

The Unquantifiable Self

An exploration into the relationship between users and their
activity trackers.

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By

Henrietta Hitchings

Dedicated to Annabell, Edwin, Amelia and The Black Cat, and to The White Cat who never saw this thesis completed.

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A b s t r a c t

Digital self-tracking generates ever increasing amounts of personal data on anything from mood and relationships to health and finance. This thesis aims to explore the relationship between the consumer and their personal data, it seeks to discover how self-tracking changes the user's experience and understanding of the world and themselves. The background research firstly discusses the usefulness and availability of self-tracking data to the consumer in comparison to other stakeholders. Secondly, it explores the services and cultural systems that guide how self-tracking might be used as a tool for self-expression. Thirdly, it outlines the ways that quantification can change how an experience is perceived and the meaning that people find in analysing their data. Finally, it discusses the impact of potential surveillance on consumers. Interviews and analysis concluded that activity trackers help users make day to day decisions, that personal data is both meaningful and useful to the user and can act as a way to express or represent their experiences and that the act of using an activity tracker also changes and often enhances the experiences of the user. These ideas were then explored in a series of design works that both critiqued self-tracking and used it as a creative medium.

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I n t r o d u c t i o n

Basics of Self-Tracking

Defining Self-Tracking

We live in a digital society and are surrounded by “everyday objects, that are readable, recognizable, locatable, addressable, and controllable via the internet” (The U.S. National Intelligence Council, 2012) known as the ‘Internet of Things’. Any society might have digital technology however in a digital society software has its own cultural agency (Rossiter & Zehle, 2015). One of the many things that can be described as ‘going digital’ is self-tracking which has “evolved out of spreadsheet computer logs” (Weigel, 2015, para. 11) to become something that is not only digital but has cultural agency. This self-tracking and monitoring of everyday life has allowed for a “deeper understanding of the internet and external worlds encountered by humans” (Swan, 2012, p.217).

Before self-tracking can be defined there first needs to be some understanding of the everyday. Sutzl (2016) defines the everyday using the description provided by Henri Lefebvre (1947). Lefebvre says that the everyday is “whatever remains after one has eliminated all specialised activities (as cited by Sutzl, 2016). Sutzl (2016) however goes on to use the argument of Kirstin Ross:

Everyday life, properly speaking, came into being only [...] when the lived experience of those new urban dwellers became organised, channeled and

codified into a set of repetitive and hence visible patterns, when markets became common between the provinces and the capital, when everything - money, work, hours, miles, calories, minutes - became calculated and calculable, and when objects, people and the relations between them changes under the onslaught of such quantification (as cited by Sutzl, 2016).

The everyday has here been defined by quantification, by tracking. The definition is not a technical one like that of Lefebvre but it does a better job at describing what the everyday means to people in a practical sense.

Self-tracking can be defined as the collection of personal data, information on the self, over time however this thesis is interested in the self-tracking of everyday experiences using online media. Rettberg (2014) uses the term “self-representation” as a way of describing this type of personal data however even this description leaves room for debate. She points out that “arguably, recording quantities of grain or other valuables can be a form of self-representation, or at least representation of what belongs to the self” (Rettberg, 2014, p.10). If even things such as “consumption and debt are intricate parts” (Urist, 2015, para. 16) of our personal identities then the only safe way to define personal data and self-representation is by allowing the user to determine the definition.

Social media also needs to be discussed to limit the definition of self-tracking. Nielsen's Social Media Report (2012) outlines that more time is spent on social media than on any other kind of website. Users are encouraged to spend this time broadcasting their lives, making them "permanent, mappable and viewable" (Manovich, 2013, p.232) to the benefit of the companies who run these sites. This can be separated from self-tracking when the focus is on "curated self-representation" (Rettberg, 2014, p.76) rather than documentation. While social media can be used for self-tracking it is certainly not used in that way by most people. There is overlap between curated self-representations and personal data collected through self-tracking but they are distinct from each other.

Activity trackers are a type of lifestyle app for smartphones which either automatically or manually collect personal data but there are also web services which do the same thing. Devices such as smartphones or wearable monitors act as a means of data collection while the activity tracker or service gives meaning to the data collected (Swan, 2012, p.219).

Why Study Self-Tracking

Data-ism is "the belief in data as objective truth" (Sondergaard, 2016, para. 22), it is the belief that enough data can provide the answers to otherwise difficult problems ultimately "saving money and saving lives" (Lohr, 2015). The kinds of problems that big data can help to solve is still being defined (Rettberg, 2014). "Data is social and networked, more complex and

ambiguous than simply measured" (Sondergaard, 2016, para. 22), especially data about the self (Rettberg, 2014). This is not the only way to think about data. Drucker (2011) suggests that "instead of talking about data, we should use the term *capta*" (as cited by Rettberg 2014, p.69). "Data" indicates that information is given whereas "capta" indicates that information is actively taken and shows an understanding that "intellectual disciplines create the objects of their inquiry" (Drucker, 2011, para. 4).

The Quantified Self community is a place for users to share self-tracking experiments, methods and results. It is about using big data collected through self-tracking and "creating a digital repository of your personal existence" (Bushhousen, 2014, p.88). It was founded by Gary Wolf and Kevin Kelly in 2010 although self-tracking has been around long before then. The Quantified Self community are the best example of the ways that data-ism and new technology combines with self-tracking.

It is important for this research to attempt to understand the effects of activity trackers. While it is something that has quickly made its way into everyday life both Rettberg (2014) and Swan (2012) agree that it has not been studied enough. Swan (2012) explains "there is typically a lag time between the availability of new technologies, and the individual and societal maturation process around them" (p.235-236). By better understanding our relationship with activity trackers we can better understand

ourselves within the context of a digital society. We can start to answer substantial questions such as “If we see ourselves and expect to be seen as data bodies, as quantifiable selves, what do we see?” (Rettberg, 2014, p.73) and “What are the eternally significant data about ourselves?” (Weigel, 2015, para. 4). Another reason for studying activity trackers is that we first need to understand how to interpret personal data before we can expect users to read and understand our interpretations. Large data streams of personal data are still unfamiliar to most people and they need a way to draw meaning from something so foreign (Swan, 2012). There are potential consequences for misunderstanding activity trackers. Not just on a personal scale but also when this data is used to make decisions or to drive artificial intelligence. Manovich (2013) stresses that “we need to consider not only ‘visible’ software used by consumers but also ‘gray’ software, which runs all systems and processes in contemporary society” (p.11) otherwise “we are in danger of always dealing only with its effects rather than the causes” (p.4).

Purpose of The Research

This research aims to investigate way that activity trackers change or maintain the meaning of the activity being tracker for the user.

Define and Identify Self-Tracking and Activity

Trackers

The literature review gives purpose and context to the research. It has been used to define self tracking as well as defining the discussion that surrounds it (Student Learning Development, University of Leicester, 2009). It has been a shortcut to terms and ideas in the research area and helped to understand the ways that the work will be interpreted. For this research the type of content that has been reviewed is much broader. It encompasses “books, chapters, journal and magazine articles, theses and dissertation, corporate and academic websites and blogs, and documented design projects” (Harrington & Martin, 2012, p.112). The literature review is organised by themes and Content is included based on its relevance to personal interpretations of self-tracking (Student Learning Development, University of Leicester, 2009). There are many discussions on both the positive and negative implications of self-tracking under this umbrella; these make up the themes for the review.

An analysis of existing activity trackers is an important part of the process of background research and is the best way to understand the activity trackers that have been identified. Harrington and Martin (2012) suggest using online databases as a way to simplify the method and to use tables to systematically summarize and synthesize the data collected. The most popular services according to the recommendations on the Quantified Self website were analysed. This was a comprehensive list of five-hundred services, each with a tag to outline the scope of the service and a price range.

Determine and Describe How Activity Trackers Changes or Maintains The Meaning of an Activity

Conducting interviews is one of the best ways to “collect firsthand personal accounts of experience, opinions, attitudes and perceptions.” (Hanington & Martin, 2012, p.102) and therefore can determine how activity trackers change or maintain the meaning of an activity. All interviews were non-directed (Kuniavsky, 2003) and involved bracketing (Beech, 1999). The interviews were phenomenological focusing on the phenomenon of using an activity tracker (Creswell, 2013). By taking this phenomenological approach, it makes sense for the design outputs to be phenomenological descriptions rather than functional works.

Framework of The Research

Conceptual Framework of the Research

The research aims to investigate the relationship between consumers and their personal data and so produces “knowing-that” knowledge, meaning that it seeks to understand how somebody does something (Downton, 2003, as cited in Frankel & Racine, 2010, p.3). Basic design research is described “as searching for an explanation in the experience of designers and those who use products” by Buchanan (2007), (as cited in Frankel & Racine, 2010). This is what the thesis aims to do; to describe and explain what the experience of self-tracking

means to the users. The research should “lead to developing theories about design that has far-reaching implications for the discipline” (Buchanan, 2001, as cited in Frankel & Racine, 2010, p.4).

The aims of this research are focused on finding problems, as “producing the problem is the [significant] work that the designer must do” (Gedenryd, 1998, as cited in Frankel & Racine, 2010, p.6). These problems will be found by understanding the experiences of those who use self-tracking technology, it is therefore useful to situate this thesis under the umbrella of phenomenological research, specifically hermeneutical phenomenology. This is described by Van Manen (1990) as “oriented toward lived experience (phenomenology) and interpreting the “texts” of life (hermeneutics)” (as cited in Creswell, 2013, p.59).

Phenomenological research has its basis in philosophy and can be best rationalised through that lense. At a basic level it is “A return to the traditional tasks of philosophy... as a search for wisdom” (Creswell, 2013, p.58) however it sees this wisdom as something that can only be gained through describing and interpreting the experiences of others because it understands reality of an object as something that “is only perceived within the meaning of the experience of an individual” (Creswell, 2013, p.59). This research is focused on understanding self-tracking, usually the technology, devices and services are viewed as the objects while the users are viewed as the subjects in the

relationship however “reality, according to Husserl, is not divided into subjects and objects, but into the dual Cartesian nature of both subjects and objects as they appear in consciousness” (Creswell, 2013, p.59). This research starts by viewing each of these players as both objects and subjects in different situations. Activity trackers have the agency to act on the users while the users have the agency to act on activity trackers. It is only through unpacking the experience of the user that this relationship can be fully understood.

The prominent role of the design researcher in interpreting the data is one that needs to be addressed as it will almost certainly influence the results of the research. There is no way for the researcher to remove themselves from the investigation entirely as they give the research a purpose. “To fail to have this direction would be to render the research meaningless and so we cannot bracket this away” (Beech, 1999, p.4). The best that the researcher can do is to “decide how and in what way his or her personal understandings will be introduced into the study” (Creswell, 2013, p.62). The designers role in influencing the outcome of the research is in determining the research question, interviewing participants, and interpreting the data that is collected through the interviews and background research. She can ensure that questioning isn’t leading however it does need to give the research or participant a focus and be specific so that they are relevant. In that way it does drive the results. In interpreting the data the researcher can “put aside any notions of truth and measures of accuracy

of what the subject of the research is saying. However, it does not mean that the researcher can put aside any notion that the subject exists.” (Beech, 1999, p.3). They can only practice reflexive research and describe why decisions have been made. Beech (1999) states that “previous influences will be there from the enormous variety of sources that we are all subject to in our daily lives... But they will not have been considered and reflected on in a mindful way and then put aside or unknown, as would be likely to occur if one has read, reflected on and bracketed the considerations raised by the reading.” (p.5). By doing this the background research can inform the data collection in a measured way and both of these things can come together to inform the concept generation and prototyping.

Thesis Structure

This thesis is divided into two parts. The first part, the background research consists of an analysis of services and a literature review. This acts as phase one and two of Hanington and Martin’s (2012) recommended phases of design work “Planning, Scoping and Definition” and Exploration, Synthesis and Design Implications”(p.7). The second part includes interviews, interview analysis and design conclusions. This acts as the “ Concept Generation and Early Prototype Iteration” and “Evaluation, Refinement and Production”(p.7). The emphasis here is on the research and problem finding rather than producing a definitive design solution. Lawson (2003, as cited in Frankel & Racine, 2010) states that “design is a process

in which the problem and solution emerge together". Ideas are generated through research. The benefit of approaching design in this way is that it prevents it from being an affirmative process. The designer is forced to think critically and cannot jump to conclusions about what should or should not be designed in the first place.

B a c k g r o u n d R e s e a r c h

Analysis of Activity Trackers

Types of Activity Trackers

The term 'self-tracking' covers a wide range of data, uses and collection methods and so, in order to define and discuss it with more nuance, it needs to be further categorised. Rettberg (2014) talks about "modes" of data, "visual, written and quantitative" however she admits "there are other possible modes" (p.3) so it would be impractical to use these to define and organise activity trackers. Dancy (2014) offers a more structured solution, that is to focus on the types of personal data that the activity trackers collect; soft data, hard data and core data. Tables showing data from the analysis of services can be found in Appendix A.

Soft Data is subjective information that is "constructed" by the user (Dancy 2014). Due to the impressionistic nature of the data it is always collected manually. The user has greater flexibility in what kind of information and how much detail they collect. While the data may take the form of a number rating it might also be collected as photographs or written comments often focusing on the quality of the experience. Figure 1 outlines the subcategories of soft data and some of the most popular examples of activity trackers that collect this type of information.

Soft data is much cheaper than other types of data, about three quarters of soft data activity trackers are free with less than 7% of the sample costing over \$10. Activity trackers that

Mood	Lifestyle	Relationships
Moodpanda (Mood Panda, 2015, October, 7) Moodscope (Moodscope Ltd. n.d.) Gotafeeling (No. 8 Media, Inc, n.d.)	Momento (d3i Ltd, n.d.) Daytum (Case & Felton, n.d.)	Klout (Klout Inc, n.d.) Honestly (Honestly App, 2016, July, 28)

Figure 1. Subcategories of soft data and examples

collected data on relationships were all free. All the soft data activity trackers from the sample cost less than \$100 and were collected through applications or the web rather than through a monitoring device (see Appendix A).

Hard Data are variables which act as a fact and change over time. This data is by far the most popular to collect because it can be collected automatically and because it allows you to quantify changes or improvements in your lifestyle. A lot of information can be collected at little effort over a long

period of time, usually in the form of measurements. Figure 2 outlines the subcategories of hard data and some of the most popular examples of activity trackers that collect this type of information.

Hard data is more expensive than soft data. Under half of the hard data activity trackers from the sample were free and about 40% of them cost over \$10, the most expensive costing well over \$250. Hard data is the only kind of data that uses monitoring devices. Health data in particular has an almost even spread

Health	Location	Finance	Productivity	Environment
Fitbit (Fitbit Inc, 2014, August, 10) Digifit (Digifit Inc, n.d.) Runkeeper (FitnessKeeper, Inc. 2016, September, 30) Daily Mile (dailymile Inc, 2013, May, 5)	Location Swap (Barooah, n.d.) Foursquare (Foursquare Labs, Inc, 2016, September, 14)	Mint (Intuit Inc. 2016, October, 4)	Equanimity (Barooah, 2013, March, 12) Rescue Time (RescueTime, 2016, September, 28) 42 Goals (42goals, n.d.) Goal Buddy (Nutcake Games, 2016, April, 14)	Xively (LogMeIn, 2016, October, 5) Wattvision (Wattvision, 2016, August, 4)

Figure 2. Subcategories of hard data and examples

between web only activity trackers, applications and devices and makes up over 70% of all devices used for all the activity trackers from the sample, the rest were environmental data activity trackers (see Appendix A).

Both hard and soft data activity trackers were equally social. With about 30% from the combined sample being explicitly community and sharing focused while 68% was focused more on introspection. Mood and location tended to be more socially focused while finance data was entirely private and never encouraged sharing (see Appendix A).

Core Data is any information that is always true and which cannot be changed for example blood-type or genetics. This can be the most difficult and expensive type of data to obtain. There is less motivation for consumers to collect core data as it cannot 'improve' over time however it is often essential for specialists to know this sort of information about their patients in order to treat them. For the reasons stated above there are very few application and web services available to collect and store core data and so, while mentioned, it will not be the focus of the thesis.

History of Activity Trackers

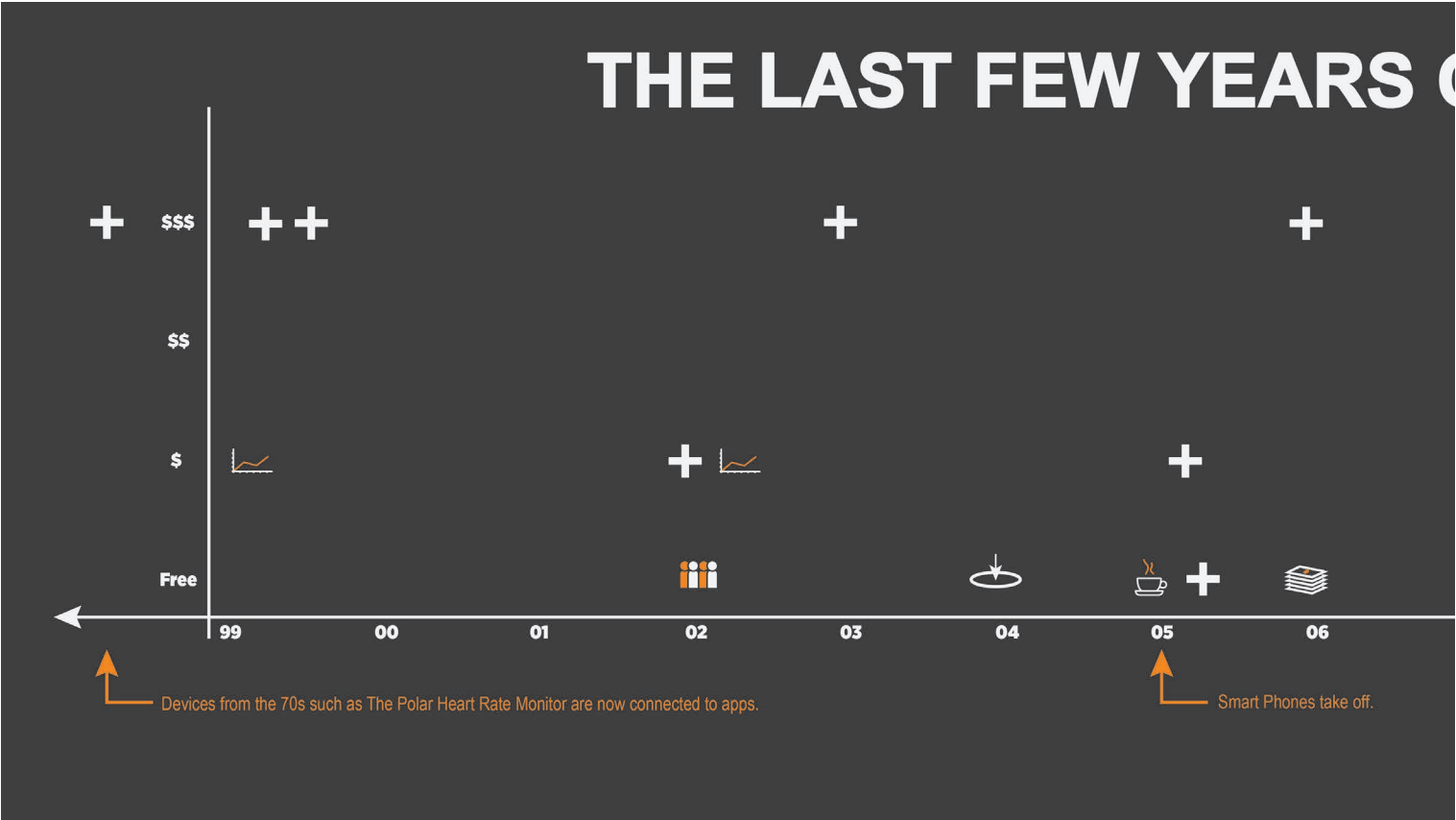
Figure 3 does not show every activity tracker from the sample studied because they were not all needed to display the trends.


There is an obvious increase in the number of activity trackers over time, with a spike in 2008 after the release of the iPhone and Android. During this spike many of the activity trackers made are cheaper than what had been seen before or were entirely free. After this time the number of new activity trackers slowly declines and fewer of the new activity trackers are under \$10. Soft data types were popular during this time however less new soft data activity trackers have appeared since.

Literature Review Introduction

Activity trackers change what an activity might mean to consumers by giving them a sense of control over their lives and larger investment in the activity being tracked. While this is the purpose of activity trackers, there are many other ways in which the user might experience the activity. They might change the way consumers think about everyday life by turning leisure activities into something productive. The activity being tracked might become a public performance or be limited by the design rather than being a true representation of the self. Even documenting an event changes experience and memory. Once the data is collected it still gets interpreted and summarised by a software, changing its meaning and the meaning of the user's life.

