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Certainty as a provocation: the design and analysis of 2 Quant-Qual tool dyads for a qualified self technology project

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Abstract: This paper takes its starting point in recognising that the Quantified Self Movement can go beyond its existing purely quantitative nature and develop a second degree of meaning, so that the individual achieves self knowledge through human insights.

We designed a research methodology to explore an individuals current and past relationship with 'Activity Levels' and 'Balance Health' using two Quant-Qual dyads. For the first Dyad, quantitative data was gathered about the number of steps taken by participants, and compared to the Qual Tool of Energy Diaries. For the second Dyad, quantitative data about postural sway was gathered through an application and qualitative data about the perceptions of balance was gathered through a personal diary. Quantitative data provided grounds for sensitising the participants to the idea of 'Balance Health' and 'Activity Levels' and the Qual tools revealed the lack of an actionable vocabulary on the one hand for Balance Health and rich narratives for activity levels on the other. Therefore, there exists an opportunity for research through design, to understand an individuals perception of their activity and to compare this existing self knowledge (or the lack of) to factual quantitative data in-order to design Qualified Self technology devices.



Grover, Atkin and McGinley | *Certainty as a Provocation.*

Keywords: Ways of Knowing; Human Centred Design; Quantified Self; Qualitative Visualisations; Technology; Cultural Probes; Qualified Self technology devices.

Introduction : About Qualified Health and Falls

“ Macroscopes can help us understand complex systems, but our own eyes, unaided, are just as important ” (Thackara 2005).

Quantified Self (QS) has been defined as using sensors and input devices to measure sleep patterns, body fat, heart rate, steps taken, calories eaten, so that an individual using these devices gains “self knowledge through numerical data” (Ziegler 2013). Software and hardware devices which aid self monitoring and conversion of the gathered data into formal, graphic and mathematic aggregations have become commonplace.

Life-logging can have a substantial impact on technology services to support the health and wellbeing of older people. When a person ages they have a different relationship with their bodies - it becomes more complex - and they have a different relationship with technology too. Over the past few years at The Helen Hamlyn Centre for Design, a new approach which goes beyond the Quantified Self Movement, so that an individual achieves ‘self-knowledge through human insight’ is being explored. This approach is called the Qualified Self (Ziegler 2013). Figure 1 shows the Panasonic project conducted in 2011.



Figure 1. The Panasonic Project about Qualified Self.

Balance’ is a two year project with industry partners ‘Stannah’, which started in October 2013. More than a third of people over the age of 65 fall every year in the UK and those who fall once are two or three times more likely to fall again (The Department of Health 2014). Falls represent over half of hospital admissions for accidental injury, particularly hip fracture. Half of those with hip fracture never regain their former level of function and one in five die within three months. Falling in older age can lead to increased anxiety and depression, reduced activity, mobility

