study involved the recruitment of participants who come to the gym to exercise with a partner (or ‘gym buddy’) or observed people in group classes, it might have uncovered factors relating to how the social context influences fitness technology use.

Features such as sensors and pedometers are being added to smartwatches under the assumption that this is what people want and are able to use throughout different settings,



including during exercise. In reality, a large number of people choose the gym as their regular source of physical activity, and this context influences what people want to use and what they can actually use. We found that if participants want to use some of these features, they choose to alter the way they exercise, for example where a participant with a wrist FitBit did not use the handlebars on the elliptical and felt unbalanced while gaining pedometer information. Similarly, people can opt out of features of the technology entirely if it does not fit into their exercise preferences, as was the case where text notifications were disabled on the Samsung Gear Fit to prevent disruption.

This research has particular relevance to the growing trend for wearable technologies, especially those geared towards fitness, such as the Samsung Gear Fit or Apple Watch. The use of these increasingly popular technologies has not been comprehensively explored in the context of everyday life, and much work still needs to be completed focusing on how different aspects of people's lives influence use and non-use, and how the use of the technology in turn influences people's lives. By using a situated approach, the current study reveals use and non-use tensions that arise for fitness technologies that may be used in the gym, as it is a complex space and individual differences are wide-ranging. We should be wary of context-independent design and research of wearable technologies that are meant to be useful in all environments, including in and outside of the gym and in conjunction with the use of a variety of other technology. Wearable technology is inherently mobile and therefore its use is influenced by the unfolding and dynamic context in which it is used, as well as the individual using it. As such, a situated approach to design and 'in the wild' evaluation would allow for the investigation of contextual factors that influence the various uses and non-uses of these emerging technologies.

## CONCLUSION

The aim of this study was to investigate the use and non-use of technology during exercise in the gym. Through taking a situated exploratory approach to this research, it was revealed that the gym context is complex and dynamic, and the complexities of the context influence the use and non-use of technology. Use and non-use tensions became evident with regards to distraction vs. disruption, information needs vs. information avoidance, and technology influencing exercise vs. exercise influencing technology. People's choices to opt in or opt out of using technology were dependent on context and situation, influenced by individual differences as well as the physicality of the gym. Values, motivations, and preferences influenced use and non-use of technology. On the other hand, even if the design of the technology caters for the variance in users, it cannot be assumed that the technology will be used in the same way throughout the exercise, for all exercises, and in the same places. This is because context is dynamic and people react in

accordance to their environment at that particular moment in time [18,39]. These findings point to the importance for future work to take a situated approach to understand, design and evaluate technology to be used in a variety of contexts by a variety of individuals, such as wearable devices for fitness.

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