Benefits of Self-Tracking






ENVIRONMENT

These services track the environment such as the weather, or energy your usage. This is often done to reduce negative effects on the environment.



LIFESTYLE

These services act as a diary and a record of everyday life without a specific goal in mind e.g. taking photos of your food.



MOOD

These services track feelings, they aim to improve wellbeing and often connect people experiencing similar things.

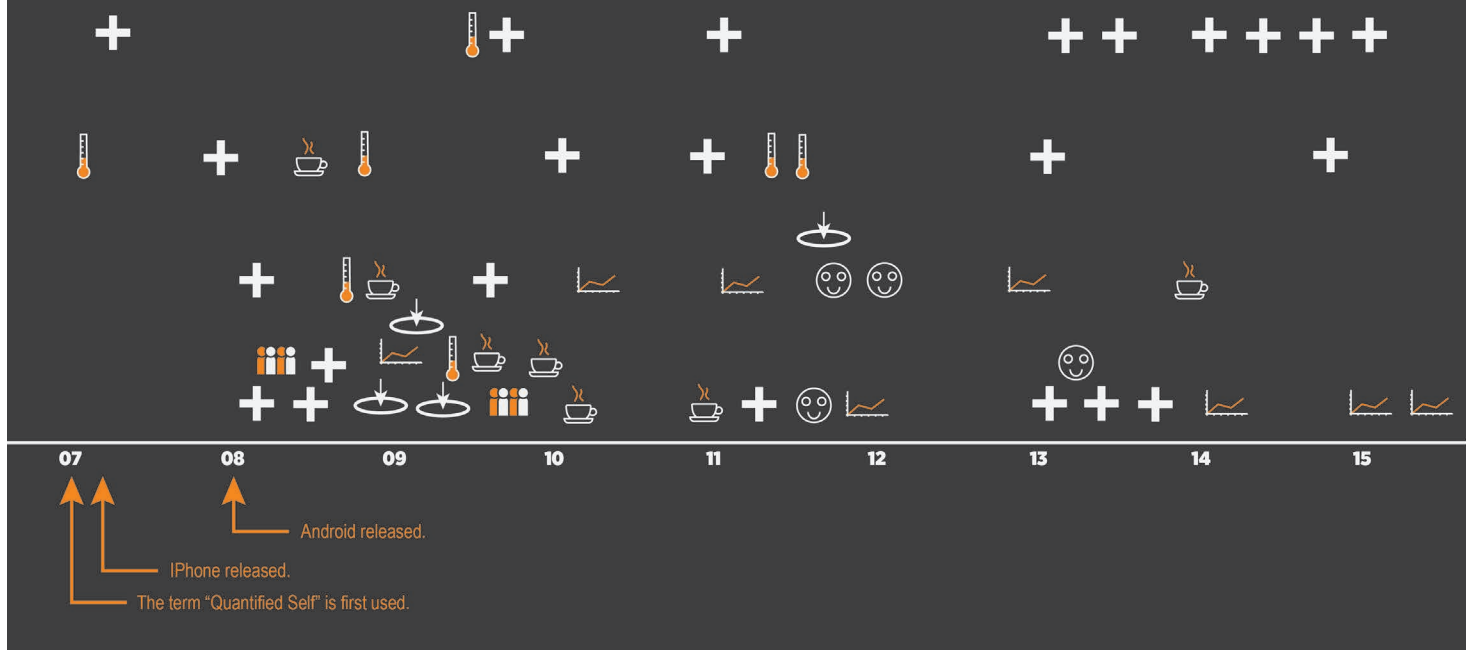


FINANCE

These services track spending and allow you to create budgets. This helps to facilitate saving money.

Figure 3. Cost of activity trackers over time

OF ONLINE TRACKING



RELATIONSHIPS

These services quantify relationships between people. This is usually done through online activities using APIs.



HEALTH

These services collect data like weight, time slept or period cycles. This is can be collected with sensors e.g. a pedometer.



LOCATION

These services track your geographical location, often to promote or show loyalty to a venue.



PRODUCTIVITY

These track activities like web use but can be very general. They aim to make you more efficient.

Self-tracking often intends to improve the outlooks of consumers by taking advantage of personal data however the systems surrounding self-tracking apps and services intentionally limit the consumer's access to their personal data.

Personal Benefits

Self-tracking is done primarily with the intention to document or change everyday activities. Rettberg (2014) concludes that "being able to measure something gives us the sense that we can control it" (p.62). Walsh (2011, as cited by Bushhousen, 2014) and Dancy (2014) both have rigorously tracked their lives and assert that it has made them better. By identifying their habits they both believe that self-tracking has given them the ability to gain control over their lives and to make themselves better people. Rettberg (2014) defines this use of self-tracking as "the mediation of technology to help us see ourselves better, to understand ourselves or to improve ourselves" (p.2). This might be inward focused or as Swan (2012) suggests, it could allow people to "operate more harmoniously in cycle with their internal and external environment" (p.239). It is possible because of the ongoing and passive data collection rather than focusing on a final goal. Self-tracking also acts as a way to document some aspect of everyday life. It is a "'dear diary' to tell our secrets to when nobody else will listen. Other times we want to share our experiences with others" (Rettberg, 2014, p.2).

In order to improve the self through self-tracking the data collected needs to be interpreted into something meaningful that requires some action from the individual. Swan (2012) explains that this is done by looking for correlations and anomalies in the data collected. However the real benefit of using self-tracking web services and apps "is the ability to deliver real-time ambient suggestions from the passive data climate to the user in unobtrusive ways" (p.235). An online service can make it easy to cross-reference data, but it also helps to bridge the gap between interpreting the data and taking action. Weigel (2015) has experienced "weekly updates and encouraging badges" (para. 7) so that she always knows that she is making progress and what the next step might be.

Not only can this self-tracking improve the habits of the consumers but it can improve their outlook on life. Rettberg (2014) describes one of the benefits of self-tracking that it is "confronting" even when "we are not paying attention" (p.2). However it phrases any setbacks as a "step on the way to some as yet unknown future" rather than a failure (p.30). It places the focus on progress rather than resigning a setback to something that cannot be changed. This, and other ways of looking at personal data, changes the way that people think about their lives. "We use the data to adjust the stories we already tell ourselves about our daily lives, and we use our stories about our lives to adjust, excuse or understand our data" (Rettberg, 2014, p.71). It also changes the way that people think about the activity that they are tracking, often the act of documenting

something “can make people feel more pride in what they do” (Rettberg, 2014, p.71).

Restrictions on Personal Benefits

The limitations of self-tracking are either part of the systems surrounding the services or are personal to the consumer. Moving data between services and sharing personal data between companies and the consumer is difficult. Rossiter and Zehle (2015) argue that users’ access to data may be “deliberately limited through design and infrastructure”, which is certainly the experience that Rettberg (2014) had when attempting to access her call history through her cell phone provider. She was given a printout of the information and she says this was so that she couldn’t graph or analyse it as easily. It is hard to believe that her cell phone provider was being malicious, more likely they did not consider the information useful to her and were unaccustomed to such requests.

Swan (2012) recognises that some progress has already been made to increase the access to, and usefulness of personal data. She talks about the emergence of a specific type of web service, one that will “integrate data flows from different IOT quantified tracking devices, web services, and social networking activity” (p.231). Manovich (2014) proposes an entirely new speculative solution to the wider issue of sharing and manipulating data which can be applied specifically to self-tracking and personal data:

It is interesting to imagine a cultural ecology where all kinds of cultural object regardless of the medium or material are made from Lego-like building blocks. The blocks come with complete information necessary to easily copy and paste them in a new object - either by a human or machine. A block knows how to couple with other blocks - and it even can modify itself to enable such coupling. The block can also tell the designer and user about its cultural history - the sequence of historical borrowings which led to the present form. And if original Lego (or a typical twentieth century housing project) contains only a few kinds of blocks that make all objects one can design with Lego rather similar in appearance, software can keep track of an unlimited number of different blocks (p. 211-212).

While both of these solutions would be a huge step forward in making the data more useful to consumers it will mostly improve access to self-tracked personal data rather than enabling consumers to use the personal data collected on them by other parties.

Self-tracking requires a commitment which is another barrier for consumers. According to Swan (2012) when someone starts to self-track they do not get the immediate satisfaction of variability of metrics or a clear indication of actions that should be taken, causing the consumer to lose interest. The designer

needs to build services that hold the attention of the consumer. The consumer in turn, needs to follow through with the promise that they make to themselves when they decide to self-track.

Commodification

Many companies are collecting personal data on individuals and turning this into a commodity for marketing, insurance or other purposes. Manovich (2013) explains that “companies have been systematically turning the elements of various subcultures developed by people into commercial products” (p.233). In this case it is the Quantified Self movement. This commodification of personal data changes the ways that everyday activities are viewed.

Self-tracking changes everyday activities into something measurable and productive, “harnessing previously ‘wasted’ energy” (Sondergaard, 2016, para. 1). Rossiter and Zehle (2015, para. 12) speculate that;

capital remains on course to mine value from the datafication of human activity, organic and inorganic life. And even if such economies are still limited in terms of the exchange and profit generated directly, they have already redefined the way we talk about infrastructures of life and labour.

Weigel (2015) agrees and discusses an implication of this; if there is no distinction between work and leisure then one will

never rest. Self-tracking is a lifestyle that requires us to be productive all the time.

Sutzi (2016) discusses the way commodification of data changes how people interact with each other. Services are designed to offer social capital in return for engagement and so “leave little space for anything outside of exchange” (Sutzi, 2016). If social interactions are quantified then the focus is no longer on the depth of the interaction and sharing but rather on producing social capital (Sutzi, 2016).

Subjective and Expressive Self-Tracking

App and web designers and social expectations guide self-tracking and therefore change what self-tracking and the activity being tracked might mean to the user.

Personal Data as Self-Representation

Sondergaard (2016) describes biometric data as being both an extension of the body and a representation of the body. It becomes difficult to distinguish between the self and representations, not just with biometric data but with other more subjective types of data too. Gina Neff (2015) clarifies this by simply saying that “the line between the data and the self is only where a person chooses to draw it” (as cited by Urist, 2015, para 19). Rettberg (2014) also argues that while personal data often comes in the form of numbers and spreadsheets it can

act as a means of self-representation similar to a self-portrait or autobiography. These personal narratives are communicated very differently through data, they are both “very accurate and very narrow” (Rettberg, 2014, p.62), often only showing a snapshot rather than explicitly telling a complete story.

If personal data is a representation of the self, then self-tracking can be used for this purpose, whether this is done with a focus on raw documentation or on curation. Manovich (2013) discusses a way to do this using tactics. Tactics “are the ways in which individuals negotiate strategies that were set for them” (p.228). In this case the design and the cultural expectations are the strategies. The tactics are the control that self-tracking allows so that users can create something that feels true (Rettberg, 2014, p.12). If they don't feel accurately represented or don't like the data then they can easily change it, or they can change the meaning behind what they do.

The increase in self-tracking and the recognition that personal data can be used as a form of self-representation has naturally led to an increase in data art. Artists use personal data visualisation as a form of expression or self-tracking as a form of performance art. As with many things in the art world it is difficult to define where either of these things actually become an artwork (Rettberg, 2014). Urist (2015) debates the significance of this type of art by saying that:

On the one hand, data art may just be a link in a

chain of artists who record and display their personal movements... on the other, data art may be the apogee of self-expression - a digital fingerprint that says more about modern man, and the inevitable forward march of time, than anything artists have been able to produce before. (para. 20).

This argument is supported by Frick (as cited by Urist, 2015), a data artist, who believes that self-tracking “allows a viewer to see her nuances and idiosyncrasies in higher resolution - and to discover things she may have forgotten about herself or perhaps has never known” (para. 12). This doesn't consider the flaws of data-ism, it should also be noted that artists use many different mediums display their “nuances and idiosyncrasies” for a myriad of different reasons. This just happens to be the medium that some choose as it is particularly relevant and dynamic at the moment.

Self-Expression Restricted by Design

While self-tracking can be used as a form of self-expression, for most people an app can limit self-expression “even more than pre-digital media” (Rettberg, 2014, p.23). Sutzl (2016) explains that this is because users “can only do what the platform allows”. Unlike pre-digital media most people don't have the skills or money to employ tactics effectively and so their self-expression is very limited. While some people can use software production to allow for better representation and expression, most can only choose between different apps and

web services. Fortunately there is a huge range in what is available (Bushhousen, 2014), from very focused and formulaic to more general and adaptable.

The apps and web services that help people collect personal data are made by designers, by people, and so cannot collect or present entirely objective information. Rettberg (2014) uses the example of the Narrative Clip which takes continual photos from a small camera which is often clipped onto the lapel. She finds that all the photos she collected were of the sky and comes to the conclusion that “lifelogging cameras were designed for people with flat chests” (p.52), they were designed for men. Everything from the aesthetic design, to the suggestions made, to the data collected, carries the bias of the app designers. It all affects the user’s ability to represent themselves rather than to be represented by the designer.

Self-Expression Restricted by Cultural Expectations

The idea that our existence is given meaning through sharing and receiving responses is a popular one. It is supported by Rettberg (2014), Sutzl (2016), Weigel (2015) and it is certainly one of the reasons why so many self-tracking apps and web services encourage or require their users to be social with their personal experiences and data. Weigel (2015) puts it simply; “you become who you are by saying what you did” (para. 13); social interactions are the main way that people develop their identities. Despite this push to share personal data on social

media “many users prefer to keep their activity data private, or to only share some of it” (Rettberg, 2014, p.12).

The main reason that users might be reluctant to share their personal data with others is the strict social etiquette and the discipline employed when this isn’t followed. Rettberg (2014), explains that “our shared ideas about what moments and milestones should be documented in life act as cultural filters that affects our choices” (p.24). Weigel (2015) notices that it is acceptable for people to obsess over their bodies as long as the discussion is focused on health rather than beauty. This is an example of a cultural filter dictating the way that health data should be interpreted. Sondergaard (2016) and Sutzl (2016) both agree that when somebody shares personal data outside of what is acceptable, maybe because it is too intimate, too explicit or simply because there is too much of it, then it becomes an act of oversharing.

Hatred, ridicule and pathologizing are used by society to discipline those seen to overshare (Burns, 2013, as cited by Rettberg, 2014). Rettberg (2014) notes that accusations of being “narcissistic or exhibitionistic” (p.18) are commonly made against women who share personal data. “This is about power and who has the right to speak in public” (p.18). We can see that the systems in place to ensure that women do not speak out in public apply in digital spaces in the same way they do physical spaces. Han (2014, as cited by Sutzl, 2016) calls this ‘smart power’ and describes it as a type of discipline

that is self-perpetuating rather than a form of discipline that has resistance.

These cultural filters and discipline change the way that people use self-tracking to represent themselves. Rather than self-tracking for the self it becomes a public performance that is done to either reinforce or break down these cultural filters. Poster (2007) argues that sharing personal data is a way for people to form “new relations to themselves and making, despite appearances of subservience to culturally dominant norms, an art of living... not actualizing themselves... but exploring possibilities of personhood in the age of information machines” (p.175).

Quality in a Quantitative World

Self-tracking can enrich or disintegrate the experience that is being tracked. The different ways of finding meaning in data can affect the outlook of the users.

Experience Collapse and Enrichment

Dancy (2014) tracks his personal data to the most extreme extent but even he says that “it’s hard to see someone on their smartphone and not think to yourself; hmmm, they’re not paying attention, they’re not really in the moment”. This aversion to technology has not received much attention in self-tracking literature but has started to enter the discourse in the last few

years. Rossiter and Zehle (2015) define experience collapse as when the present is forgotten in the act of archiving. While it is easy for self-tracking to be seen as a distraction, there are other things that self-tracking does to cause experience collapse.

The record of an experience is very different to the experience itself. Sondergaard (2016) describes personal data as “an object of purity; something you cannot touch or smell” (para. 4). While data isn’t pure in the sense that it is objective, the clean world of numbers is far removed from the mess of human life that it is trying to track. This is true at least in a physical sense and is used in the marketing of activity trackers. Sondergaard (2016) uses the example of menstruation trackers and argues that the “phenomenological experience of how your period feels is lost in quantification, which potentially also loses any subjective knowledge of the workings of your inner body” (para. 17). She says that this process allows us to deny menstruation and to civilise it.

Another way that self-tracking might cause experience collapse is by placing a high value on the specific thing being quantified rather than the experience overall. Weigel (2015) talks about her experience of using a Fitbit;

FitBit tells us back a story of our lives that has become highly abstract. The difference between the springtime run that you take with two friends and the

half hour of jumping jacks that you do in the bathroom after not managing to throw up all of a chicken burger will not register. In this life, steps are steps (para. 20).

The act of using her Fitbit not only distracts from the joy of going for a run, but it renders that part of the experience completely unnecessary by ignoring it.

Not only is it possible for there to be a collapse in the experience but also a kind of relationship collapse. Experience collapse affects social interactions when they are quantified and turned into personal data. Gregg (2011) discusses the way that sharing and social capital leaves us with “the prospect of being unable to appreciate the benefits of intimacy for unprofitable purposes” (p.6). Another way that activity trackers do recognise relationships is through competition however, Weigel (2015) is also concerned that this might become our only form of interaction. Either way self-tracking could lead to a “network of isolated selves” (Weigel, 2015, para. 27) rather than true intimate relationships.

In contrast to this self-tracking is also a way to enrich the experience of the thing being tracked. Rettberg (2014) says that this happens because self-tracking makes people more invested in what they are doing. It also allows us to aestheticise the everyday, a “method to become more mindful of our daily experiences” (Rettberg, 2014, p.25). There is very little else

written about the way that self-tracking might enrich experience.

Finding Meaning in Data

The struggle to make personal data meaningful is all part of adjusting to a digital society. Swan (2012) recognises that people use correlations and anomalies to explain the data however they still often have a “so what?” (p. 235) response. This is because data flows are new to the consumers and they are unfamiliar with how to interpret them. Rettberg (2014) says that as people become familiar with reading personal data they will become “adept at interpreting them as stories” (p.11). Using activity trackers changes the way that this data is interpreted even before it gets to the point of being seen as a narrative.

Humans see data very differently to the way that machines do. “From the human perspective, there is mainly just one traditional concept and mode of behaviour regarding data, the binary filter of important or non-important” (Swan, 2012, p.236). Swan (2012) argues that this is why most of the data collected before automation is salient and why in the past “the related actions to take are implicit to the user from the information display” (p. 236). Now however, this is not the case. Rettberg (2014) explains that an activity tracker “lacks the knowledge of the human’s emotions and memories” (p.55) and so cannot differentiate between important and unimportant data. Swan (2012) explains that this distinction can only be made when users find data streams that are resonant and meaningful to them.

Users show their data in more meaningful but less precise visualisations as a way to humanise the data (Rettberg, 2014, p.70). Rettberg (2014) discusses the specific example of the narrative and highlights the difference between personal data and the traditional narrative; “there is no closure” (p.58) it is more like a diary. It tells the story of the user’s life. By giving the personal data meaning and shape, it gives the person meaning and shape to their lives. Swan (2012) sees this as “an opportunity to make better tools” that find the narrative rather than drowning it in meaningless data. Hayles (2004) describes this machine as an active cognizer, something that could even “learn what particularly moved each user” (Rettberg, 2014, p.56) and then emphasise those things in the data display.

The Cryptopticon

Potential surveillance of self-tracking data might change what the activity means to the consumer.

That personal data is vulnerable to security breaches and that activity trackers do not intend to keep data private is a concern of Bushhousen (2014), Weigel (2015), Swan (2012), and others. Manovich (2013) describes this fear as coming from “the darkest years of the cold war - except that now we are being tracked with RFID chips, computer vision surveillance systems, data mining and other new technologies of the twenty

first century” (p.202). It is this technology that Manovich talks about that makes self-tracking on this scale possible but it also opens up opportunities for surveillance. It is a privilege to avoid being tracked, it requires “you to have very sophisticated technical knowledge or have a lot of money” (Angwin, 2014, as cited by Rettberg, 2014, p.8). Aside from the possibility of a security breach the sheer quantity of personal data available to the public makes for a significant threat to maintaining privacy. Someone might use a number of different services to track their data including social media and while “users themselves share this information, it cannot be said as a privacy loss, but if all these data can be combined together, it will give out much more information than desired by the users” (Gupta, 2013, p.3).