FALLS SERVICES OVERVIEW

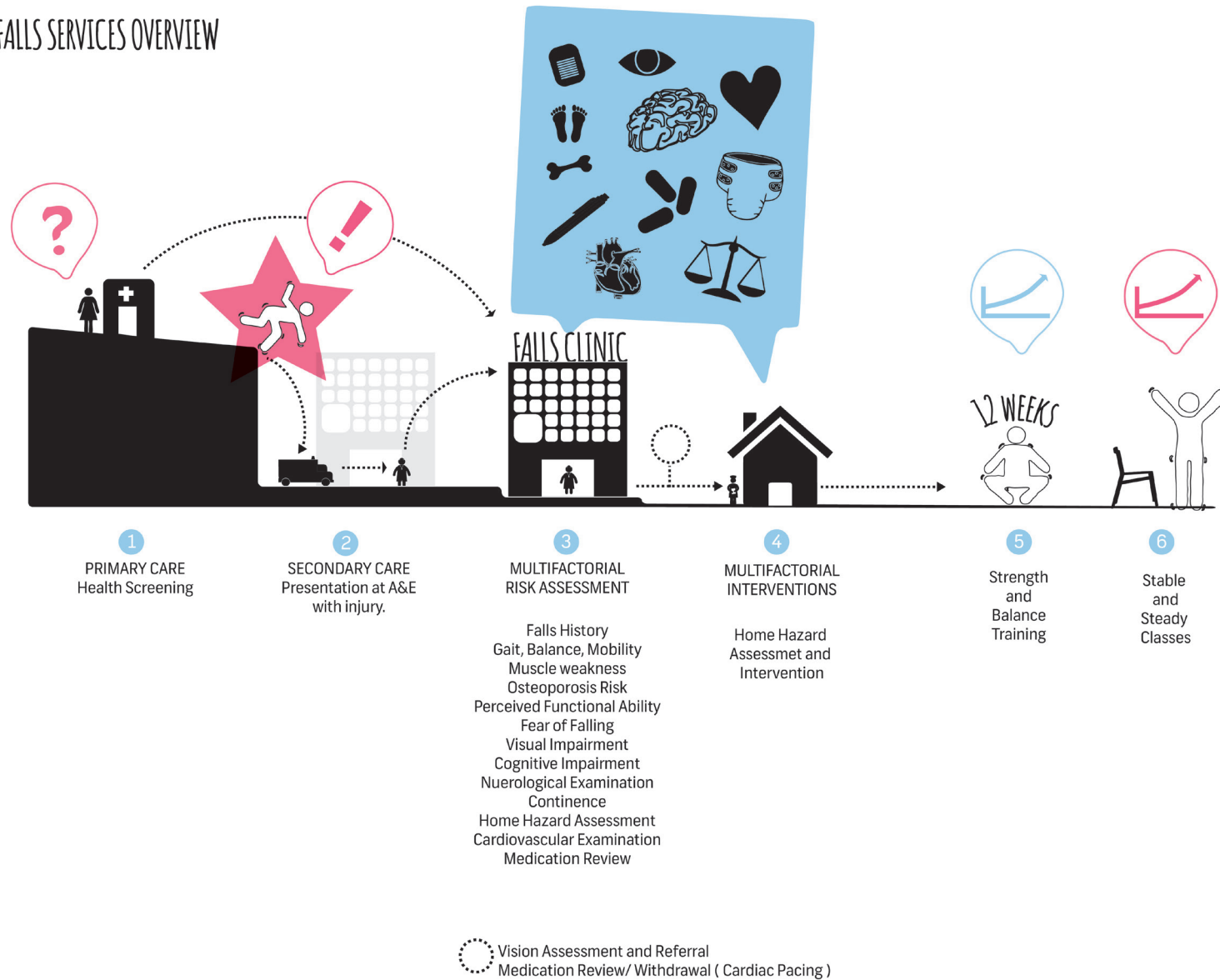


Figure 2. The NHS UK Falls Services.



Figure 3. A Stable and Steady Class in Earls Court.

and social contact, higher use of medication and greater dependence on medical and social services and other forms of care. Of those older people who enter falls prevention programmes, most do so only after they have fallen, by which time they may have suffered serious consequences (AgeUK 2012).

“ Most people don’t know about loss of balance unless they have someone who is a friend or a family member who has taken a fall and suddenly, they become ‘Edified’...you get to know only when there is a ‘Event’ ” - Moore 2014, Industrial Designer, Gerontologist

Figure 2 shows the Falls Services of the NHS (UK National Health Service). Post a fall, an individual is referred to a occupational therapist or physiotherapist who conducts a lengthy multi-factorial assessment either at home or within a Falls Clinic to identify falls risk factors (both extrinsic, intrinsic and acquired) and rehabilitation needs. If Mobile, individuals are recommended to undertake a 12 week strength and balance

training exercise programme. This is followed by a recommendation to attend a Stable and Steady Class, shown in Figure 3. Currently, Most of the interventions and NHS resources are focused on post fall recovery programs to prevent the likelihood of a recurrent falls.

The focus of the project is to develop a therapeutic diagnostics device which encourages a proactive attitude towards ‘Balance Health’ over the lifetime of an individual. The rationale being that if individuals engage with ‘Balance Health’ or the symmetry of muscle control; as a separate actionable component of their health much earlier on in their lives, falls can be prevented in later life. Accumulating evidence indicates that structured exercise help maintain an independent life by maintaining postural stability (balance), strength, endurance, bone density and functional ability and, in so doing, may prevent falls and injuries associated with falls in older age (Skelton 2001). However, Balance Health can be challenging to engage with, progress can often be slow with repetitive exercises required over a sustained period-of-time. There is no ‘silver bullet’ for improving balance. In addition, the ideas of Balance and proprioception were abstract at best in the minds of our cohort.