It is assumed that a lack of privacy changes the way that people behave, they “don’t commit crimes” (Rettberg, 2014, p.85) or social faux pas “because we know we could be caught” (Rettberg, 2014, p.85) and disciplined in some way. Many discussions of self-tracking refer to the work of Michel Foucault to support their arguments (Rettberg, 2014). Foucault outlines “the main principles of the disciplinary prison [the panopticon] that are isolation, work and detailed regulation of the conduct in time and space, modulation of penalty” (Sargiacomo, 2006). Self-tracking is often the practice of monitoring behaviour, and the ways that it might be conducive to isolation and work have already been discussed. Self-tracking is certainly a ‘panopticon-like’ system, it is “capable of making all visible” (Foucault, 1977).

Surveillance is now well known and taken for granted so the idea of the panopticon is no longer entirely relevant. Vaidhyanathan (2011) suggests the cryptopticon, which differs from the panopticon in that “we don’t know all the ways in which we are being watched or profiled - we simply know that we are. And we don’t regulate our behaviour under the gaze of surveillance. Instead we don’t seem to care” (Vaidhyanathan, 2011, as cited by Rettberg, 2014, p.85). Surveillance in the traditional sense is still a concern to others but is not relevant to this thesis.

M e t h o d o l o g y

Interviews

Survey

The preliminary survey was conducted for two reasons; the first was to gather basic information about how people are self-tracking, and the second was to introduce possible interviewees to the research. There are two sections to the survey, each directly relating to one of these purposes. The survey took the form of an online questionnaire, to allow for “collecting a lot of data in a short timeframe” (Hanington & Martin, 2012, p.172). The survey was designed to ensure that any participants who continued to the self-tracking activity would be able to complete it. It was also important that survey questions started to provide contextual information that might affect the participants experience of the activity and to guide specific questions that were asked when they were interviewed. According to Kuniavsky (2003) Survey questions should identify and eliminate people who have a conflict of interest.

The survey was promoted online through social media and within the university, specifically targeting the first year students who were not yet biased from their studies. The survey was shared to appropriate groups after first taking note of the “community’s rules” (Kuniavsky, 2003, p. 91) and getting the “organisers permission” (Kuniavsky, 2003, p. 91) where appropriate. Kuniavsky (2003) points out that “people who match your recruiting criteria are likely to know other people like themselves” so participants were able to and encouraged

to share the survey with their friends and family.

The survey (See Appendix B) firstly aimed to clarify demographic information about the participant. This was done in order to rule out participants who might be underage, and therefore could not be a part of the study due to the terms of approval by the Victoria University of Wellington Ethics Committee. It was also to rule out participants who were experienced in media studies or app design and would therefore be biased in their responses. Participants were already much more likely to be in the 18-34 year old age group and have a higher income, due to the methods used to promote the survey. Secondly the survey aimed to determine if the participant would be able to complete the self-tracking activity easily. Any participants who did not own smartphones were not asked to continue on to the activity, however this should not rule out many participants, as over seventy percent of adult New Zealanders do own a smartphone (Research New Zealand, 2015). Finally the survey aimed to collect information about the participants current self-tracking habits.

Self-Tracking Activity

Section two of the survey provided the participants with information about the self-tracking activity and interview, and collected their contact details. The participants were first given the following description of the activity and then asked if they would like to participate. Participants only continued if they indicated that they were interested in the activity. Participants

were then provided with several suggestions of what they might be able to track and how. Each service suggested was free and available to download and did not require additional devices to use. The services collect a variety of data types to allow participants to be in control of decisions and invested in the activity without having to do their own research. Participants were then asked questions to gather preliminary information about their self-tracking. This information was used in preparation for their interviews. They were also asked for their names and details.

A total of nineteen participants filled out this section of the survey. Polkinghorne (1989) suggests that only approximately fifteen participants, and no less than five participants are interviewed (as cited by Creswell, 2013, p.61). Participants were then selected based on their answers and availability to make a total of 6 interviews.

Interviews

The purpose of the interview was to examine the experience users had with activity trackers. This included the experience of self-tracking and the “contexts or situations [that] have typically influenced or affected” (Moustakas, 1994, as cited by Creswell, 2013, p.61) self-tracking. Both of these things needed to be discussed in order to gain a phenomenological understanding of the experience (Moustakas, 1994, as cited by Creswell, 2013). Each topic discussed in the interview needed to be divided into at least two questions to address the

experience and the context.

Kuniavsky (2003) also provides useful criteria for framing interview questions:

- Questions should “concentrate on immediate experience.” (p.120). It was better that participants were not asked to speculate but rather to discuss what actually happened and how they felt.
- Questions “should be focused on a single topic” (p.121) so that participants could provide clear answers and so that the interviews could be easily analysed.
- “Keep questions open-ended” (p.121) so that participants could discuss their experience with detail and depth.
- Questions should not be leading “since they inject the prejudices of the person asking a question into a situation that should be completely about the perspective of the person answering it” (p.119).
- “Questions should be non-judgemental” (p.121) to ensure that the participant felt comfortable giving any answer.

With the purpose of the interview and criteria for questions in mind an initial list of interview questions were drafted (See Appendix C.). A practice interview was then conducted to evaluate the proposed interview questions. The length of the interview was suitable, it took approximately a quarter of an hour, however the participants being interviewed were likely to have more to say bringing it closer to the half hour limit. It was also better to allow for more time than what was expected.

Initial feedback suggested that the questions have more direction and that they be individualised. In order to do this the interview needed to be unstructured, allowing the participant to be more conversational and comfortable (Hanington & Martin, 2012). It still required a “guiding set of topics” (Hanington & Martin, 2012, p.102), in this case the four main topics are outlined below:

- **Expectations**
 Participants described the expectations they had of the activity before they started tracking.
 Participants described their possible expectations for the experience of self-tracking and the activity they tracked.
- **The Service**
 Participants described their experience of the activity before it was being tracked.
 Participants described their experience of the technology and its functionality. They also discussed their decision making process in choosing the service.
- **Sharing**
 Participants described the way they would talk about the activity before they tracked it.
 Participants described their decision to share or keep their personal data private, they also discussed how this changed their experience of self-

tracking and their activity.

- **The Data**

Participants described what the activity meant to them before they began tracking.

Participants described their experience and understanding of the data and how this changed or didn't change the activity that they were tracking.

Each section needed to discuss both the participant's experience and the context and was planned to take no more than seven minutes. Kuniavsky (2003) explains that the structure of the interview should be “an hourglass shape that begins with the most general information and then moves to more specific questions before stepping back for a bigger perspective” (p.118). This was reflected in the order of the interview sections which not only progressed in roughly consecutive order but placed the broader ideas at the start and end of the interview.

At the beginning of the interviews an effort was made to “establish the role of the interviewer as a neutral, but sympathetic party” (Kuniavsky, 2003, p. 118) to ensure that participants responses were genuine. This was continued throughout the interviews through “no attempt to agree or disagree with the [participants] original statement, rather an attempt to elicit more information” (Beech, 1999, p.7). “After each interview takes place the information available to the researcher increases. Consequently, the process of reflection

and quieting of the mind must be carried out prior to all interviews.” (Beech, 1999, p.6).

Data Analysis

Creswell (2013) outlines the best way to analyse phenomenological data is to start by highlighting “significant statements”. These are determined by their intention and implication. “The value of the story” Beech (1999) explains “lies in the access it gives to the person’s experiences, and not in its relationship to any claims to an objective truth.” (p.3) These significant statements were then grouped into clusters of meaning forming themes.

Diagrams were used to organise the relationships between these themes, firstly a tree diagram was drawn up as a way to further group and “communicate hierarchy” between the themes. (Hanington & Martin, 2012, p.22). Figures 4, 5 and 6 show the three branches of the tree diagram.

Once the data had been organised into themes and clustered it was then put into the thematic network shown on figure 7 to “explore relationships between themes so that the most unifying message can be visualised” (Hanington & Martin, 2012, p.178). The blue text in figure 7 simply shows the tree diagram however the relationship between points are also show with the pink arrows and text. The yellow stars show points which were particularly important to many of the participants while the green arrows show the logical order in which to structure

the results in the writing.



Figure 4. Tree diagram of interview analysis, benefits of self-tracking

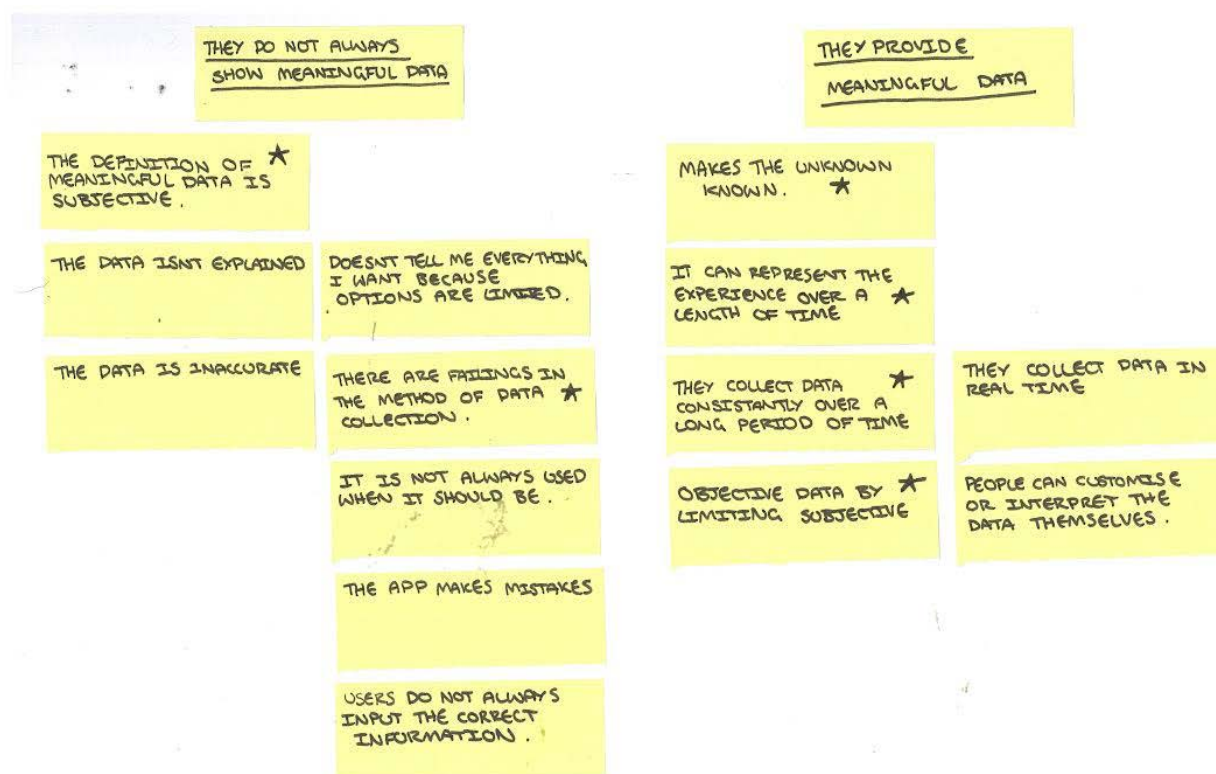


Figure 5. Tree diagram of interview analysis, subjective and expressive self-tracking

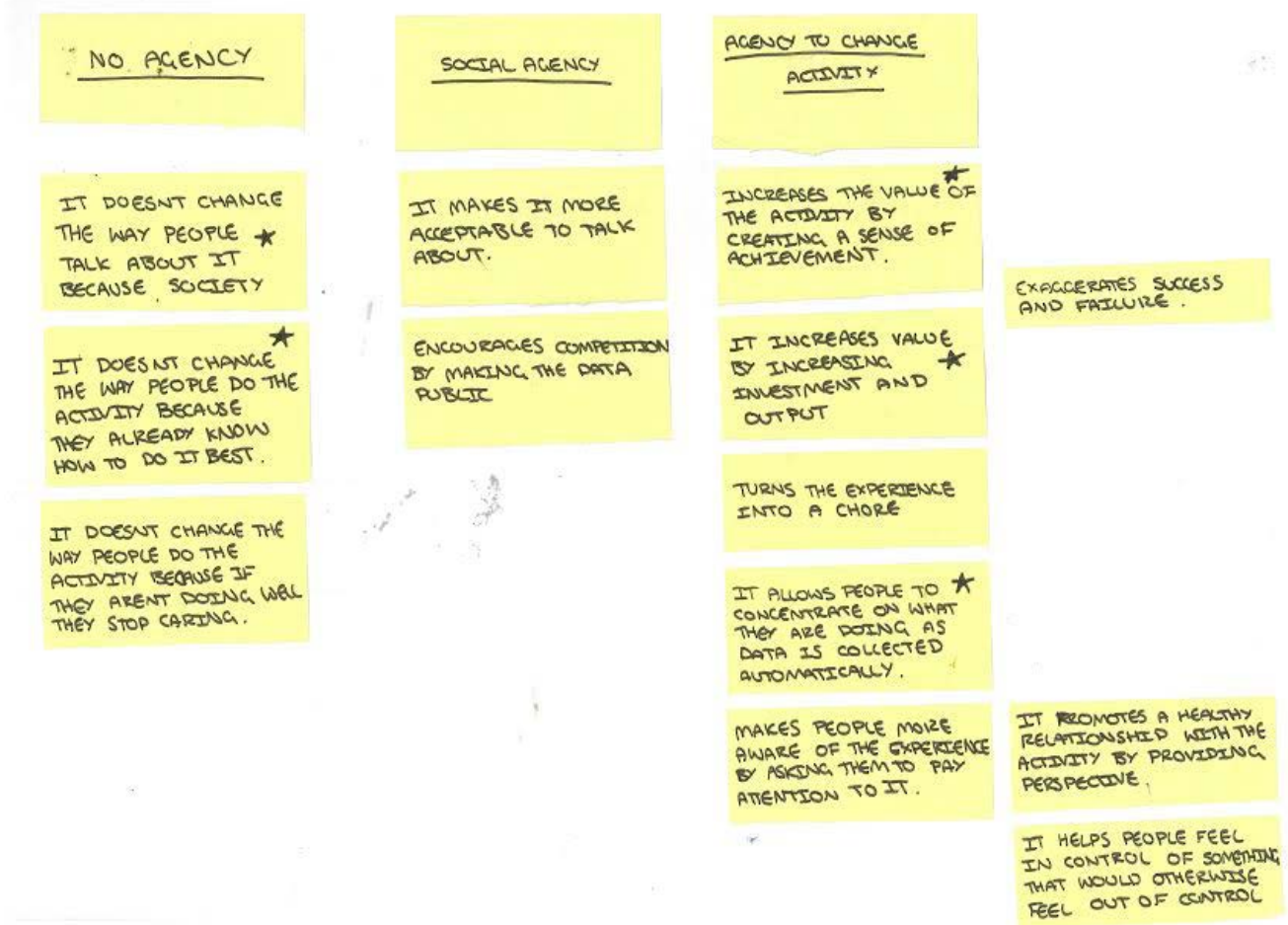


Figure 6. Tree diagram of interview analysis, agency of activity trackers



Design

Conceptualisation

Precedent work was looked at when conducting background research and could be divided into two categories; data artists who were interested in visualising their information such as Laurie Frick (2014) or performance artists who used self-tracking in their work such as On Kawara (1969, as cited by Lippard, 1973). These two types of art were used as a focus and inspiration for the generation of concepts for the resulting works.

A map was drawn up on which design ideas were placed, linking a relationship between interview themes shown in figure 8. This made a starting point to further develop more successful concepts, they were judged on their simplicity and ability to be confronting either for both the artist and audience.

Experimentation

Research through design was then conducted as experimentation and development of these ideas. This involved documentation of the design process and explicit explanations of decisions made. Hanington and Martin (2012) describe research through design as “the design process itself, including materials research, development work and the critical act of recording and communicating the steps, experiments, and iterations of design” (p.1146). A major part of this was parallel prototyping which allowed for a few different outputs to

be designed. Parallel prototyping is a useful method to “keep from fixating on a design direction too early, improve the nature of design critiques, and lead to more effective design results” (Hanington & Martin, 2012, p.122).

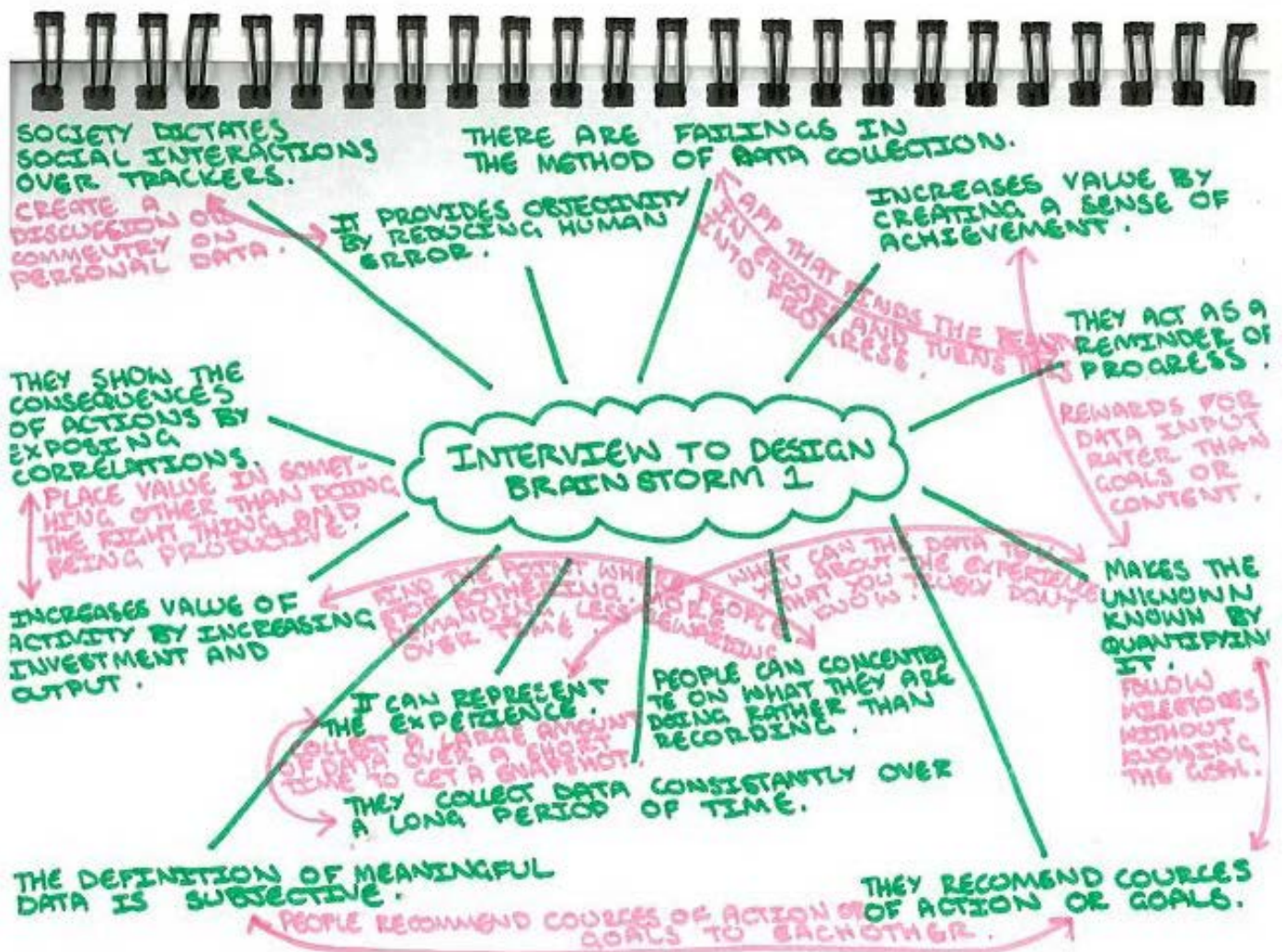


Figure 8. Design concept generation map

I n t e r v i e w s

Survey Results

Demographic Information

The majority of participants were born between 1992 and 1998. Figure 1 shows that this group were teenagers when self-tracking became popular and so will have had a unique understanding of it. The majority of participants were also students although most did not specify what they studied. Most students are still developing their sense of self and so self-tracking might have different significance for this group than for adults who tend to have a more stable sense of self.

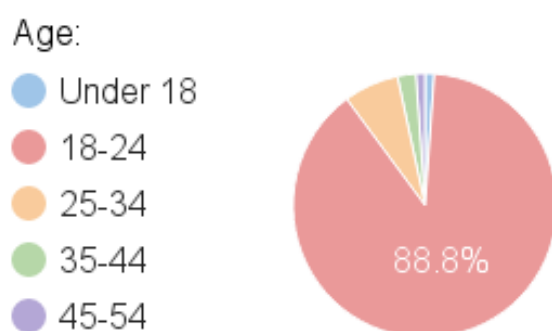


Figure 9. Age groups of survey participants in percentage

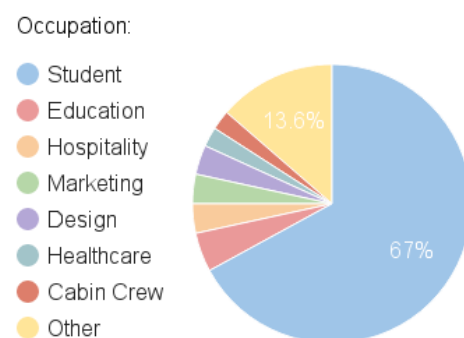


Figure 10. Occupations of survey participants in percentage

Internet Use and Ability to Complete Activity

Figure 11 clearly shows a normal distribution curve with the majority of participants spending between eleven to forty hours online. There is a large difference between eleven and forty hours and the most popular response of eleven to twenty hours only made up 34.44% of the total, only marginally more than twenty one to forty hours.

Most of the participants gave multiple responses when asked what they viewed most frequently, several gave as many as four or five different answers. Social media is by far the most popular type of content for this group of respondents to view online for leisure however it should be noted that many of these content types overlap and multimedia websites might count under several of these headings (Manovich, 2013).

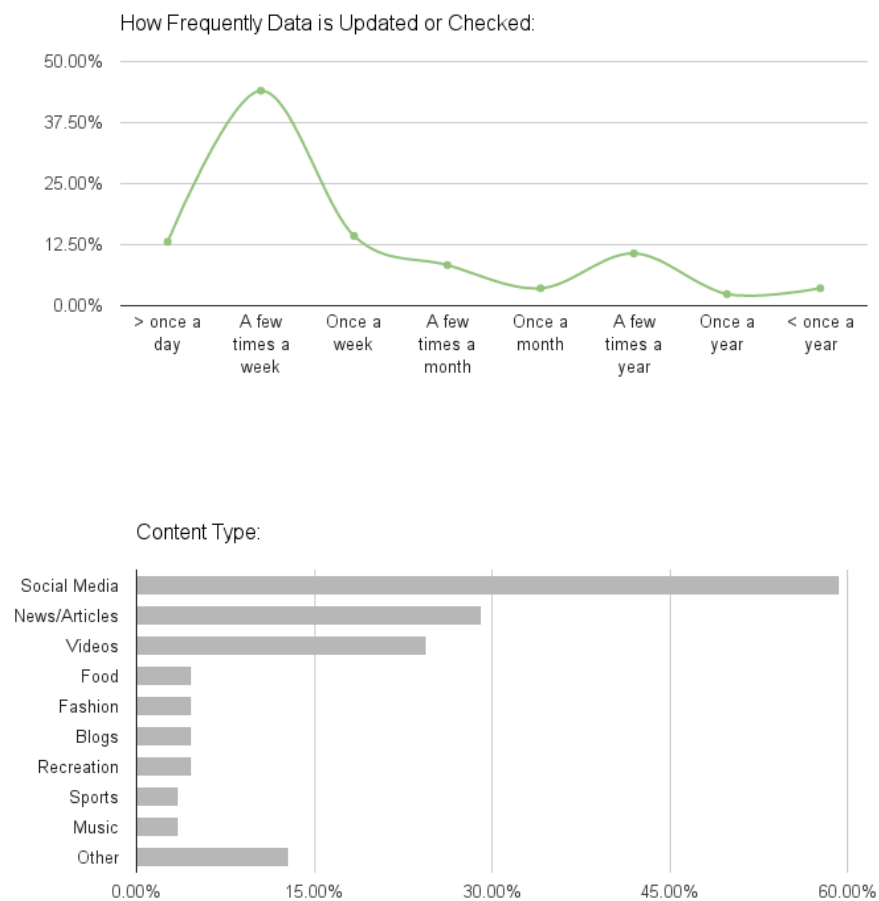


Figure 11. Average number of hours survey participants spent online

Figure 12. Content viewed most frequently by survey participants

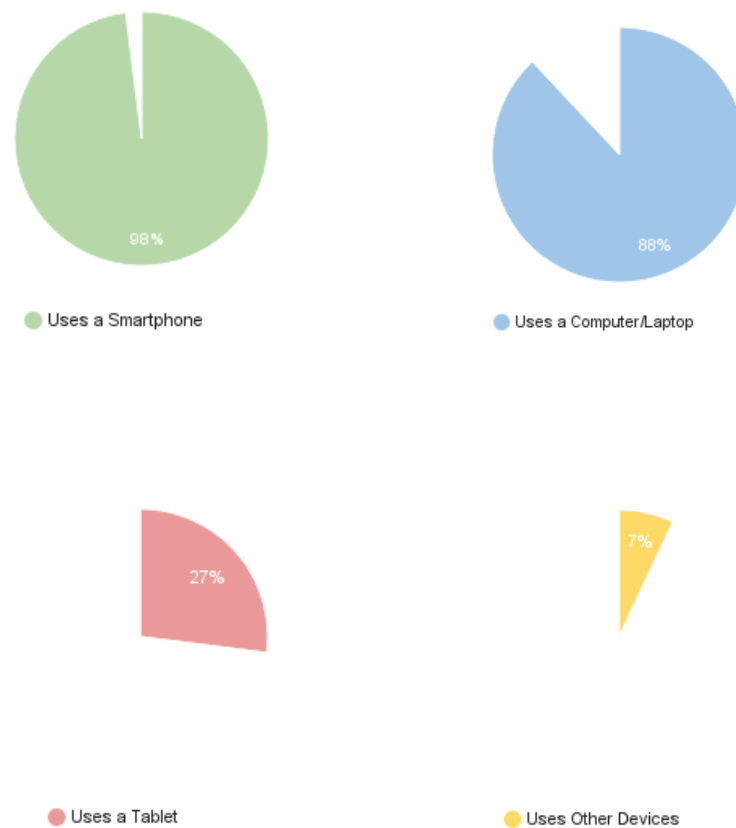


Figure 13. Survey participants who own and frequently use a smartphone by percentage

Figure 14. Survey participants who own and frequently use a laptop or computer by percentage

Figure 15. Survey participants who own and frequently use a tablet or ipad by percentage

Figure 16. Survey participants who own and frequently use other networked devices by percentage

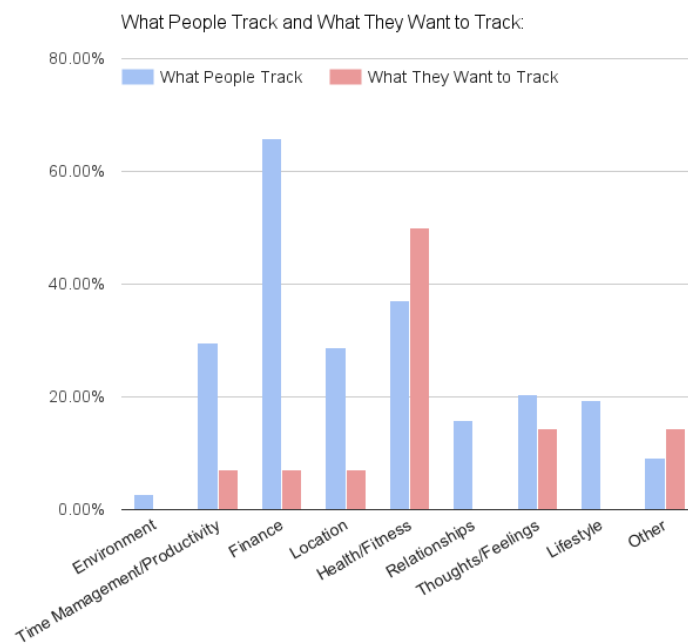


Figure 17. What survey participants tracked and what they wanted to track by data type

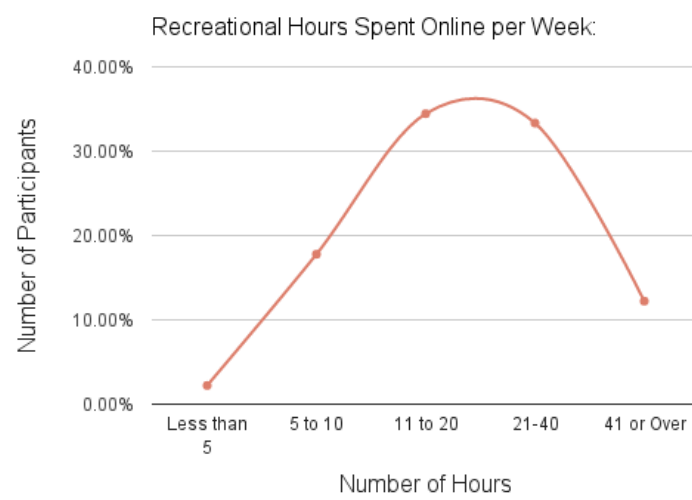


Figure 18. How frequently survey participants checked their personal data in percentage

On average, participants reported frequently using 2.2 different devices to connect to the internet; this was comprised mostly of smartphones and PCs. The 7% use of “other” devices mentioned included smart TVs, playstations, kindles, smart-watches and Fitbits. It is likely that this last 7% was under reported in the survey because participants would not consider them as connecting to the internet since they do not access the web.

Preliminary Information for Interview

In particular many people reported a desire to track their sleep which comes under the category of health and fitness. Most participants tracked their finance, usually through online banking or apps provided by their bank.

There is a clear long tailed bell curve in figure 18 showing that most people check their data a few times a week. This graph was fairly consistent for all types of data.

Interview Summaries

When writing about participants their names were changed to provide anonymity and protect their privacy.

Name	Data Type	Service	Date
Jennifer Wilson	Mood	Selfspective (Selfspective, n.d.)	11th June, 2016
Summary			
<p>Jennifer Wilson started using Selfspective (Selfspective, n.d.) as part of the self-tracking activity in preparation for the interview. She had used activity trackers sporadically before taking part in the research, focusing entirely on health data. Using the activity tracker enabled Wilson to notice when she was in a good mood by reminding her to think about it at those times. Correlations in the data also helped her to realise that the people she spent time with had a bigger impact on her mood than she previously thought. Wilson found Selfspective (Selfspective, n.d.) easier to use than she expected. The activity trackers she had used in the past often required her to do an activity and they would then collect the results. Mood was much easier for her to track because there were always results to collect regardless of what she was doing and so she didn't have to feel guilty about not doing something. Wilson used Selfspective (Selfspective, n.d.) both because it was recommended to her in the survey, and because she objected to the design of other mood trackers. She did not like the "frilly" aesthetic choices of other apps and liked Selfspective (Selfspective, n.d.) because it was clean in presentation. When Wilson first started tracking her mood she told the app that she was happier than she really was because she didn't want to admit to herself that she wasn't feeling that happy. It took her a while to realise that this was what she was doing, which resulted in a sudden drop in the data even though her mood had not really changed. Wilson found that tracking her mood throughout the day meant that she was able to recognise how her mood changed over time, rather than thinking of herself as having been in only one mood all day.</p>			

Name	Data Type	Service	Date
Harry Martin	Run	Nike + (Nike, Lnc, 2016, October, 4)	11th June, 2016
Summary			
<p>Harry Martin started using Nike + (Nike, Lnc, 2016, October, 4) to track his running in approximately January 2016. He wanted to track his running after being away and unable to run for a while to see his improvement and to motivate himself to get back into it. He said that staying fit was extremely important to him. He wanted to know exactly what he was doing rather than just having to guess and he used Nike + (Nike, Lnc, 2016, October, 4) because he knew that friends of his were using it. They shared their running data on facebook and Martin found that it made things more enjoyable and competitive. He was in competition with his friends but also with himself to consistently improve. Despite enjoying the competition he was embarrassed and apologetic about sharing his data to facebook, he said that he did not know how to turn this function off. The data could tell him a variety of things about his running and so he could see where his weaknesses were and how to improve. The app also acted as a personal trainer, but Martin wasn't interested in using this function. It was important to him that it was as unobtrusive as possible and that it didn't consume his run. Martin found that Nike + (Nike, Lnc, 2016, October, 4) would be a reminder to go for a run if he hadn't been in the last few days. He was surprised by how often he needed to be reminded. He knew the data was not perfectly accurate but he would use it to see overall trends so it this did not matter.</p>			

Name	Data Type	Service	Date
India Robinson	Steps	Apple Health App (Apple Inc. n.d.)	14th June, 2016
Summary			
<p>When Isabella Robinson first got her new phone it started tracking her steps automatically using the Apple Health App (Apple Inc. n.d.), she didn't realise this was happening until months later when her cousin pointed it out to her. From then she started actively using the app since it was collecting the data anyway. Robinson only thought about her walking as a means of transport but once she could see the number of steps she set herself the goal of walking 10 000 steps each day. This became an important aspect of walking for her and she became concerned about walking enough and walking for fitness. Robinson views the data as a reflection on her life, when she has the time to walk a lot it is because she feels more in control of other things in her life. She can see the overall trends over time and find correlations in the data and other things going on in her life. Robinson really valued that the app would collect the data automatically and that she did not have to do anything. She said that she would like to use activity trackers for other things in her life but only if they could also be collected automatically. Robinson felt that the data was true to her experience because it was so consistent and because she was using it to compare which days she had walked more or less rather than focusing too much on the number of steps as long as she had met her goal. She thought of the data as an unbiased view on her life, telling her what she had achieved without any kind of motive, so it gave her a real sense of satisfaction when she did achieve the 10 000 steps. Robinson would talk to her friends about it, especially with those who also track their steps and encouraged others to start if they didn't track their steps already. She wanted to share with them when she was doing well. If she was doing badly, Robinson said that she would stop looking at the data because she didn't want to see how badly she was doing.</p>			

Name	Data Type	Service	Date
Robbin Miller	Sleep	Sleep Cycle (Northcube AB, 2015, October, 23)	18th June, 2016
Summary			
<p>Miller found that when she started tracking her sleep it didn't mean as much to her, it was regulated by her parents as she was still at school. However, now she is responsible for herself and so it is much more important for her to keep an eye on what she is doing. Miller started using Sleep Cycle (Northcube AB, 2015, October, 23) in high-school because her cousin recommended it. She used it intermittently over the last few years. It was a fun challenge for her to keep using the app and a challenge to improve her sleep. She wanted to improve and was competitive with herself. If she had forgotten to use it for a while then a night of bad sleep might motivate her to try again. Miller didn't look at the overall trends shown in the data because she didn't trust that it was accurate. She didn't use it consistently and so couldn't understand how the app could represent data that she had not collected. Instead she looked at the data from a day to day point of view, to explain why she was feeling good or tired when she woke up. Some days the app wouldn't collect the data properly and she wasn't sure why. Since Miller started living with her boyfriend the app has picked up their combined data rather than just reading hers. Her boyfriend thinks that she is too reliant on technology. Now that she understands better how the app works she would like to start again to eliminate all of the data that wasn't collected properly. Overall it doesn't really change what she does, since she usually uses it as a normal alarm clock. It is something she might bring up while talking about her sleep but she finds that everyone naturally wants to talk about their sleep so often already. By using Sleep Cycle (Northcube AB, 2015, October, 23) Miller feels more able to be in control and to understand her sleep patterns.</p>			

Name	Data Type	Service	Date
Anna Davis	Steps	Pedometer ++ (Cross Forward Consulting, LLC, 2016, October, 5)	22nd June, 2016
Summary			
<p>For Davis walking was a mode of transport. If she wanted to exercise she would go for a run or go to the gym but walking was about getting out of the house and having a positive day overall. It was a bad day if she didn't leave the house. When she first started tracking her steps and using Pedometer ++ (Cross Forward Consulting, LLC, 2016, October, 5) she wasn't expecting to benefit as much as she did. In the past when she had tried to measure her fitness it was based around the amount of time spent being active. Using Pedometer ++ (Cross Forward Consulting, LLC, 2016, October, 5) was a far more tangible and accessible way for her to see progress and make goals that were relevant, rather than being too abstract or too easy. Davis found that using the app was a real motivation to achieve 10 000 steps each day. It helped her to view fitness in a healthy and positive light by showing her overall weekly results rather than just the number of steps for a day. Davis would use the app more if she felt she was achieving more and meeting her goal, or if she was doing poorly and wanted to improve. At the end of a day she would often check her achievement as part of her reflection before bed. She would also use it as a way to reflect on periods in her life; if she had been walking more or less over a few months she could see the trends or mark out important dates if the data was exceptional. If she was doing well she would want to share that with her friends and talk about it, however she made it very clear that she was not interested in posting her data to social media. Davis loved the way the app was designed. It was easy for her to use and was low maintenance. The data was collected automatically and she didn't even need to open the app to check the data.</p>			

Name	Data Type	Service	Date
Sarah Morgan	Sleep	Sleep Cycle (Northcube AB, 2015, October, 23)	5th July, 2016
Summary			
<p>Morgan started using Sleep Cycle (Northcube AB, 2015, October, 23) because although she would sleep for the whole night and she wanted to know more about her sleep patterns. She is more aware now of how she is sleeping and she feels better in the mornings because she is now waking up at the right time. Despite this she isn't concerned with the science behind sleep but likes to be able to make comparisons between nights and most importantly use the information to make better decisions. She learnt that she actually has a really good sleep pattern and she can see how other things she does during the day, like exercise or drinking coffee, affect her sleep. Morgan started tracking her sleep in high-school but she had a rigid schedule then; now that she's at university it is more varied and the data is more interesting. She really likes using the alarm function on the app as long as there is something she actually has to get up for. In the university holidays she does not want to be woken up and it is an annoyance for her. Morgan started using Sleep Cycle (Northcube AB, 2015, October, 23) because it was recommended in an article she read online about productivity. It is a way for her to quantify and understand her sleep which would otherwise be hard for her to examine. Morgan does not usually talk about her sleep or using the activity tracker because she thinks that other people would not be interested. Although she is worried about companies using her data and tracking her, she feels the benefits she gets from using the app warrant the risk.</p>			

Interview Analysis

The Benefits of Self-Tracking

Rettberg (2014) said that one of the real benefits of activity trackers is that they allow users to improve themselves by better understanding themselves. This was the first and most obvious comment made by participants during their interviews. There were two main ways in which this happened, firstly participants found that their activity trackers helped them to make better choices and secondly, their activity trackers helped motivate them to keep making these choices over a long period of time.

Activity Trackers Help People Make Choices

Participants whose activity trackers helped them to make choices were more invested in self-tracking and found it more meaningful and fulfilling. One of the main ways that activity trackers did this is by showing them the consequences of their actions by exposing otherwise unknown correlations between activities. An example of this was Morgan who manually input extra data into Sleep Cycle (Northcube AB, 2015, October, 23) about what she was doing during the day and integrated it into Nike+. “You can say it’s just about sleep but at a broader level it’s not. Especially when you think about everything else, with running and exercise and motivation and that kind of thing it all has an impact”. By using Sleep Cycle (Northcube AB, 2015, October, 23) she could see what this impact was. The biggest example for Morgan was her intake of coffee. She

had been drinking coffee most days since she was a teenager and thought that it did not affect her. Since she found that it keeps her awake at night by using Sleep Cycle (Northcube AB, 2015, October, 23) she has tried to switch over to herbal tea later in the day and in the evening. The app allowed her to make comparisons and conclude what would keep her awake and what would allow her to sleep through the night. For her, tracking was all about “having the knowledge to make better decisions”. She said “I’m more interested in that comparison and about how to get a better sleep and what are those things that do make it better”.

Davis got a real sense of satisfaction out of interpreting the data and finding correlations. She said “I would be really sad if the app wasn’t in my life... I’m really good at interpreting stats and doing stuff with them and coming up with solutions”. Davis described this by saying:

Tracking really helps me to look at my habits and look at what I do in a day and look at why I’m getting fat. It’s because I’m sitting studying all day. It really helps me to make some changes. This is a way that I can make a change.

Wilson was also able to use tracking to identify her daily habits and what affect they had on her. She liked to be able to compare her mood to how she has felt at the same time in previous weeks. She said “It also shows you dots from previous

of the same days (sic) so I can go, this time last Saturday I was feeling about the same but by about four o'clock I was feeling a bit worse". She found it interesting to see what she was doing and how it made her feel. She was surprised that her mood depended on who she was spending time with and so she was able to see who should spend more time with in order to be happier. "I observed an increase in my feeling happiness at work if I was working with others at the time".