Hence, the design challenge goes beyond the development of an accurate diagnostics device, it is just as essential to design-in relevance for sustained engagement with ‘Balance health’. Today formal mathematic aggregations

are common; However, contextual qualitative visualisations, which encourages individuals to act mindfully are not. This paper firstly describes our attempt to work with six participants; to understand qualitatively the complex relationships with their bodies, their narratives of energy levels, preconceptions about their postures, experiences of falling, emotions about wellbeing, motivators for movement and compare this information with factual quantitative data gathered via a 'fit-bit' and a custom built phone application. We attempt to provide a frame of reference for use of QS devices within a human centred research methodology and highlight our considerations during the selection and design of tools. In the second section, we present the visual analysis of the data gathered from the two Qual Quant Tool dyads. We conclude with a discussion of our steps in the project post-analysis and a few lines on our current work on visualising balance.

Intent of the Research and Methodology

The purpose of our design research was to explore the changing relationship of our participants with their bodies as they are ageing and motivations for everyday activities. We wanted to explore their daily life routines, current activity levels, awareness of and attitudes towards 'Balance Health', understand causality through personal narratives (past), and aspirations for their future selves. During expert interviews, we developed a particular interest in women as users. This was because while

women have a longer life expectancy than men, they typically have a lower quality of life; twice the lifetime risk of osteoporotic fractures (Age UK 2014). Interestingly, experts also pointed out that women are less likely to self-identify as previously as being 'active':

“Women don't know the amount of exercise they get rearing children and managing a household. They don't look at it from that vantage point as you see...they didn't really have a life history of 'activity' so they don't associate it with something they can do.” - Pearl 2013, Postural Stability Instructor

The sample group of the study was therefore made up of six women between the ages of 51 and 72, who were living independently. The inclusion / exclusion criteria ensured a range of individuals with varying current activity levels and lifestyles.

Figure 4 is a depiction of our participants, Each participant was undergoing a lifestyle or a medical transition with a known relationship to balance health and hence had a heightened awareness of their balance. The study was hosted at The Helen Hamlyn Centre of Design in London over a period of eight weeks. Figure 5 depicts the three distinct stages of the research methodology. In phase one, a set of five short exercises were designed to be conducted along with the participants over a two hour period. In phase two, a box; as shown in Figure 6, containing four cultural

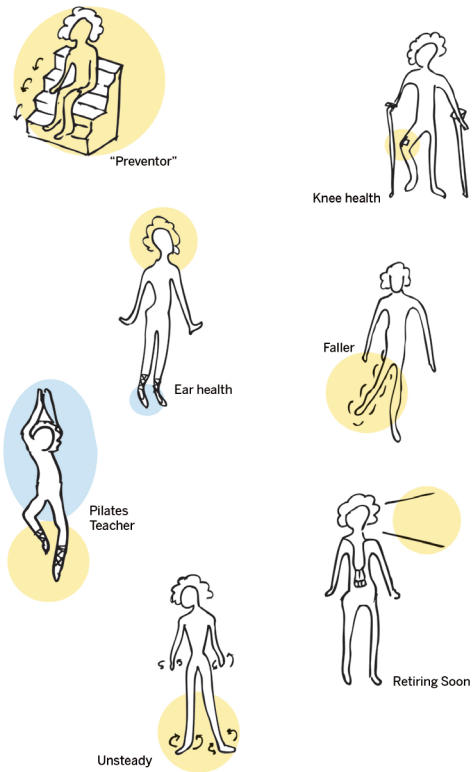


Figure 4 (left). An illustration depicting our participants relationship to balance.