Participants said that activity trackers helped them to make better choices by recommending they do particular things or asking them to meet particular goals. They can give people specific information and recommendations based on previous research or use the crowdsourced data that their users provide to them to find new correlations. Davis was the best example of this. Her activity tracker was extremely goal orientated and asked her to set her own goal, ultimately making her a bigger part of the process and making her more invested in it. It made the goal a tangible and relevant challenge for her. When she had tried to set fitness goals in the past she struggled with them being too ambiguous. She said, "beforehand it was hard to make that standard relevant to me.... There was no real scale, thirty minutes a day is still no real scale". While she was able to see how far she was running at the gym she found it difficult keeping up an active life outside of the gym and to set her own goals. One of the things she particularly liked about Pedometer ++ (Cross Forward Consulting, LLC, 2016, October, 5) was that the colour feedback that it gave her gave

her an overview of how close she was to her goals throughout the week rather than just telling her whether or not she had achieved it.

For Morgan it was the alarm function on Sleep Cycle (Northcube AB, 2015, October, 23) that would require her to wake up at a certain time which would act as a recommendation rather than a goal. She found that it did make her feel better and so it was easier for her to be motivated. In comparison to when she did not use the app Morgan said:

You feel better in the morning because you're not being woken up while you're at your most asleep and so I am more likely to get up when my alarm goes off rather than lie in bed for another hour.

Participants said that having an activity tracker that makes recommendations is not always a good thing. Wilson tried to find an app that would not give her advice on how to improve her mood because she found it condescending. "I looked them up and tried to find a whole bunch of different ones and a lot of them seem quite patronising".

Activity Trackers Motivate People Over Time

Participants found that their activity trackers were a motivation to achieve goals. Davis and Robinson both found that they checked their activity trackers often and when they saw how close they were to their goals it would motivate them to walk

more than they normally would in order to complete the 10 000 steps each day. Robinson recounts “I was looking at it every day day to try to reach my 10 000 steps and sometimes if I was at 9 700 and I was walking home I would walk back and walk home a bit more”. She would not be satisfied to see that she was close to the goal without having completed it. Davis tells an almost identical story and laments the days when she was close to her goal and forgot to check. “I could have done more if I actually looked at that” she said. Martin also used the activity tracker as a reminder. Going for a run would often slip his mind if he was busy and he would forget when he last went running. Nike + (Nike, Lnc, 2016, October, 4) was a great reminder for him and he was astonished at how often this was useful. “You think you’d just know that but it’s surprising how much you don’t. Like you look back on the week and think, when did I last run?”.

Many participants said that their activity trackers encourage competition between users but they also allowed them to compete with themselves and push to be better. This competition is the other main way that activity trackers motivate people to achieve their goals. Miller found that tracking her sleep became like a game, especially if she knew that getting enough sleep was going to be difficult. She said it was “like a challenge. When I was doing assignments at uni and I was doing really late night sleeps sometimes I’d track it just because I’d be like how little sleep am I getting?”. She became competitive with herself but would sometimes stop using the app when she

knew that she was doing badly so that it wouldn’t create a drop in her record “if I know I’m not going to get a good night sleep I kind of don’t bother because I’m like well it’s not going to be one hundred percent and I want to get over eighty percent every night”. Using Nike + (Nike, Lnc, 2016, October, 4) made Martin’s running much more competitive. He could see how well he was running compared to his friends, “in terms of a weekly breakdown or a monthly breakdown you can see who’s doing the best”. He could also see a breakdown of his own running and be more competitive with himself about different aspects of the run. He said that it made him “more aware of what you’ve done and how you’re achieving so you know where to improve your game whether that’s in distance or speed”.

Subjective and Expressive Self-Tracking

Activity Trackers Do Not Always Show Meaningful Data

When Wilson was tracking her mood the activity tracker asked her what she was doing at the time in order to find correlations. It showed her how much time overall she had spent doing particular activities on a graph. However she said “It doesn’t mean an awful lot to me, like I don’t really care that I’ve done more of x or more of y”. Miller also found that her activity tracker was not showing her what she wanted. Each morning Sleep Cycle (Northcube AB, 2015, October, 23) would ask her how she felt when she woke up, it was looking to see if it could find a point in her cycle that felt better for her to wake

up in than others. Each morning she would give it the same answer, she didn't feel good in the morning, just tired and so had to turn off the function in the end. The data did not mean anything because there was no variation over time. To her "it just seemed pointless".

Wilson found that activity trackers do not always show data that is meaningful. They can be prescriptive and limiting and she was left with questions that the activity tracker could, but does not answer. For example Wilson, found that she was only able to select a mood or activity from a few options and so often had to select something that did not quite match how she was feeling or what she was doing. She described it by saying "It only gives you the scale from good to bad, there's not very much nuance to it which can be a little bit irritating". Alternatively she could select 'other' as an option but that meant she was unable to see specific correlations between activities or use the data as a representation of what she had been doing. She recalled: "there was one day where everything I had been doing was 'other'". Miller also struggled with the activity tracker not collecting all the data she wanted. Her partner sometimes talks in his sleep and she wanted to know how that affected Sleep Cycle (Northcube AB, 2015, October, 23) and to take an audio recording of it. The data would have related to sleep but have carried a deeper meaning than just how well they were sleeping.

The biggest reason the data was not meaningful discussed

by the participants was because they do not always collect accurate data in the first place and so it was harder for them to identify with it. Miller used Sleep Cycle (Northcube AB, 2015, October, 23) to see her last night of sleep but did not examine the overall trends. She said there is "no point" because of the "big gaps" in the data. She says "I don't quite understand how the graphs represent that. If I haven't used it for a month how come they can have that month in a graph?" Participants expressed concerns about the data being inaccurate for many different reasons.

Wilson is an example of this. When tracking her mood she found that she "wanted it to be better than it was" and it took her a while to realise that she was "over reporting it". After inputting data more carefully she noticed that the results showed her mood decrease significantly even though she said "I actually don't think there's been a particular drop overall in how i've been feeling".

One main reason why the data may be incorrect is because the user is not using the activity tracker properly. They might not be using it when they should, or they might be using it when they should not be. Whatever the reason, incorrect use of the activity tracker, especially if the data is collected automatically, would result in incorrect data. Miller in particular struggled with this. She sometimes found that she was using it incorrectly by placing her phone too far away from where she was sleeping on the bed. She described "it will be almost a flat line; it will be

like warning, very deep sleep, be concerned, and I'm like, well that's not accurate". Miller also had trouble knowing when to start using it each night, she would sometimes stay up late with her boyfriend but could not predict when this would happen. If she had already set Sleep Cycle (Northcube AB, 2015, October, 23) going then it might tell her that she had a broken sleep when she hadn't been trying to sleep at all. In contrast to this she often forgot to use it entirely and so there would be gaps in the data when she had been sleeping regularly. After using the activity tracker in this way for several years she said "In some ways I'd quite like to delete all the information and just start again, fresh because I understand how it works a little bit now".

Davis also noticed that she had been using the activity tracker incorrectly but saw it in an entirely different light. There were times when she would forget to keep her phone on her when she was walking or running and so it would not be able to collect the data. She trusted that this did not happen often enough to affect overall trends. When looking at her data on a weekly scale she was able to mentally add it on to what she had already achieved. She viewed it as a bonus rather than as data that was lost. She describes one instance:

I had my phone on the treadmill so it didn't catch the steps but in a way it still indirectly let me know that just walking down to the gym would not be enough steps, and body balance was all stretchy. I went home that night and just added on 5k onto it and was

like, yeah! That's super great. I feel really awesome. I saw it and I knew.

For Davis it did not matter if she was using the activity tracker correctly or not however for Miller it made a huge impact on her experience of using Sleep Cycle (Northcube AB, 2015, October, 23) and directly influenced how meaningful the data was to her.

Some participants found that data collection methods did not work for them or their lifestyles. Both of the participants who used Sleep Cycle (Northcube AB, 2015, October, 23) for example had periods of time sharing their bed. Morgan would share her bed with their pet dog when she stayed at her parents house. "It shows every time he moved as well because it uses the accelerometer in the phone to track it and so that was really terrible". For Morgan the dog's effect on the data was a bad thing but for Miller, who shares a bed with her boyfriend this was more fascinating than annoying. She makes the point that it "means something different now than how it was when it was just me. You can't just track yourself". For Morgan it meant the data was incorrect and less useful but for Miller it became a way to track both her sleep and that of her partner.

Davis was unsure about what her data should mean to her because she did not know how it was collected and what she should be aiming to achieve as a goal. She would ask "what is an average step? I'm very small so are two of my steps one

step, so if it says 5 000 steps have I done 10 000?" She didn't know if the data was collected through GPS or through the accelerometer and therefore she didn't know if the data was accurate for her.

When using Selfspective (Selfspective, n.d.) Wilson found that the app would ask her how she was feeling at a particular time in order to track her mood. Her mood would fluctuate throughout the day and she said that "it just didn't get me at the right moment because I guess like, certainly feeling ten out of ten is fleeting unless you're manic", she also noticed that if she was in a good mood she was unlikely to put it into the app herself because she was "happy and doing stuff" rather than on her phone. For these reasons she said the data was milder than her mood and lacked the highs and lows of real life despite the fact that she was using it correctly and honestly.

Activity Trackers Provide Users With Meaningful Data

Despite acknowledging that the data was not always correct, most participants felt that because the data was collected so consistently over such a long period of time that overall trends were still accurately reflected. For many of the participants the number value and the data was less meaningful on a day to day basis as it is more about making long term comparisons and seeing long term improvement. Robinson was not concerned if the app was over or under estimating the number of steps she was taking as long as it was doing the same thing each

day. She said "Even if it's not accurate, it's consistently not accurate so I know where I'm lying in that respect". The differences between the number of steps each day was what concerned her, and this would not be affected as long as any inaccuracies were constant. Martin felt the same way. While he said that the data is very accurate he felt it was important to note that it was not perfect. He said "even if it wasn't that accurate as long as it was recording that this run's bigger than this one by a lot and you ran here on this day then that's all I really need". Just like with Robinson the difference between the numbers is more important. Martin was able to verify the consistency of his data by using milestones of his previous runs since he would take the same route many times. He concluded that while "the GPS is pretty good maybe it's stuffing up at other parts" but did not seem too concerned.

Morgan uses Sleep Cycle (Northcube AB, 2015, October, 23) to find patterns. She did not know exactly what the data meant and was unconcerned about the science behind the app but she was still able to use it to make comparisons and find correlations. For her it was quite interesting to see the patterns of sleep. She stressed that "as much as it can be insightful it can also be quite weird." for example she found that regardless of her schedule she was more likely to have a good sleep on Wednesday than on any other day of the week, and she did not have an explanation for this. For Morgan, using Sleep Cycle (Northcube AB, 2015, October, 23) was a way to look at something that was otherwise immeasurable and to look at

it in an analytical way. Regardless of the fact that she did not understand the science, the overall trends were still extremely fascinating and often useful for her.

As previously outlined, activity trackers act as a reminder of progress and as a way to motivate users. This is only possible when the data and is updated live. Using Pedometer ++ (Cross Forward Consulting, LLC, 2016, October, 5) Davis was able to check on how she was going throughout the day and was able to adjust her activity for that day. It would not have been as useful to her if she was only told at the end of the day how many steps had taken. She was able to view her progress on her home screen without having to open the app. It showed her the number of steps as if it were a notification. Having the data there helped her to adjust her activity throughout the day to ensure that she achieved her goal.

Participants found that they can create data that more accurately reflects their experiences when they can input a larger variety of things or when they have more control over interpreting the data. Davis was able to set her own goal of the number of steps she wanted to stake each day. "You can change the standard" she said, "I think now It's on 8 000 because I felt as though I wasn't actually achieving the 10 000 and it sucked and I wanted more green". On some days she would be focusing on other areas of her life, such as university, she wanted her results to reflect that she was doing well rather than just being lazy. Wilson on the other hand did not have as

much control over the different variables that she can put into her activity tracker however she was able to control the way she used and interpreted the data. While this forced her to use the 'other' category very frequently she said "it doesn't really bother me because I know that other is usually like show stuff". She, alone knew what her data was supposed to mean.

Participants were able to keep track of information that they normally would not be able to measure and remember themselves. They were able to see connections between things that people might not see without the large amounts of data. This was one of the main reasons why Morgan wanted to track her sleep rather than another activity. For her sleep "was a really unknown thing" and she "wanted to know what was happening". She explained that she had used other activity trackers but she said "that's just more a log of what I've accomplished whereas this is the unknown". Sleep Cycle (Northcube AB, 2015, October, 23) could tell her if she was getting a good sleep or not when it was difficult for her to compare sleeps and understand it with only what she experienced. Martin also used his activity tracker to find out new things. He was able to consistently measure how well he had been doing. "I really just wanted to have a record of what I've been doing" he said, "I used to just guess how long [the run] was but now I actually know". Having the data that he could not have accessed previously she has become an important part of his running and it is something that he would miss if he could not use the activity tracker. He said "once you

put a statistic to something and you can improve on it and you introduce that added element to it, it changes". He made sure to note that the joy of running and being fit is still very much the most important part of the activity for him, and that the data is an added bonus.

Some participants used anomalies in personal data to mark out events and used their activity trackers as a type of diary. Davis searches for these significant moments in her data and uses it as a reminder on what she did on particular days. "One time I was trying to figure out the exact date that I was in Hong Kong" she said, "all I did was go back and figure out when I did 25 000 steps [in one day]". She also uses it to reflect of the events the week as a prompt and reminder on what happened. She said "You can see the day that I have my day off on Thursdays because it's like one hundred steps". Exactly as people do who keep diaries, Davis had a routine of reflecting on her data each night before she went to sleep. Although Morgan was far less invested in using her activity tracker as a diary than Davis, she still found that it added intrigue to the data she was already collecting and reflecting on and made the whole experience more meaningful. Morgan stumbled upon this quirk of self-tracking and found that looking at her data as a representation and record of her experience made it more meaningful and more interesting to her. "It's funny to think back" she said "where I had a really big assignment due or when I had work the next day. It's kind of like a calendar in a sense."

Users feel that activity trackers will honestly represent their progress rather than making what they have done seem more appealing or worse than it actually is. Robinson found that the Apple Health App (Apple Inc. n.d.) would give her an unprejudiced and neutral reflection on the ups and downs of her life through tracking her steps. "I do think it's accurate" she said, "I can tell for me how well I'm doing or not doing". Miller also found that using an activity tracker would make her more aware of her own bias. Using Sleep Cycle (Northcube AB, 2015, October, 23) would ensure that she could not use lack of sleep as an excuse when she had actually slept well and she could not pretend that she was fine when she was actually exhausted. She saw this honesty as a positive influence in her life. "It gives you something to work towards in the future" she said "rather than just being able to lie to yourself." Morgan used the objectivity of her activity tracker Sleep Cycle (Northcube AB, 2015, October, 23) to validate the way she felt in the morning. She said "you think you've had a bad sleep but this confirms that yes, you've had a terrible sleep". Being a "numbers person" she really valued being able to see such concrete data when she found that "often sleep is hard to grasp, people talking about dreams and talking about the states of sleep but unless you completely understand that it can be quite confusing."

The Agency of Activity Trackers

Activity Trackers Have Agency to Influence

Social Interactions

Participants really wanted to discuss their experiences and talk about their achievements. Robinson for example used self-tracking as a point of conversation, when she would not usually discuss walking as a mode of transport she is far more eager to share the success of achieving her goals. She recounts “I would sometimes bring it up, especially if I’m enjoying it then I’ll talk about it”. She recommends using the Apple Health App (Apple Inc. n.d.) to her friends and enjoys showing them the data they might have collected without realising. She really wants to “encourage other people who have the ability to do it to do it too”. Morgan has noticed that over the five years she has spent tracking her sleep that it has become more and more common to talk about as more and more people are tracking it. “Previously that was something that was quite personal, you didn’t really talk to anyone about it”. Morgan still views activity trackers as being “quite personal” however she said that “these days you would see something like this on facebook and you would tag someone in it, there’s much more of a social aspect to it”. Now that activity trackers are more common however it is something that people can relate to rather than being seen as unusual. Martin shares his running data with his friends who also use Nike + (Nike, Lnc, 2016, October, 4) and he is able to see their running data in turn. Before he started tracking his runs he did not know which of his friends were dedicated to running and so would not talk to them about it so much. He said “I’ve always been competitive with it but there were only so many people who I knew were running as well”. Now

that he knows who would be more interested to talk about it with him he is more likely to share his running experiences with those people. Martin found that “There’s still not heaps of people who [run] regularly but you now know who does”. From these examples we can see that previously solitary activities can become something that people have in common if they have tracked the same thing.

Participants found that interactions between users could become competitive because people are interested in sharing their achievements . This showed through in the way that participants discussed their success or failure. Martin reported that amongst his friends who were using the Nike + (Nike, Lnc, 2016, October, 4) they became very competitive with each other. This was much more prominent when the app was fairly new to them and achievements were easier to log and so more common. After the novelty wore off for Martin the competition remained but wasn’t discussed so frequently or openly. Martin described it by saying:

I guess it’s a bit of a vanity thing really. Like running’s kind of a private thing, you do it by yourself but through doing this you try and show everyone, initially, all your running friends just how much you run but you’re also interested in how much everyone else runs to know where you stand on the whole thing.

Davis also described competition as something that changed the way she talked about walking. She said “I’m totally bragging, it’s awesome. I’ve got this achievement and I want to share it with you”. The competitive aspect for her was entirely with herself, however the success and failure was an extremely important part of her experience. She would associate the success and failure of walking 10 000 steps with other aspects of her life showing her what was being prioritised at the time. She was able to say that because she was prioritising walking more or less that this was the reason for fluctuations in her weight and that it was something she could control because she was aware of what was going on. She recounted an instance where she was able to tell her Dad “I’m not getting fat because I did all these steps”. Davis describes it as being “tangible, it’s like a fact. I can talk to myself about it and be like, yeah, go you, you did a good thing”. Davis was using the data to “adjust the stories” (Rettberg, 2014, p.71) that she would tell about herself, using it as a language to describe what she was doing and using it as a way to excuse not walking when she would otherwise feel guilty about it.

There Is A Limitation To The Agency That Activity Trackers Have

Only approximately one third of activity trackers encouraged their users to share their personal data (see Appendix A.) and this perfectly reflected the number of participants who wanted to share their data and the extent to which this was comfortable for them. Participants found to some extent the social

expectations dictated the way they shared or talked about their data and using the activity tracker more than the design of the activity tracker itself. For both Morgan and Miller the act of tracking their sleep was something they did for themselves and tended to keep to themselves. Both of them said that it is natural for people to talk about their sleep as it is such an important part of everyday life but that they would refrain from telling other people about their tracking when sleep was brought up. Morgan speculated “If someone said to me that they had a really weird dream last night I would never say that I track my sleep. It’s not something that, even if we were talking about sleep, that I would bring up”. Morgan goes on to say that she does not think that it is “worth sharing” because the data does not mean anything to anyone aside from herself. “They’re not going to care unless they are interesting in tracking their sleep”.

Miller did talk about using Sleep Cycle (Northcube AB, 2015, October, 23) occasionally however she made it very clear that sharing her data to social media was not something she was interested in doing. “It’s for me, it’s not really necessarily for that. Other people don’t care, I don’t care if they know but I’m not going to be like, hey guys I slept for seven hours”. While she does not regularly share her sleep data she does share other parts of her life to facebook and instagram and she said that her boyfriend described her as being too technologically into it and would poke fun at her for tracking her sleep and posting about herself online. “He says I’m an oversharer, but

we have different terms for that phrase which I think is quite funny. He means technologically I'm too into it, like I'll snapchat somebody something and that's oversharing".

Martin had a very different experience of this to Morgan and Miller. For him competition was an extremely important aspect of tracking his run and so the expectation that he keep the information to himself and behave modestly made him embarrassed about sharing his data. "[posting stuff to facebook is] bad but I do, I got the celebrity trophy which is good but I don't actually know how to turn [sharing] off so I apologise to everyone". Most of the interviewees wanted to keep their data to themselves however for those who wanted to share their successes it was one of the most important and valuable parts of using the activity tracker.

Some participants found that much of the insight that activity trackers have to offer is already known to the user and might become unwelcome and unheeded advice. Miller experienced this when she was using Sleep Cycle's alarm function (Northcube AB, 2015, October, 23). She already knew when she wanted to wake up regardless of what the app was recommending to her and she recounted why she turned the alarm off:

Because you don't want to get up late you always set that thirty minutes with the latest time being the time that you want to get up. I don't know how well that works to be honest, I would rather have a real good

length sleep, and especially with work because I need to get up by a certain point. So what I actually did over the last couple of weeks is I turned the alarm off.

Ultimately Miller said "It doesn't affect necessarily how I choose to sleep" because she already knows what she wants. She was just using the app as a measure of achievement. Wilson was also using her activity tracker in the same way. She liked the one she was using because it was not condescending like others that she looked at. It allowed her to track her mood without having to change or feel bad about what she does. When she was going to download the app she found "a whole bunch of different ones and a lot of them seemed quite patronising". She liked Self Spective because it did not imply that she should feel happy or that she should 'fix' her mood in any way and it did not get in the way of whatever she was doing at the time. "There is no actual doing that I have to do... it's not invasive and if I don't do it at the time that it reminds me I can do it later, it's not an issue".

For participants, the most prominent limitation to the agency of activity trackers is that they only have agency if people care and are invested in them. Robinson is the best example of this. She reported that if she was not meeting her goals or was doing badly then she would stop using the activity tracker altogether rather than using it as motivation. She said "Because I know I'm walking less I don't really want to admit that I'm doing that

so I'm making it less of a priority". It was demoralising to see herself doing badly when she felt that she was doing her best at the time. She said "It's just because I've got really really busy recently I know that I can't really reach those goals as much as I used to be able to". She recognised that walking and using the activity tracker was not always a priority for her and that she needed to be okay with results that reflected the chaos and business of everyday life.

The activity tracker that Robinson used did not have built in goals, however Pedometer ++ (Cross Forward Consulting, LLC, 2016, October, 5) did, and Davis was able to set her goal herself. Rather than completely suspending using her activity, Davis was simply able to lower her goal when walking was of less importance so she was still able to keep an eye on her tracking without feeling as if she had let herself down. At the time of the interview she said "It's on 8 000 because I felt as though I wasn't actually achieving the 10 000 and it sucked and I wanted more green".

Activity Trackers Have Agency to Change The Experience of Doing The Activity

Many participants said that activity trackers have the agency to influence how much the activity means to the them and what it means to the them. Davis, for example found that some aspects of activity trackers made the experience of the activity less meaningful. It has already been outlined how the data might be the cause of this but the process of using the

activity tracker in itself might turn the activity into a chore. Davis mostly discussed using Pedometer ++ (Cross Forward Consulting, LLC, 2016, October, 5) to track her walking but she also mentioned that she had tried to track other things in the past. "There was a really great menstruation app" she said, "I really liked and it was easy to use". She explained that the problem "was the fact that I had to do something and I'm not very good at doing it every day. I'd feel bad that I didn't do it every day, in a way it became a mental burden". She lost interest because the investment of her time and energy was too much.

Participants found that energy invested in an activity tracker is energy invested in themselves and the activity. The more people put into the activity the more they get out of it. For Martin using the Nike + (Nike, Lnc, 2016, October, 4) was added motivation to get back into running and to stick with it despite his busy lifestyle. Before he started using the app he "didn't really have a way of measuring calories being burnt or anything", it just wasn't something that he thought about. Once he started tracking his runs however, the data "became vitally important". He guiltily admitted "I'd definitely feel like something was missing [without it]. Definitely. It would annoy me as well actually because I would know that I was missing out on kilometers".

For most participants activity trackers foster a sense of achievement and make success more tangible. This was a

huge motivation for Davis; she would look at her activity tracker because she was “looking for a reward or visible achievement”. She said “it’s not a certificate but it’s kind of like a certificate. It’s so important with exercise to see progress and to not feel super shit”. Her activity tracker made her excited about achieving goals by expressing it through the design, almost every activity tracker shows a graph of the user’s success but this one also used colours as a visual cue of the user’s effort. The activity tracker also made the achievements more real to Davis because it gave her a way to think and talk about them, a way to express what she had done. “It’s so cool to see something tangible and to be able to say I achieved that” she said “I can talk to myself about it and be like, yeah, go you!” Robinson and Martin also experienced this. Martin in particular found that he got a lot more satisfaction out of reaching his goals when using the activity tracker and that the tracker provided him with more, intermediary goals than he would have set for himself. “You get trophies” he said, “they are just little icons that come up but associate with your profile and if you do certain things like if you run five times in the rain or five times at night”.

Participants whose data was collected automatically were able to concentrate on the experience and the activity rather than having to document or remember the information themselves. This means that the user has the space to focus on the phenomenological experience of the activity and benefit from the data and motivation that documentation has to offer. Most

of the participants choose the activity tracker that they used based on how unobtrusive and automatic it was. Davis, for example said “getting [Pedometer ++] has made me think that I want to track other things in my life but it’s just so much harder”. She liked that the app was “low maintenance” and wanted other apps that were as easy to use. Even Wilson, who had to input the data herself said, “I liked that it would remind me but it wasn’t invasive”. Many of these participants wanted to stress that the activity tracker was always second to their enjoyment of the activity. “It’s definitely not something that consumes my run”. Martin said “The goal with it is to be as nonintrusive as possible”. Many of the participants said that automatic data collection was extremely valuable and important to them in an activity tracker so that it was not an annoyance. Failing this was the biggest reason why people said they had stopped using an activity tracker in the past.

While activity trackers do collect data automatically, they might ask users to supplement this with manually entered data. Some participants had the option of including notes on their experiences, this allowed them to reflect on, and have a deeper understanding of the activity. Wilson was the best example of this, possibly because the type of data she was tracking was so subjective and she was required to enter it herself. Before she started tracking her mood she would only take note of it when it was bad however the act of using the activity tracker and inputting the data would remind her to acknowledge good moods equally. Participants who tracked other types of data

still experienced this. Morgan said that she always felt as if she had a better sleep when she was using Sleep Cycle (Northcube AB, 2015, October, 23) and when it told her she had just slept well than when she had been sleeping without using the app. She said “I used to be less aware of what was going on. It used to be a time where you didn’t think... Some nights I would wake up in the middle of the night and I wouldn’t know why”.

Many of the participants used activity trackers to help improve something that they perceived as a problem in their lives. Interviewees found that their activity trackers helped to stop rumination by offering another perspective that they saw as being more objective than their own. Davis in particular experienced this. “I think it gives me more of a healthy relationship with exercise as well”. She said “It makes me feel as though I can have some down time, and times when I can push extra hard to make up for it”. Wilson also experienced something similar although she was tracking her mood instead. Before she started tracking she would think of her mood as being either good or bad for each day however after using Selfspective (Selfspective, n.d.) she said “It’s made me be able to think of it as something more fluid rather than something that is very static”. It changed the way she thought about her mood, improving the experience, even if this was simply improving it in hindsight. What the interviewees experienced is completely counter to the argument that Weigel (2015) makes however Rettberg (2014) outlined this as one of the main distinctions of self-tracking “the mediation of technology to help us see

ourselves better”.

Participants used activity trackers as a way to help them fix something that they thought was a problem, rather than tracking something they are already succeeding in. This was particularly evident in the interviewees who were tracking their sleep. They had both been tracking this on and off for several years and noted that they would start using Sleep Cycle (Northcube AB, 2015, October, 23) again after a period of sleeping badly in an attempt to gain control over their sleeping habits. Morgan said “I was having real issues waking up in the morning and I thought, maybe I’m not sleeping as well. Usually I get ten hours of sleep a night and I would be tired. So I started using it again”.

D e s i g n i n g

While designing the ‘perfect’ activity tracker may seem an obvious conclusion of this thesis, the primary goal of phenomenological research is to describe the experience of the interviewees (Creswell, 2013). The following designs attempt to encapsulate a few of the key points that consistently emerged throughout the interviews. Rettberg (2014) discusses the distinction between self-tracking and curated self-representations. These design works are all firmly placed within the category of curated representations, however they all represent various discussions on self-tracking found in the background research and interviews. They apply the appropriate medium of self-tracking and personal data to express these ideas.

Selfies

Concept and Process

Rettberg (2014) discusses the way that self-tracking encompasses tracking objects which belong to the self. Regardless of what kind of data is being collected the activity tracker can only track its own experience. Self-tracking can only track other objects, as there are always layers of interpretation between the user and their personal data. Almost all of the participants reported that their activity trackers were collecting data that did not fully reflect their experience. In this section, this idea is explored by making a comparison between the experience of the user and the experience of the activity tracker. Photos were taken in locations that FRICKbits (Frick,

2014) had incorrectly pinpointed and were juxtaposed with photos in the correct locations. FRICKbits (Frick, 2014) is a tool for users to create their own data-selfies however it acts in the same way as an activity tracker. In this case the ideas of influence and cause and effect are explored through the process of creating the design.

First initial locations were found. These were collected during the previous few months in order to reduce the likelihood of a location being mistakenly forgotten. For practical reasons the locations were taken within short driving distance of Wellington’s central city. Twelve locations were found in total. An initial test was then carried out in which selfies were taken with a phone camera and gathered from several of these locations.

There was a distinct blur over the bottom half of the photos which can be seen in figure 19 due to a crack over the front facing camera so in the second round of photos a different phone camera was used. They were taken in many of the remaining and more distant locations. They include but are not limited to selfies in the way that the first selection of photos are.

Photos were then taken in a second set of locations as can be seen in figure 20. They show the locations which the activity tracker should have been displaying. Most of the images are not selfies but rather point of view shots or shots of empty spaces

to show that, from the perspective of the activity tracker, the space is empty.

The photos shown in figure 21 were then paired with photos from the initial locations in order to make the best comparisons between locations. The distance from each image and the activity tracker was then calculated and shown in the caption.



Figure 19. Initial photos taken from incorrect data locations: Ohiro Road, Francis Place, Ellice Street, Waripori Street and Hopper Street.

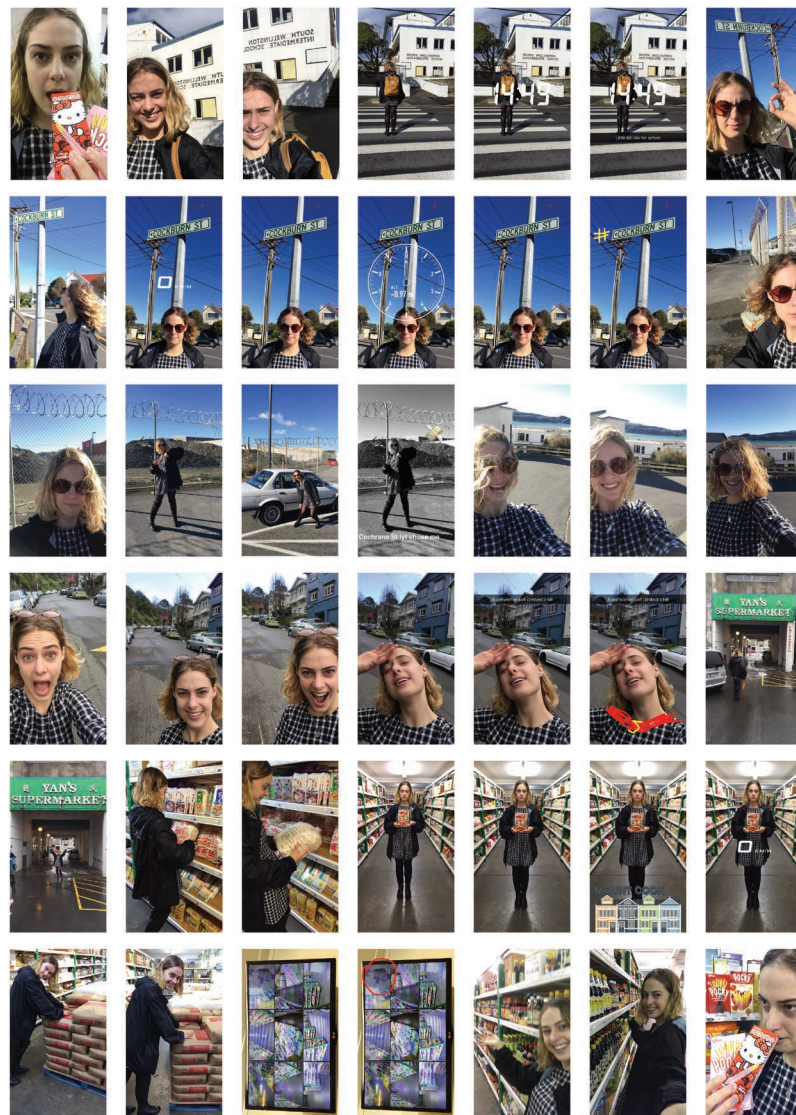


Figure 20. Photos taken from incorrect data locations: Adams Terrace, Hopper Street, Waripori Street, Cockburn Street, Cochrane Street and Nuku Street.

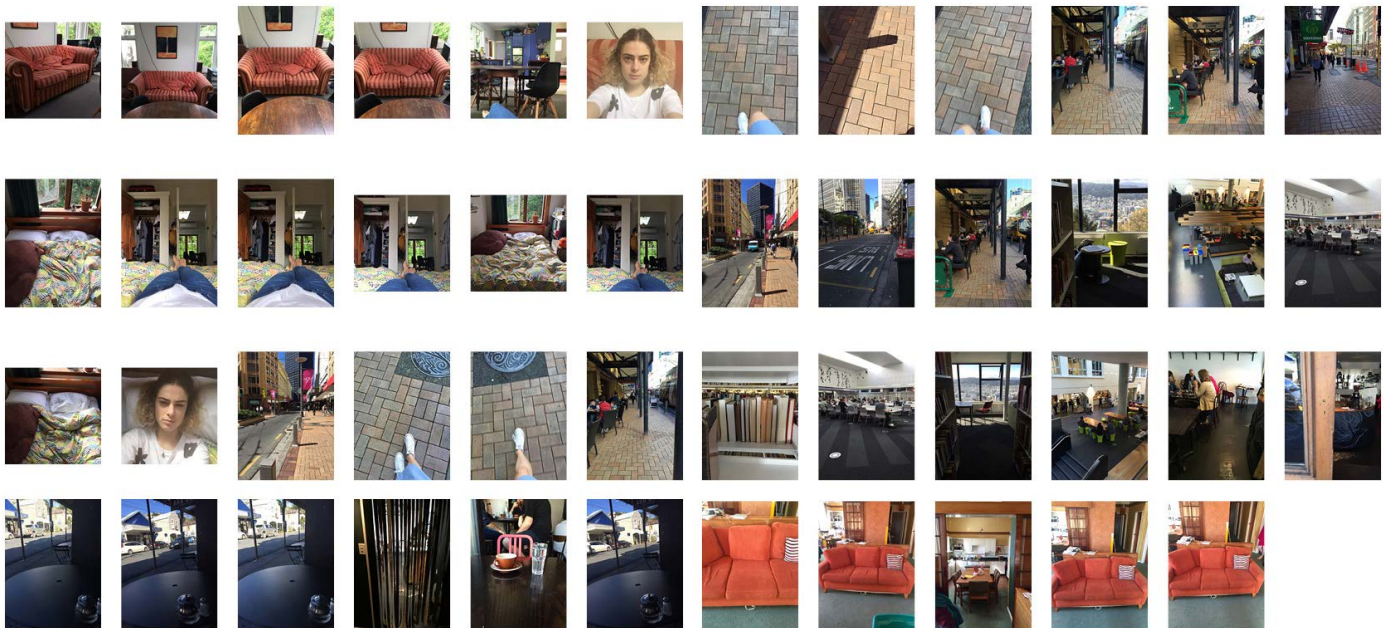


Figure 21. Photos taken from correct data locations: Epuni Street, Lambton Quay, Victoria University of Wellington Kelburn Campus, Aro Street and The Terrace.

Final Documentation

This series of photos shows a comparison between data collected using activity trackers and reality. Each pair of images shows a particular type of moment while the numbers below them further quantify the difference between the activity tracker and human experience.

The works in figures 23 to 27 will be framed in pairs and viewed in the gallery, the photos will be the most prominent part of the work while the distances can be viewed upon closer inspection. An explanation of the work will outline that the distances below each image indicate the distance from original location, however the street names will not be provided.



0m



707.37m

Figure 23. Purchasing Sustenance



0m



3610 m

Figure 24. Getting Down to Business



0m



5080 m

Figure 25. Hanging out



0m



5660 m

Figure 26. Enjoying the View



0m



1480 m

Figure 27. Shopping

Spending

Concept and Process

The concept for this idea was to take financial data and use it to tell stories about why each transaction had been made. This would show the intimate nature of personal data that would be otherwise unreadable by others and it would show the benefit of actively self-tracking rather than only reading the interpretations of the activity tracker.

First, a bank statement was downloaded from dates between the 25th of July and the 23rd of August 2016 and entered into a spreadsheet. These dates were chosen because significant and meaningful transactions were still easily memorable. Short descriptions were then written for the significant and meaningful transactions, this was based not on the quantity of money moved but the emotional investment made for each transaction; and on the stories behind them. Any automatic or regular transaction was given the same description (See Appendix D)

Several of the most significant and meaningful transactions were then selected and were chosen to best result in a variety of personal stories. Voice recordings of these stories was the most powerful way that this information could be presented. People are very used to acquiring information visually, however speaking directly into someone's ear is a form of communication usually reserved for sharing intimate secrets. A script was

then written for each recording, they all take the same basic format, starting with the date and transaction details, followed by a short description of why the transaction was made. Each recording could be no longer than thirty seconds.

The stories shown in figure 26 were then read aloud and audio recordings were taken and edited together.

Final Documentation

This work explores the relationship between activity trackers and diaries. It does this by curating personal data and by placing it back in the personal context from which it came. A direct comparison is made between the data set and the meaning that it carries.

When this work is being viewed the person will first see a formal print out of the bank statement and a pair of headphones hanging on the wall. They can inspect the data as they please however it will not carry any meaning for them until they put the headphones on and the stories will be spoken into their ears like small confessions or secrets. This audio will be played on a loop and the person will be able to refer to the transaction on the bank statement. They will also be able to read a brief explanation of the work however the process will not be made explicit.

<p>On the twenty fifth of July 2016 I spent eight dollars and eighty cents on morning tea. I didn't want a cup of tea and a piece of slice but I did want to spend time with my boyfriend. He read the newspaper so I read articles on my phone.</p>
<p>On the twenty seventh of July 2016 I spent thirty dollars and twenty cents on tickets to see a film. One of my friends had suggested it at the last minute and I was feeling lonely and didn't want to miss out. We sat in the middle of the front row and I cried for the first hour.</p>
<p>On the twenty seventh of July 2016 I spent ten dollars and ninety cents going out for dinner. I agreed to it because one of my friends wanted to hang out and it would have been awkward to hang out at home but I felt guilty about not spending enough time with them. I wanted to get it over with quickly and I couldn't be bothered cooking.</p>
<p>On the eighth of August 2016 I spent three dollars on a toy for myself. I wanted something that I could play with at university, like a stress ball to stop myself from picking at my skin. I bought a different toy three days earlier but I broke it.</p>
<p>On the twelfth of August 2016 I spent twentyfour dollars and seventeen cents on cake ingredients. My mother had instructed me to bake a cake for 18 people for my grandmother's eighty second birthday. I make two madeira cakes which mum stacked on top of each other to make them look more extravagant.</p>
<p>On the fifteenth of August 2016 I transferred seven hundred dollars into my savings account. I did it because there was nothing that I needed to buy and I felt guilty that my parents had given me so much money for my birthday.</p>
<p>On the twenty second of August 2016 I spend thirty two dollars on tickets to see a play. I felt obliged to see it because one of my friends was in it but I didn't want to go by myself. After inviting several people who were unable to make it I ended up going with an old friend. He thought it was a date.</p>

Figure 28. Script for audio recordings

25/Jul/16			
to	Savoire Caf	EFTPOS TRANSACTION	-\$4.50
to	Decant	EFTPOS TRANSACTION	-\$8.80
to	Burger Fuel Panui	EFTPOS TRANSACTION	-\$14.40
26/Jul/2016			
to	Aro Fruit Supply	EFTPOS TRANSACTION	-\$10.40
to	Bamboo	EFTPOS TRANSACTION	-\$10.90
to	Aro Valley Mini Mart	EFTPOS TRANSACTION	-\$19.80
to	Flat Account	AUTOMATIC PAYMENT	-\$201.00
27/Jul/2016			
from	Dad	BILL PAYMENT	\$220.00
to	Flatmate	BILL PAYMENT	-\$30.20
to	Whitireia Performing	EFTPOS TRANSACTION	-\$108.00
28/Jul/2016			
	Caffe Astoria	EFTPOS TRANSACTION	-\$7.50
	New World Metro Will	EFTPOS TRANSACTION	-\$8.38
	Farmers - Lambton Qu	EFTPOS TRANSACTION	-\$20.99
29/Jul/2016			
to	Aro Valley Mini Mart	EFTPOS TRANSACTION	-\$10.69
1/Aug/16			
from	Dad	BILL PAYMENT	\$330.00
to	Midnight Espresso	EFTPOS TRANSACTION	-\$3.50
to	Aro Valley Mini Mart	EFTPOS TRANSACTION	-\$4.80
to	Lamason	EFTPOS TRANSACTION	-\$5.00
to	Le Moulin Bakery	EFTPOS TRANSACTION	-\$8.40
to	The Hangar	EFTPOS TRANSACTION	-\$9.00
to	Embassy Theatre	EFTPOS TRANSACTION	-\$10.00

Figure 29. Sample of back statement to be displayed

Snapshot

Concept and Process

The initial concept for this work is to take location data and create images to give the overall impression of a long period of time transferred into a “snapshot” of the data and overall experience. Personal location data has been collected using the activity tracker FRICKbits between March 12th 2015 and August 31st 2016. This activity tracker was used because the data can easily be exported and manipulated. Significant dates were then selected; these were based around times spent in certain locations, such as holidays or scenic walks in order to get better visual variation between images. This curation removes the work slightly from self-tracking however each image contains hundreds of data points collected over weeks and so only an extremely small portion of the image would be curated in a strict sense. These data points were then placed on the map taken from Google Earth (Google Inc., 2015) as seen below in figure 30. This was archived using Processing (See Appendix E). Although the points were not perfectly accurate, this did not matter, as the overall impression of the points was more important.