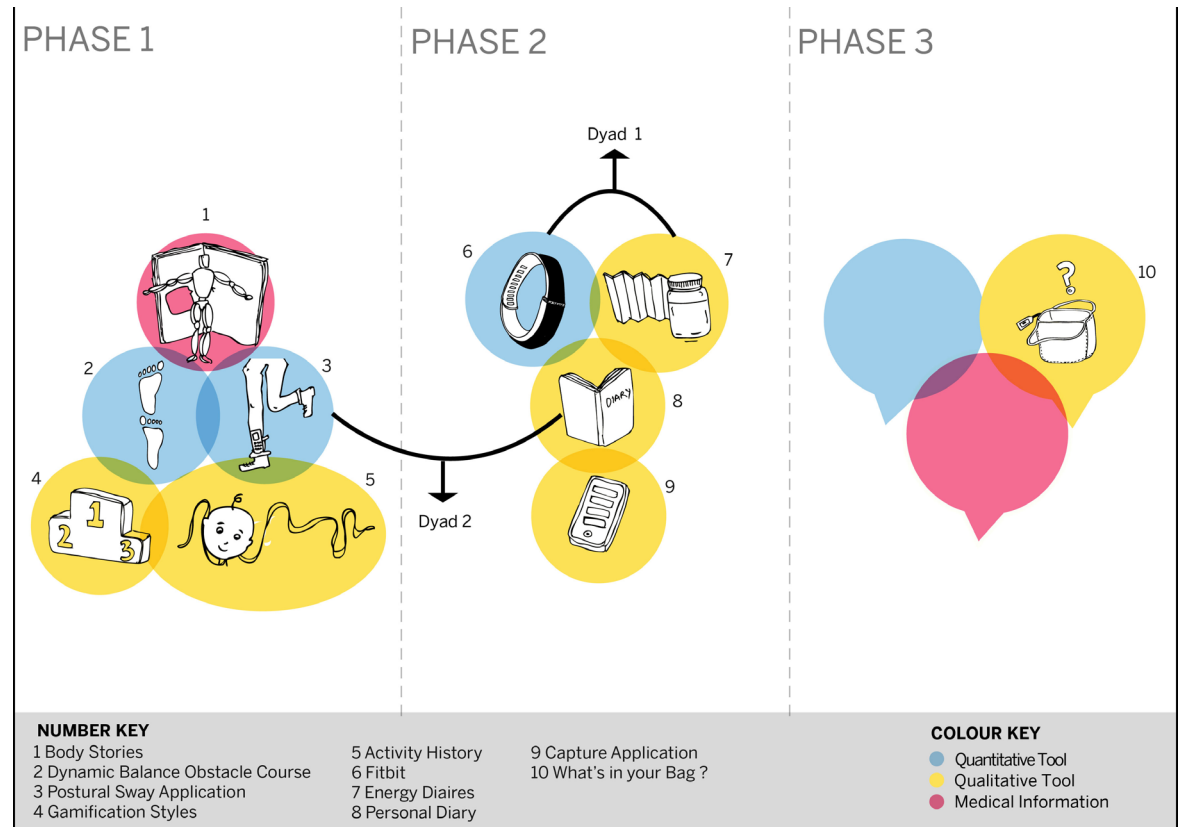


Figure 5 (above). Overview diagram of the three stage research process.



Figure 6 (above). Contents of the cultural probes including energy and conventional diaries, a Fitbit and a custom phone application.

probes (Gaver, et al. 2004), was given to the patient to use independently at home. In phase three, the researchers interviewed each patient individually after the completion of the cultural probes, during which probe outcomes were used to uncover insights.

An iterative process was followed in-order to develop the three phases. Open ended interviews were conducted with four women with a heightened awareness of their balance, to distill the focus areas. A pilot test was conducted to hone the language of the cultural probes. This test highlighted concerns about information privacy and tracking which accompany the use of digital devices.

The First Quant-Qual Tool Dyad: Balance Health

Using a Quantified Provocation to recall Everyday Postural Tactics

With the first dyad, we wanted our participants to first reflect upon, ‘How is my balance?’ and causally, ‘How does my balance affect me everyday?’ The first quantified tool was designed to actively quantify Balance, and the accompanying qualitative tool aimed to provide prompts for initiating contextual reflection. We selected postural sway as the aspect to quantify, due to ease of measurement. Figure 7 shows the Postural Sway¹ Application which allowed us to plot our participants static balance on a scale from good to bad and record initial reactions. This activation was followed by a dynamic balance exercise².

Figure 8 shows the obstacle course, designed with everyday life prompts. Participants were encouraged to cross the obstacle course by placing alternate feet in step (tandem walk), while answering questions designed to gauge the role of balance while they are going about their daily routines. By engaging their cognition and reducing their base of support, the intent being to recreate daily life movements, like shopping in a supermarket, in a lab setting.

The aim with the first Dyad was not to conduct a physiological assessment of postural sway and provide a diagnosis, but to isolate ‘balance narratives’ from the mundane everyday via activation of muscle memory and assist recall by recreating experiences.