From each of the points on the map a strip of pixels was taken to create the barcode image. The centre line through the image was the location of each of the points, slight variations within clusters of points would give the image fluid consistency whereas bigger distances between points showed contrast in

the image. The points were then removed as they were used only for reference. The original image with and without the points can be seen in figures 32 and 32 respectively.

The image was then cropped to the correct dimensions. This served to remove most of the areas at the top and bottom which show data that is off the map. They were also cropped to a shape that references barcodes, speaking to the unique nature of each image and given length to indicate a vastness of time rather than simply giving the impression of one moment. Some experimentation was done, as shown in figure 33, to compare different scales and this worked best on an individual basis as each data set and map was so different.

For a variety of reasons there are still many points on which the data is off the maps and appears as a white strip on the images. These were filled in black to contrast with the points where the pixels were legitimately white and to prevent the image from looking broken up. The images were then scaled up to show a pixelated and impressionistic view of the locations.

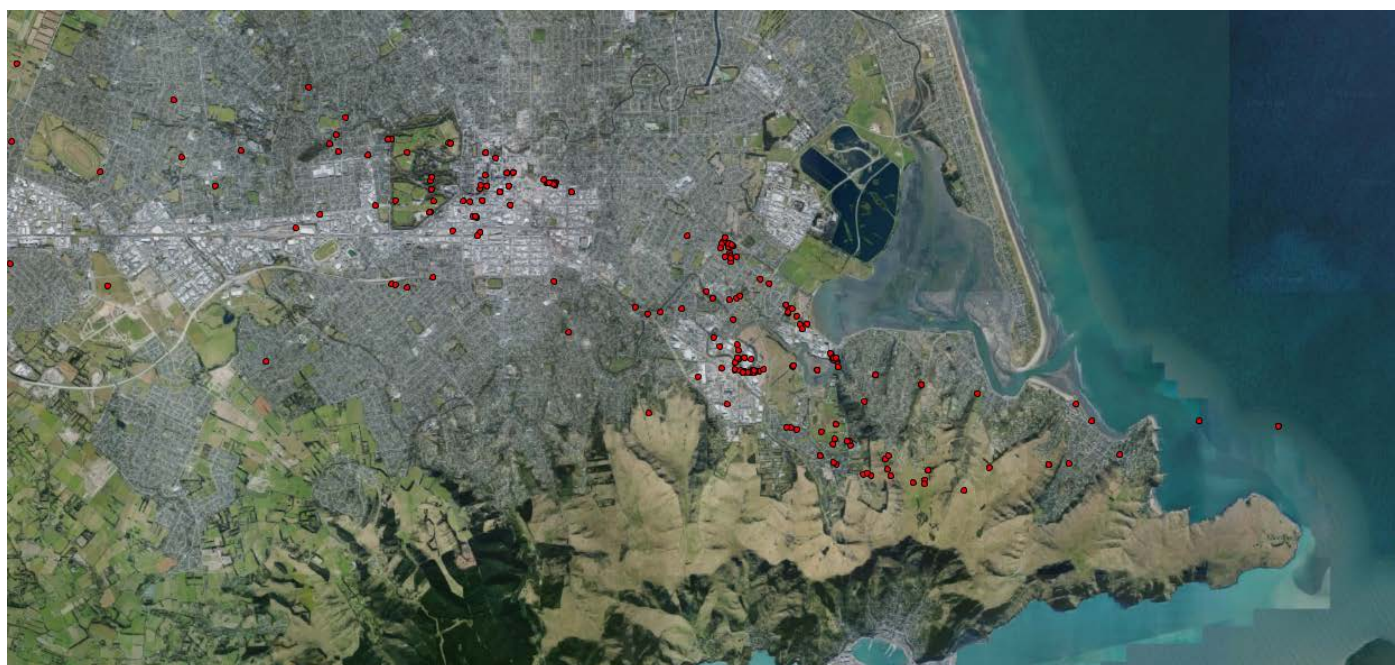


Figure 30. Map of Christchurch with location data from 6th July 2016 to 27th August 2016

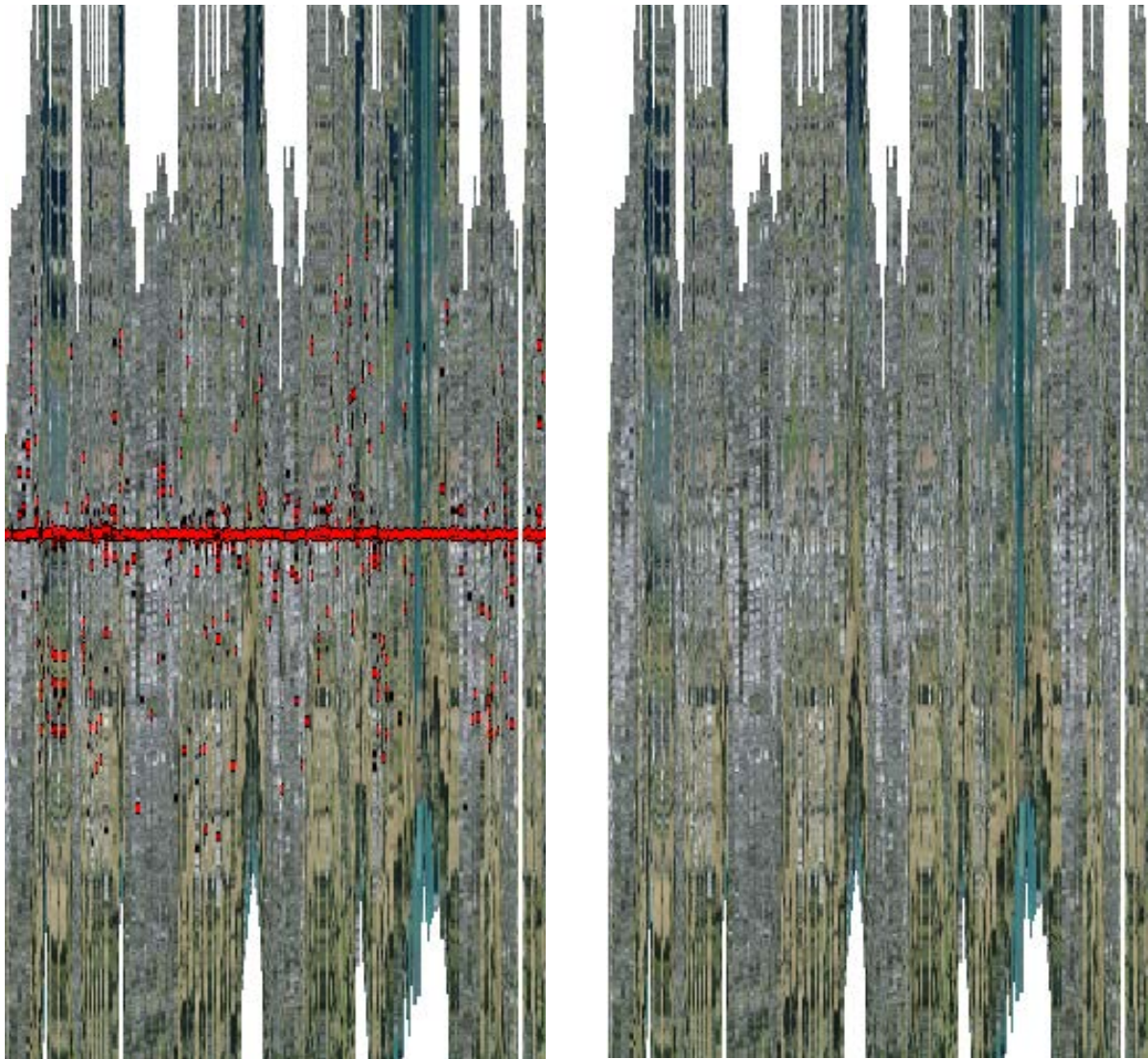


Figure 31. Location data from Christchurch between 6th July 2016 to 27th August 2016 presented in strips with points for reference

Figure 32. Location data from Christchurch between 6th July 2016 to 27th August 2016 presented in strips without points

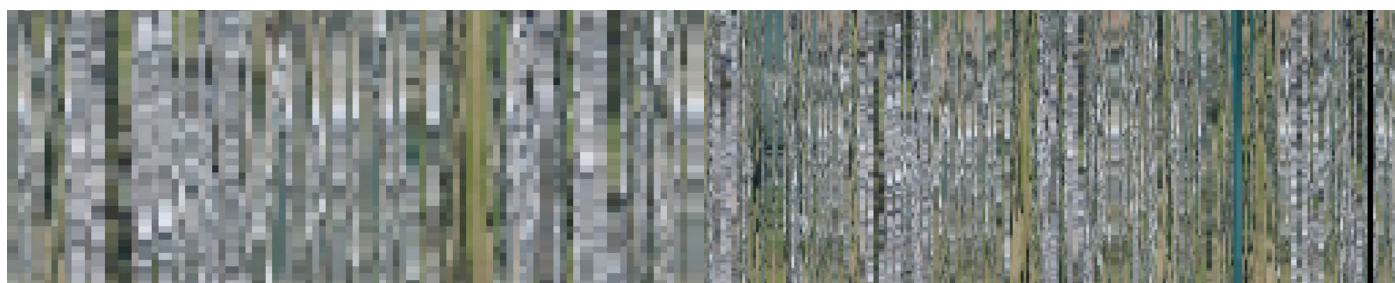


Figure 33. Experimentation with wide and thin strips

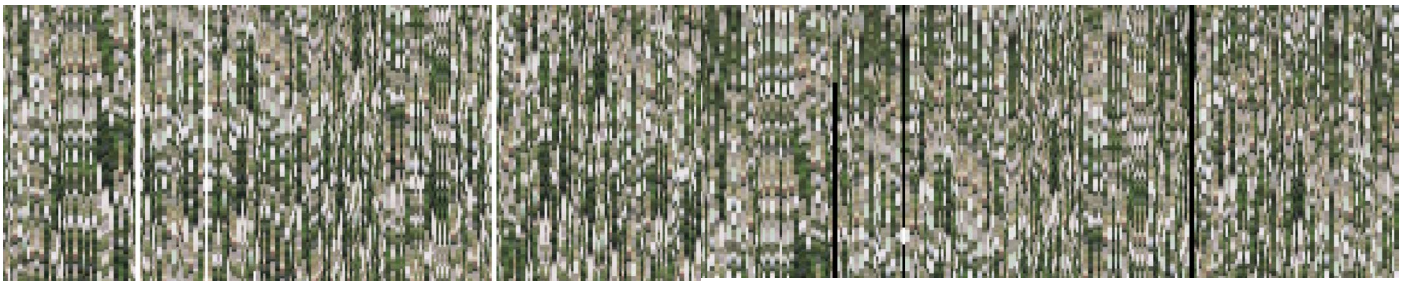


Figure 34. Experimentation with white and black representing missing data

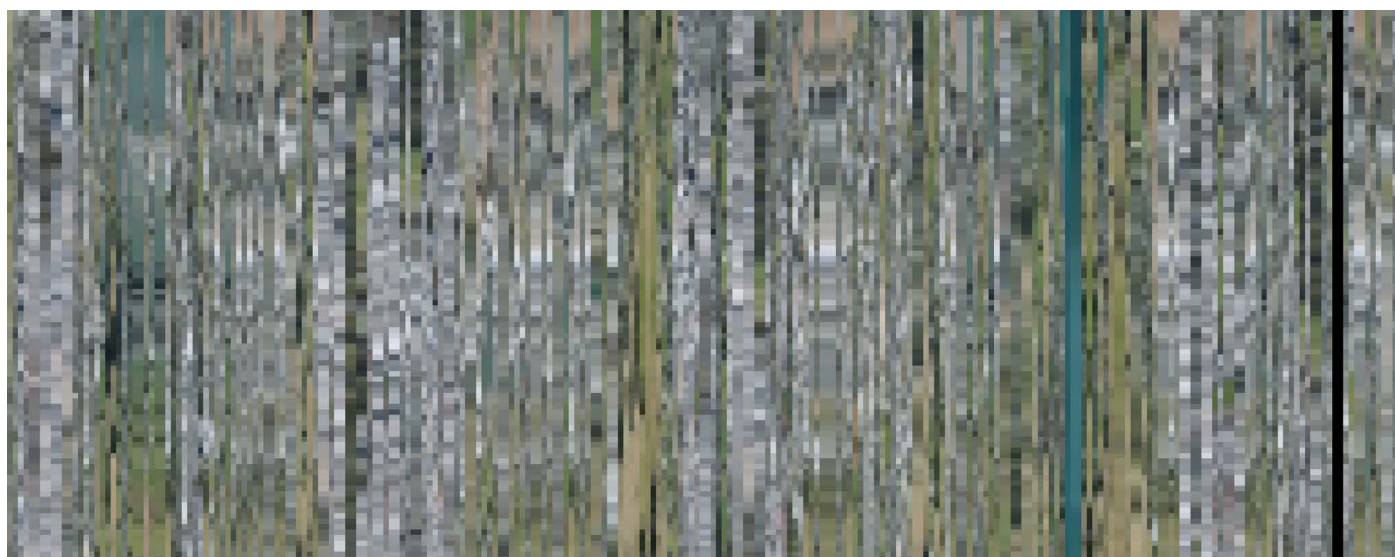


Figure 35. Final image: Christchurch, 6th July 2016 to 27th August 2016



Figure 36. Final image: Melbourne, 19th May 2016 to 19th July 2016

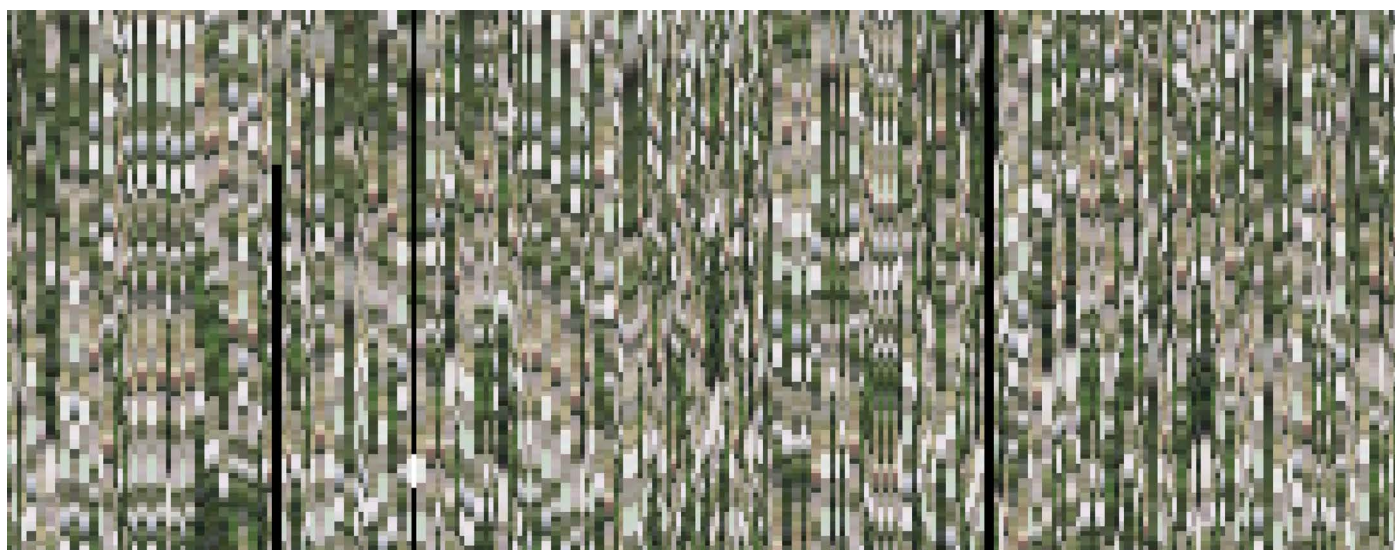


Figure 37. Final image: Wellington 9th July 2016 to 31st August 2016

Final Documentation

This work shows a personal representation of location data as collected through Henrietta's cell phone. It is a response to data-ism that highlights the emotional blurring of the passing of time and the relationship one has to different settings through the lens of activity trackers.

When this work is being viewed the three representations as seen in figures 35 to 37 will be displayed in full size on the wall next to each other and so will be the first thing seen. An explanation of the work can also be read with it, and will include; the written explanation of the concept behind the work and a step by step process of how the representations were generated with accompanying images. The locations and dates for each representation will be displayed as a caption under each representation rather than with the explanation of the work.

C o n c l u s i o n

Activity trackers are powerful tools that will be increasingly refined and used for self-tracking. In order for designers to progress self-tracking into something more powerful and meaningful than is currently is they will need to be mindful of the following points in their work.

Defining and Redefining Self Tracking

The language that surrounds self-tracking needs to be redefined and communicated to the user through the design of the activity tracker. The terms “data”, “self-tracking” and “activity tracker” can be misleading, used in the wrong context or confused with similar ideas. This creates a disconnect between users and their personal data. It is important that the users have a clear understanding of the true nature of these concepts so that they can self-track accordingly. Giving users a language with which to understand activity trackers equips them with the ability to employ tactics more effectively. They will be better able to manipulate the activity trackers to produce results that are meaningful to them giving both the user and the activity tracker more agency to act on one another. This interpretation allows space for technology to catch up to design ideas since activity trackers would no longer be trying to collect perfect and objective data.

Data should be redefined as “capta” as suggested by Drucker (2011, as cited by Rettberg 2014). Capta is information that is actively taken from reality and is driven by inquiry rather than being supplied. This would be a small step in bridging the gap

between the realities of an activity tracker and data-ism, “the belief in data as objective truth” (Sondergaard, 2016, para.22). Understanding that the action of collecting data always has an agenda gives focus and supports to the user’s goal of better understanding themselves or the activity. It allows them to ask questions actively rather than simply stumbling upon correlations. There also needs to be recognition through design of the relationship between activity trackers, quantitative data and accumulation without criteria in comparison to diaries, qualitative data and the curation of a collection or work. Self-tracking, especially self-tracking of soft data types, exists on a spectrum between these two extremes. It is impossible to distinguish between these things entirely because they use the same tools for a slightly different purpose so can often only be placed on this spectrum with the intention of the user. Activity trackers always follow a narrative and so need to recognise that storytelling, in any form, is an extremely meaningful and powerful way to communicate personal data (Rettberg, 2014). Participants interviewed already used activity trackers to tell brief stories about themselves, even if this was mostly to themselves. In order for activity trackers to best convey this meaningful data they need to become storytellers.

Objectivity and Agency

The reciprocal nature of the relationship between the user and the activity tracker is vitally important for its success and so needs to be taken into consideration in the design of activity trackers. What is meaningful to each user can differ greatly

even within the context of a single activity, customisation and assigning new meaning are an example of tactics that can be employed to grapple with this (Manovich, 2013). Everyday life is so messy that in order for activity trackers to accommodate for every piece of data that the users might want to collect it would change the nature of the results from quantitative to a qualitative description. These solutions are still only superficial and an 'active cognizer' (Hayles, 2014, as cited by Rettberg, 2014) is needed to provide deeply meaningful data to individuals.