The Second Quant Qual Tool Dyad: Activity Levels

Pairing Activity Narratives with an Activity Tracker

The second dyad was designed to compare the constructs of energy levels to factual data about activity levels. The QS device was an off-the-shelf activity tracker and the accompanying qualitative tool was an energy diary provided to record reflections. The activity tracker, shown in Figure 9, was worn by the participants for four days, the application accompanying the tracker was not installed on the smart devices of the participants, instead the information was passively collected, and accessed by the researcher post the completion of the four day period.

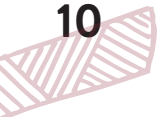


Figure 7. The Postural Sway application in use.

Figure 8. A participant tandem walking between the 'Everyday Prompts'.





Figure 9. Image of project participant wearing a Fitbit during initial interview.

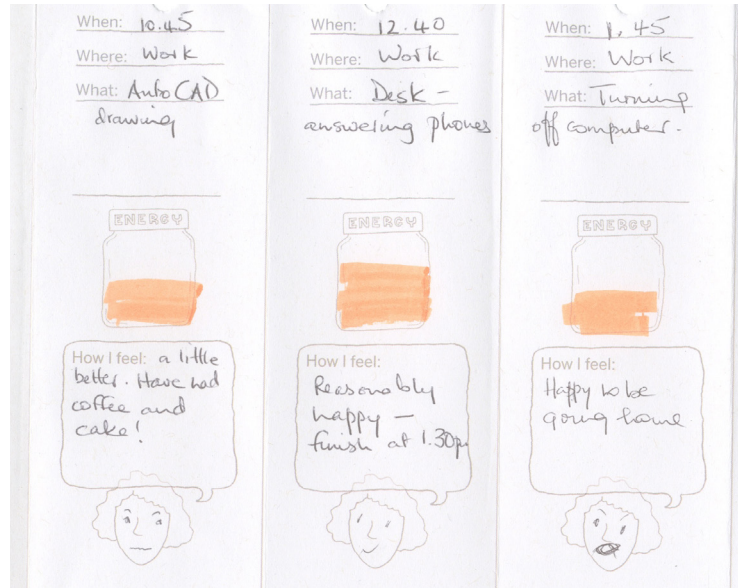


Figure 10. The filled out energy diary.

Four fold out 'Energy Diaries', page view in Figure 10 were given to each participant, to be filled in on the days on which they wore the tracker. The instructions asked the participants to fill in the diaries every time they finished or began an activity. By recording their perceived energy levels, the emotions on completion of a task and the spatial context; insights into the ups and downs of each participant's day were gathered.

The aim with the second Dyad was not to quantify activity levels and derive relationships between perceived levels and actual energy levels, but to gather a handful of insights into what makes-up our participants day, what tires them disproportionality, what energises them; and who they spend their time with.

Supporting Tool Designs

To accompany and support the dyads, support tools were designed to further contextualise the data. A paper by Rivera-Pelayo et. al. (2012) has identified contexts which might enrich the mathematical data from QS devices, our tools are categorised into these contexts:

Social Context

A card-sorting tool attempted to understand the extrinsic vs intrinsic motivation of the participants with relation to wellbeing and conscious exercise, shown in Figure 11.



Historical Context

Participants explored causality between their present body health and activity histories via two exercises. The first involved using a ‘mini-me’ to indicate current health of body parts shown in Figure 12. The second; identifying various climactic moments along their lifetime, tracing the build-up and the denouement w.r.t activity levels, pictured in Figure 13.

Spatial Context

Participants were requested to collect various images of their environment by way of a smart phone application which prompted them with questions like “Take a photo of...” As illustrated in Figure 14, The intentionality of tools was mapped along the path of expression (Sanders, E.P.N. and Jan Steepers, P, 2012) and tools were designed to match the ‘Make, Say, Do’ model. An ice-breaker activity about ‘what are the contents of your bag’ was subsequently added.

Research Outcomes

The data gathered from the six diverse participants was rich and varied. First, Insights from all participants were analysed together to find overall themes and then results from the tools were visualised using small multiples. Space does not permit the presentation of the complete analysis, below we present the information pertinent to the dyads.

The First Dyad

Figure 15 shows the initial analysis of the first dyad, which allowed us to plot the participants balance³ and compare it to their everyday narratives. The Postural Sway exercise was conducted with five⁴ participants and proved to be an effective activator to engage people in the articulation of their present state of Balance; A participant who has had two falls in the past reflected, “I find this very very difficult, I bet that was a high number wasn’t it? That is bad, how do I fix it?”

Another participant displayed high awareness and prior knowledge about the exercise. “I can stand longer on my left leg down than on my right. Having shoes on makes it easier to do it, while with eyes closed is almost impossible I have been practicing this after my knee surgery.”

Talking while engaging in the tandem walk through the everyday life-obstacles course did not come naturally to the participants, however it proved to be an effective method to provoke both verbal and physical responses from participants. Three of the six participants re-enacted the prompts on the floor to jog their memories and then responded to the questions, Figure 16 depicts a re-enactment. Participants related specific information; “I am ashamed to say that I avoid stairs, but will [would rather?] walk down [rather] than walk up” and four participants gave examples of additional everyday situations when their balance was challenged and tactics they employed.

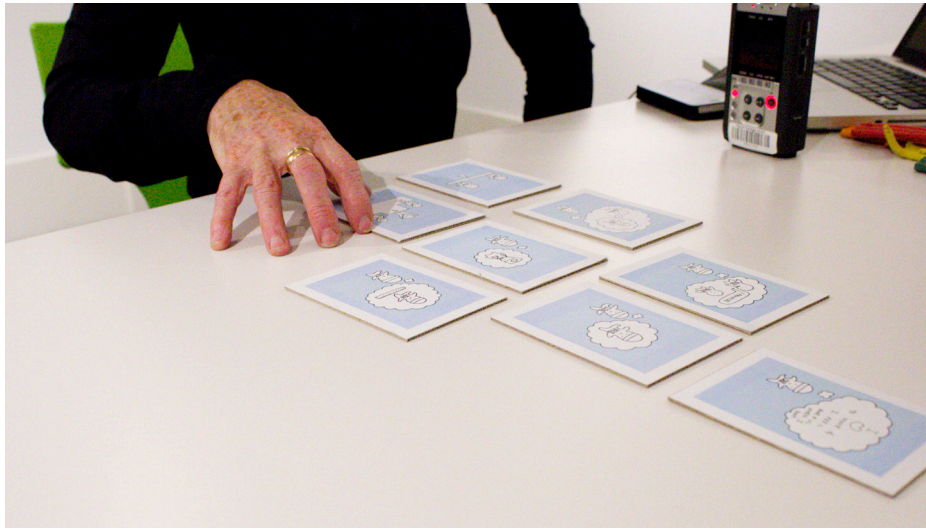


Figure 11 (above). A participant sorting her activity motivators.

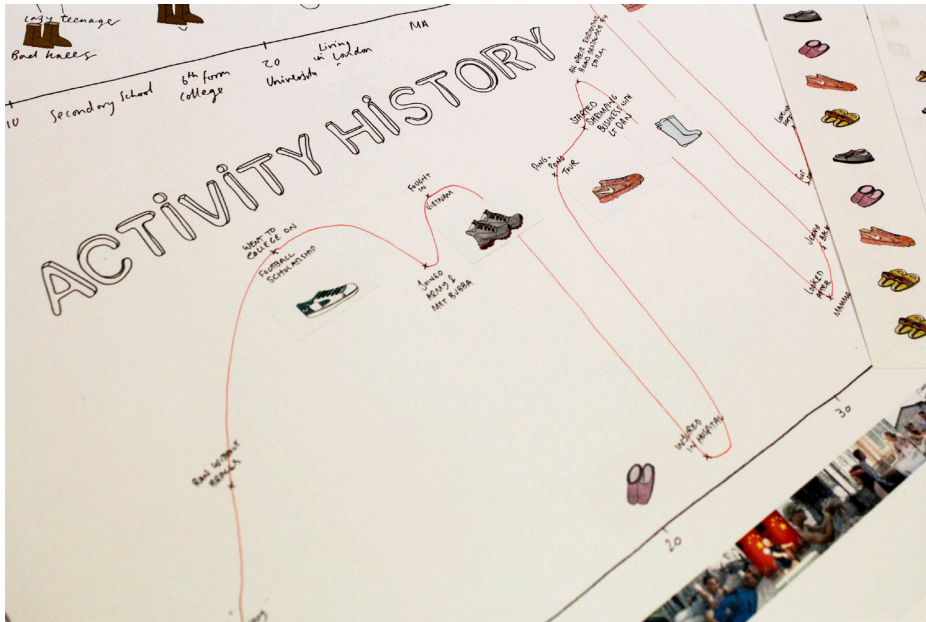


Figure 13. A sample activity history sheet.