When using an activity tracker, especially one that requires active tracking or manual input, users find that the more time and energy they put into activity tracking the more they get out of it. Users might take away the agency of the activity tracker to protect themselves however, when the user invests time into their activity tracker they are investing more time and emotional energy into the activity by extension and into bettering themselves. Self-tracking can be confronting and users should be prepared for this. Activity trackers have the agency that the users give them. If the data is rich and the activity tracker has judgements built into it then this can often make a positive difference in the way the user understands the activity and themselves. Activity trackers are confronting and have the ability to force the user to reflect on themselves in a way that is almost impossible to deny. This gives them a unique ability to influence the user in a way that no person could recreate. Users are less likely to perceive and activity

tracker as criticizing them because they appear to be objective and have no agenda.

In order for this to be possible activity trackers cannot lose their sense of objectivity. The users benefit from the consistency and focus that this objectivity provides. Data should be understood as 'capta' to an extent however the illusion of data is a big part of what gives activity trackers agency and what makes them meaningful to the user. Activity trackers provide a different, more objective perspective on the activity and so can often help people to have a healthier relationship with the activity they are tracking.

Process over Product

Rather than reporting "experience collapse" (Rossiter & Zehle, 2015) participants found that their activity trackers made them more aware of their experience by asking them to pay attention to it and giving them the language to perceive and share it. Swan (2012) proposes that designers should focus on making activity trackers that hold the attention of the user for a longer period of time in order to hook them with better results. Users stop and start using activity trackers for valid reasons and Swan's suggestion is only a superficial fix to a bigger problem. By making activity trackers that enhance the user's experience rather than conflicting with it designers can give users an experience that would be missed if the user stopped tracking their activity. Self-tracking could be more smoothly integrated into everyday activities.

Activity trackers which focus on the process rather than exclusively on the product or goal will enable long term use and better outcomes for the user. Activity trackers mean more to the user when they make something unknown known. Users like to know more about what they are doing rather than just what they will achieve. Knowing the information can become part of the experience and enhance rather than overwhelm it. One way that activity trackers can ask the user to focus more on the process is by gathering soft, qualitative data to complement the data already being collected. Soft data, subjective information that has been “constructed” (Dancy, 2014) carries more meaning to users and has more agency to change the way they think about themselves whereas hard data that acts as a fact has the agency to change what the users do. This thesis did not explore the differences between Rettberg’s “modes of data” (2014, p.3) however further research could be done to determine how different soft or hard modes compare to each other.

These three points outline possible considerations for designers when making activity trackers. It is important to note that the frame of mind of the user is always an important context for their relationship with their activity tracker and their personal data. This is outlined perfectly by Rettberg (2014) and Weigel (2015) who both comment on the narrow perspective from which activity trackers tell their stories and the ways which this can be interpreted negatively or positively. This is reflected in

the varying attitudes of the participants interviewed. If users are not achieving their goals then they might stop caring in order to protect themselves from a perceived failure while a success acts as validation encourages the user to continue tracking.

The implications of collecting personal data is unique and far reaching in comparison to other types of big data so it should be prioritised and treated as distinct. Self-tracking is a reality of digital societies and can be better embraced by focusing activity trackers more on the experience of the activity. By adjusting the language used around self-tracking and acknowledging the reciprocal relationship between the activity tracker and the user, designers and users are both more empowered to mindfully consider and inform how we want these societies to be.

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Appendices

Appendix A.

Data Analysis Tables:

DATA TYPE							
Data Type	Social	Introspective				Not Found	TOTAL
Mood	3	1					4
Lifestyle	2	7					9
Relationships	1	2					3
Soft Data	6	10					16
Health	15	33					48
Location	3	3					6
Finance	0	1					1
Productivity	4	13					17
Envrionment	4	8					12
Hard Data	26	58					84
TOTAL	32	68					100

DATA TYPE							
Data Type	Social	Introspective					TOTAL
Mood	75.00	25.00					100
Lifestyle	22.22	77.78					100
Relationships	33.33	66.67					100
Soft Data	37.50	62.50					100
Health	31.25	68.75					100
Location	50.00	50.00					100
Finance	0.00	100.00					100
Productivity	23.53	76.47					100
Envrionment	33.33	66.67					100
Hard Data	30.95	69.05					100
TOTAL	32	68					100

COST OF SERVICES								
Data Type	Free	\$0-\$10	\$10-\$25	\$25-\$100	\$100-\$250	\$250<	Not Found	TOTAL
Mood	3	1	0	0	0	0	0	4
Lifestyle	6	2	0	1	0	0	0	9
Relationships	3	0	0	0	0	0	0	3
Soft Data	12	3	0	1	0	0	0	16
Health	16	4	5	7	14	2	0	48
Location	5	1	0	0	0	0	0	6
Finance	1	0	0	0	0	0	0	1
Productivity	8	6	1	1	0	0	1	17
Envrionment	5	1	0	4	2	0	0	12
Hard Data	35	12	6	12	16	2	1	84
TOTAL	47	15	6	13	16	2	1	100
COST OF SERVICES IN PERCENT								
Data Type	Free	\$0-\$10	\$10-\$25	\$25-\$100	\$100-\$250	\$250<	Not Found	TOTAL
Mood	75.00	25.00	0.00	0.00	0.00	0.00	0.00	100
Lifestyle	66.67	22.22	0.00	11.11	0.00	0.00	0.00	100
Relationships	100.00	0.00	0.00	0.00	0.00	0.00	0.00	100
Soft Data	75.00	18.75	0.00	6.25	0.00	0.00	0.00	100
Health	33.33	8.33	10.42	14.58	29.17	4.17	0.00	100
Location	83.33	16.67	0.00	0.00	0.00	0.00	0.00	100
Finance	100.00	0.00	0.00	0.00	0.00	0.00	0.00	100
Productivity	47.06	35.29	5.88	5.88	0.00	0.00	5.88	100
Envrionment	41.67	8.33	0.00	33.33	16.67	0.00	0.00	100
Hard Data	41.67	14.29	7.14	14.29	19.05	2.38	1.19	100
TOTAL	47	15	6	13	16	2	1	100

METHOD OF DATA COLLECTION							
Data Type	Device	Application	Web Only			Not Found	TOTAL
Mood	0	3	1			0	4
Lifestyle	0	6	3			0	9
Relationships	0	2	1			0	3
Soft Data	0	11	5			0	16
Health	17	14	13			4	48
Location	0	4	1			1	6
Finance	0	1	0			0	1
Productivity	0	8	6			3	17
Envrionment	5	1	6			0	12
Hard Data	22	28	26	0	0	0	84
TOTAL	22	39	31	0	0	0	100
METHOD OF DATA COLLECTION IN PERCENT							
Data Type	Device	Application	Web Only			Not Found	TOTAL
Mood	0.00	75.00	25.00			0.00	100
Lifestyle	0.00	66.67	33.33			0.00	100
Relationships	0.00	66.67	33.33			0.00	100
Soft Data	0.00	68.75	31.25			0.00	100
Health	35.42	29.17	27.08			8.33	100
Location	0.00	66.67	16.67			16.67	100
Finance	0.00	100.00	0.00			0.00	100
Productivity	0.00	47.06	35.29			17.65	100
Envrionment	41.67	8.33	50.00			0.00	100
Hard Data	26.19	33.33	30.95			9.52	100
TOTAL	22	39	31			8	100

Appendix B.

Survey

The Unquantifiable Self

Q11 Thank you for your interest in this project. Please read this information before deciding whether or not to take part. If you decide to participate, thank you. If you decide not to take part, thank you for considering my request. My name is Henrietta Hitchings and I am a Masters student in the Masters of Design Innovation at Victoria University of Wellington. This research project is work towards my thesis. This project explores the way that web and application design can educate consumers about self-tracking (keeping a record of personal activity, thoughts or health) online. By filling out this survey you are agreeing to take part in this research and will not be able to withdraw the information once the form has been sent. Information will be kept confidential. The results of this research may be used in academic reports and/or presented at conferences. I will not name you in any reports, and I will not include any information that would identify you. Only my supervisor and I will read the notes from the survey which will be kept securely and destroyed on the 18th of January 2017. The purpose of this survey is primarily to get an overview of basic self-tracking behavior and to identify a few people who are willing and able to participate in a short self-tracking activity and an in-depth interview. This research has been approved by the Victoria University of Wellington Human Ethics Committee. Application number: 0000022936 If you have any questions, either now or in the future, please feel free to contact either:

Student:

Henrietta Hitchings
hitchihr@myvu.ac.nz

Supervisor:

Walter Langelaar
Media Design Lecturer
School of Architecture and Design
+64 04 463 5512
walter.langelaar@vu.ac.nz

Q1 What is your age?

Under 18 (1)

18 - 24 (2)

25 - 34 (3)

35 - 44 (4)

45 - 54 (5)

55 - 64 (6)

65 - 74 (7)

75 or older (8)

Q2 What is your Occupation?

Q3 How many leisure hours a week would you use the internet?

None (1)

Less than 5 (2)

5-10 (3)

11-20 (4)

21-40 (5)

41 or Over (6)

Q4 What kind of information do you most frequently look at on the internet?

Q5 What devices do you frequently use to access the internet?

Smart Phone (1)

Computer/Laptop (2)

Tablet (3)

Other (Please specify) (4) _____

Q6 What other smart devices do you use if any?

Q13 What kind of personal information do you keep a digital record of? (This could range from online banking to an activity tracker to a blog).

Environment (Such as water usage) (1)

Time Management/Productivity (2)

Finance (3)

Location (4)

Health/Fitness (5)

Relationships (6)

Thoughts/Feelings (7)

Lifestyle (Such as clothing) (8)

Other (Please specify) (9) _____

None (10)

Answer If What kind of personal information do you keep a digital record of? (This could range from online... None Is Not Selected

Q8 How frequently do you check or manually update records of your personal information?

More than once a day (1)

A few times a week (2)

Once a week (3)

A few times a month (4)

Once a month (5)

A few times a year (6)

Once a year (7)

Less than once a year (8)

Answer If What kind of personal information do you keep a digital record of? (This could range from online... None Is Not Selected

Q9 Who can see digital records of your personal information?

Answer If What is your age? Under 18 Is Selected

Q24 Thank you so much for completing this online survey! Your participation is invaluable to this research.

If Thank you so much for compl... Is Displayed, Then Skip To End of Survey

Q19 In order to conduct interviews about the experience of self-tracking I first need participants to track an activity of their choice (such as walking) using a method of their choice (such as using the Apple Health App) over a period of two weeks. I will provide a few suggestions if you want to participate but aren't sure what to do or you could continue to track something that you already track. It should not take more than a few minutes each day. If you do choose to participate I will confirm this with you over email, I will also send you a short survey one week into the activity so that I can see how your experience changes over time. The interview will be conducted at the end of the activity, I will not be asking you about the personal data that you collected. If you wish to withdraw from the activity or interview you can do so at any time by sending me an email.

Q20 Would you be interested in participating in the self-tracking activity and interview?

Yes! It sounds like fun. (1)

No thanks. (2)

Answer If Would you be interested in participating in the self-tracking activity and interview? No thanks. Is Selected

Q25 Thank you so much for completing this online survey! Your participation is invaluable to this research.

If Thank you so much for compl... Is Displayed, Then Skip To End of Survey

Q23 To make self tracking easy there are a lot of apps available for smart phones. Some examples are Momento which helps to document moment, Clue which is a menstruation tracker, Map My Walk and Moves which are both fitness trackers and, Selfspective and T2 Mood Tracker which are both mood trackers. You could use one of these for the self-tracking activity or, if you had something in mind (such as using a sleep tracker, a Fitbit or taking a photo of everything you eat or wear) you could do that instead.

Q21 What would you like to track? For example: Time Management - Amount of time watching TV

Environment (1) _____

Time management (2) _____

Finance (3) _____

Location (4) _____

Health (5) _____

Relationships (6) _____

Thoughts/Feelings (7) _____

Lifestyle (8) _____

Other (9) _____

I haven't decided yet (10)

Q26 How will you track it? (Which app will you use if you use one?)

Q30 On what date will you start self-tracking?

Q31 Will you be available for an interview between the 29th of June and the 10th of July? It will not need to take longer than half an hour.

Yes (1)

No (2)

Q33 Please provide some contact details so I can confirm your participation.

Name (1)

Email (3)

Q34 Thank you so much for completing this survey and participating in the self-tracking activity. The information you have provided is invaluable.

Appendix C.

Initial Interview Questions

- What were you expecting or hoping to get out of the activity?

- How were your expectations met?
- How did you decide on the service that you chose?
- When would you use this service?
- What would you do when you used it? (Could you please show me?)
- What features of the service would you have liked to change if any?
- Did you share the data with other people?
- If so then what did you share and who did you share it with?
- What did you get out of sharing the data? If you didn't share it then why?
- What do you see as the most important aspects of what you were tracking?
- How did the service you chose address these things?
- Did self-tracking change your activity?
- How do you feel about the data on reflection?

Appendix D

Items from bank statement and their descriptions

Date	Amount	Other Party	Payment Type	Description
25/07/2016	-\$14.40	Burger Fuel Papanui	EFTPOS TRANSACTION	I desperately needed to eat
26/07/2016	-\$10.40	Aro Fruit Supply	EFTPOS TRANSACTION	I need food to survive
26/07/2016	-\$10.90	Bamboo	EFTPOS TRANSACTION	I felt guilty about not spending enough time with someone
26/07/2016	-\$19.80	Aro Valley Mini Mart	EFTPOS TRANSACTION	I need food to survive
26/07/2016	-\$201.00	Flat Account (26 A E	AUTOMATIC PAYMENT	I want to live walking distance from uni

27/07/2016	\$220.00	Dad	BILL PAYMENT	Dad doesn't want me to work while I'm studying
27/07/2016	-\$30.20	Flatmate	BILL PAYMENT	I was curious and lonely
27/07/2016	-\$108.00	Whitireia Performing	EFTPOS TRANSACTION	I need structure and exercise in my life
28/07/2016	-\$20.99	Farmers - Lambton Qu	EFTPOS TRANSACTION	I wanted to buy something but I didn't want to spend too much money
29/07/2016	-\$10.69	Aro Valley Mini Mart	EFTPOS TRANSACTION	I need food to survive
01/08/2016	\$330.00	Dad	BILL PAYMENT	Dad doesn't want me to have a student loan like my sister
01/08/2016	-\$10.80	Aro Valley Mini Mart	EFTPOS TRANSACTION	I need food to survive
02/08/2016	-\$201.00	Flat Account (26 A E	AUTOMATIC PAYMENT	I want to live walking distance from uni
03/08/2016	\$220.00	Dad	BILL PAYMENT	Dad doesn't want me to work while I'm studying

05/08/2016	-\$28.99	Unichem Cuba Mall Ph	EFTPOS TRANSACTION	I wanted to wake up in the morning feeling good
08/08/2016	\$100.00	Mum	DIRECT CREDIT	Mum wants me to be well dressed
08/08/2016	-\$36.01	New World Wellington	EFTPOS TRANSACTION	I need food to survive
09/08/2016	-\$50.00	Online Bonus Saver	AUTOMATIC PAYMENT	I want to be financially independent
09/08/2016	-\$201.00	Flat Account	AUTOMATIC PAYMENT	I want to live walking distance from uni
10/08/2016	\$220.00	Dad	BILL PAYMENT	Dad doesn't want me to work while I'm studying
11/08/2016	-\$46.00	Recycle Boutique 20	EFTPOS TRANSACTION	Retail therapy
12/08/2016	-\$24.17	Aro Valley Mini Mart	EFTPOS TRANSACTION	I was obliged to by my family
15/08/2016	\$50.00	Mum	DIRECT CREDIT	Mum wants me to be well dressed
15/08/2016	\$330.00	Dad	BILL PAYMENT	Dad doesn't want me to have a student loan like my sister
15/08/2016	-\$700.00	Savings Account	ONLINE BANKING	I felt guilty about my parents giving me so much money

16/08/2016	-\$201.00	Flat Account	AUTOMATIC PAYMENT	I want to live walking distance from uni
17/08/2016	\$220.00	Dad	BILL PAYMENT	Dad doesn't want me to work while I'm studying
18/08/2016	-\$24.12	Countdown Cable Car	EFTPOS TRANSACTION	I need food to survive
19/08/2016	\$100.00	Mum	DIRECT CREDIT	Mum felt guilty about not giving me enough for my birthday
22/08/2016	-\$20.00	Spark Prepaid 18	DEBIT	I want to communicate with people
22/08/2016	-\$25.00	Origami Restaurant	EFTPOS TRANSACTION	Made someone else feel better
22/08/2016	-\$32.00	Bats Theatre Ltd 19	DEBIT	I used a friend as an excuse to do something fun
22/08/2016	-\$36.65	Adobe Il Creativ 18	DEBIT	I got roped into a subscription
23/08/2016	-\$201.00	Flat Account (26 A E	AUTOMATIC PAYMENT	I want to live walking distance from uni
23/08/2016	-\$50.00	Online Bonus Saver	AUTOMATIC PAYMENT	I want to be financially independent

Appendix E

Processing Sketch

```
PImage img;
Table locationData;

PVector chch_latitude = new PVector(-43.505795, -43.60623); //min, max
PVector chch_longitude = new PVector(172.54692, 172.85103); //min, max
PVector latitude = chch_latitude;
PVector longitude = chch_longitude;

int stripHeight = 500;
int numData;

PGraphics mapView;
PGraphics barcodeView;
boolean inMapView = true;
boolean shouldDrawPoints = true;

void setup() {
  size (1246, 1023);
  img = loadImage("earth_view.jpg");
  locationData = loadTable("locationdata.csv");
  numData = locationData.getRowCount();
  println(numData + " total rows in table");
  mapView = createGraphics(width, height);
  barcodeView = createGraphics(width, height);
}
```

```
void draw() {  
    //clear canvas and draw image  
    background(255);  
    drawMapView();  
    drawBarcodeView();  
}  
  
void drawMapView() {  
    mapView.beginDraw();  
    mapView.background (255);  
    mapView.image (img, 0, 380);  
    img.resize(width, 0);  
    if(shouldDrawPoints) drawPointsOnMap();  
    mapView.endDraw();  
    if (inMapView) image(mapView, 0, 0);  
}  
  
void drawPointsOnMap() {  
    //draw our strips  
    for (int i = 1; i < numData; i++) {  
        TableRow row = locationData.getRow(i);  
        float lat = row.getFloat(0);  
        float lon = row.getFloat(1);  
        float yMap = map(lon, longitude.x, longitude.y, 380, 380+img.height);  
        float xMap = map(lat, latitude.x, latitude.y, 0, width);  
        mapView.fill(255, 0, 0);  
    }
```

```

    mapView.ellipse (xMap, yMap, 5, 5);
}
}

void drawBarcodeView() {
    barcodeView.beginDraw();
    barcodeView.background (255);
    drawStripsFromMap();
    barcodeView.endDraw();
    if (!inMapView) image(barcodeView, 0, 0);
}

void drawStripsFromMap() {
    mapView.loadPixels();
    //go through all points
    for (int i = 1; i < numData; i++) {
        TableRow row = locationData.getRow(i);
        float lat = row.getFloat(0);
        float lon = row.getFloat(1);
        float yMap = map(lon, longitude.x, longitude.y, 380, 380+img.height);
        float xMap = map(lat, latitude.x, latitude.y, 0, width);
        PImage strip = copyStrip((int)(xMap), (int)(yMap)-stripHeight/2, stripHeight);
        //strip.resize(0, height);
        float expansionFactor = 1;
        for(int u=0; u<expansionFactor; u++){
            barcodeView.image(strip, i*expansionFactor+u, 0);
        }
    }
}

```

```
}

PImage copyStrip(int midX, int midY, int h) {
  PImage strip = mapView.get(midX, midY, 1, h);
  return strip;
}

void keyPressed() {
  if (key == 'm' || key == 'M') {
    inMapView = !inMapView;
  }
  if (key == 'p' || key == 'P') {
    shouldDrawPoints = !shouldDrawPoints;
    println(latitude);
    println(longitude);
  }
  if (key == 's' || key == 'S') {
    saveFrame("capture##.png");
  }
  float smallNum = 0.0001;
  if(keyCode == DOWN){
    longitude.x -= smallNum;
    longitude.y -= smallNum;
  }
  else if(keyCode == UP){
    longitude.x += smallNum;
    longitude.y += smallNum;
  }
}
```

```
if(keyCode == LEFT){  
    latitude.x -= smallNum;  
    latitude.y -= smallNum;  
}  
else if(keyCode == RIGHT){  
    latitude.x += smallNum;  
    latitude.y += smallNum;  
}  
}
```