Figure 12. A participant with her 'Mini-Me'.

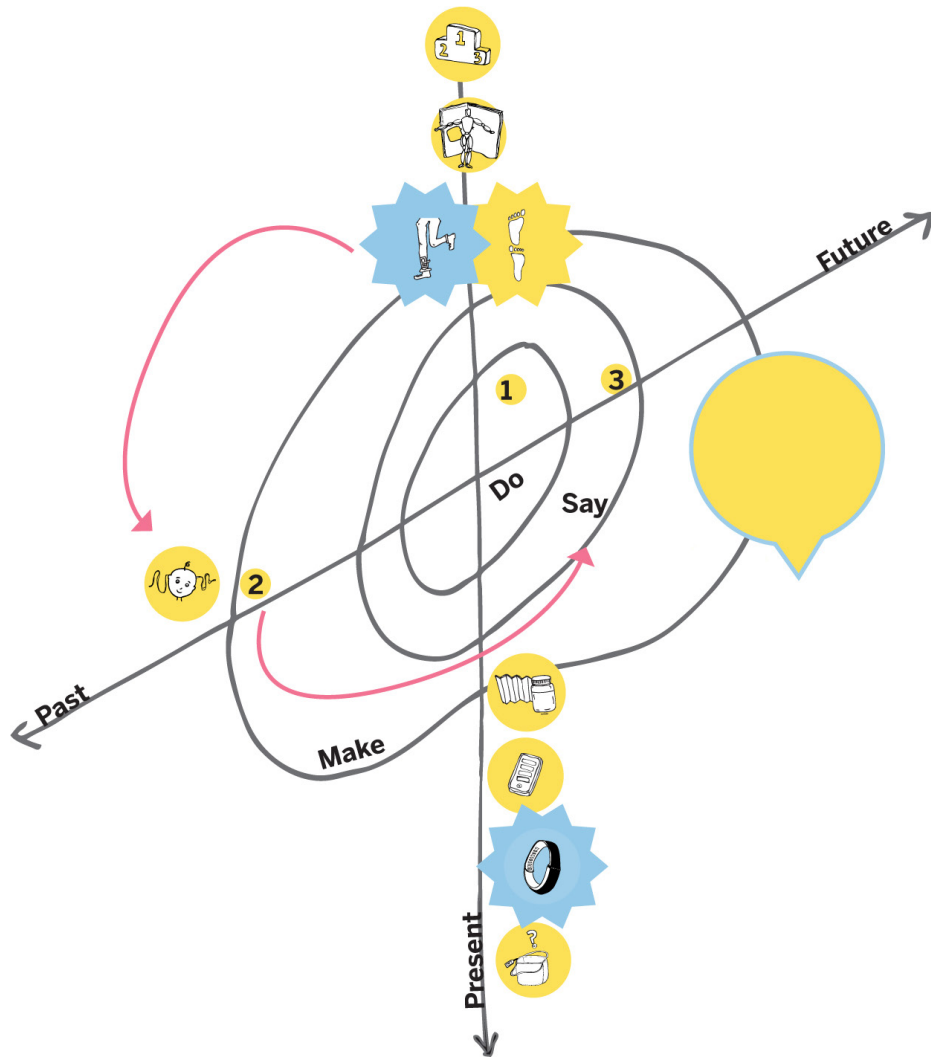


Figure 14. Path of Expression of Tools.

The Dyad helped us establish that while we might be able to quantify physiological Balance Health (subject to an independent scientific testing of the application), and that this information was engaging in the immediate time-period for the Participants, two dimensions differed based on prior experiences. These were; the fear of falling itself and body proprioception (knowing how to fall), the design challenge is to address these during the design of devices.

The Second Dyad

Figure 17 depicts the Initial analysis of the second dyad which allowed us to compare the activity levels between participants. We also compared to understand to what extent their time was structured, what were the everyday motivators for movement and for whom activity was ‘put upon’ i.e. a responsibility or duty, and for whom it was self-initiated.

Participant activity levels ranged from an average of 1500 steps/day to over 14,000 steps/day. A participant who has had keyhole knee surgery averaged over 10,000 steps reported “My life has not changed much.” Another with an average of 1500 steps, reflected on her low activity levels; “Activity is and has been a means to an end with which I was not always comfortable, even when I was dancing and reached the stage where I was winning medals.” and “Physically am inactive in most places, but mentally I’m constantly fizzing.”

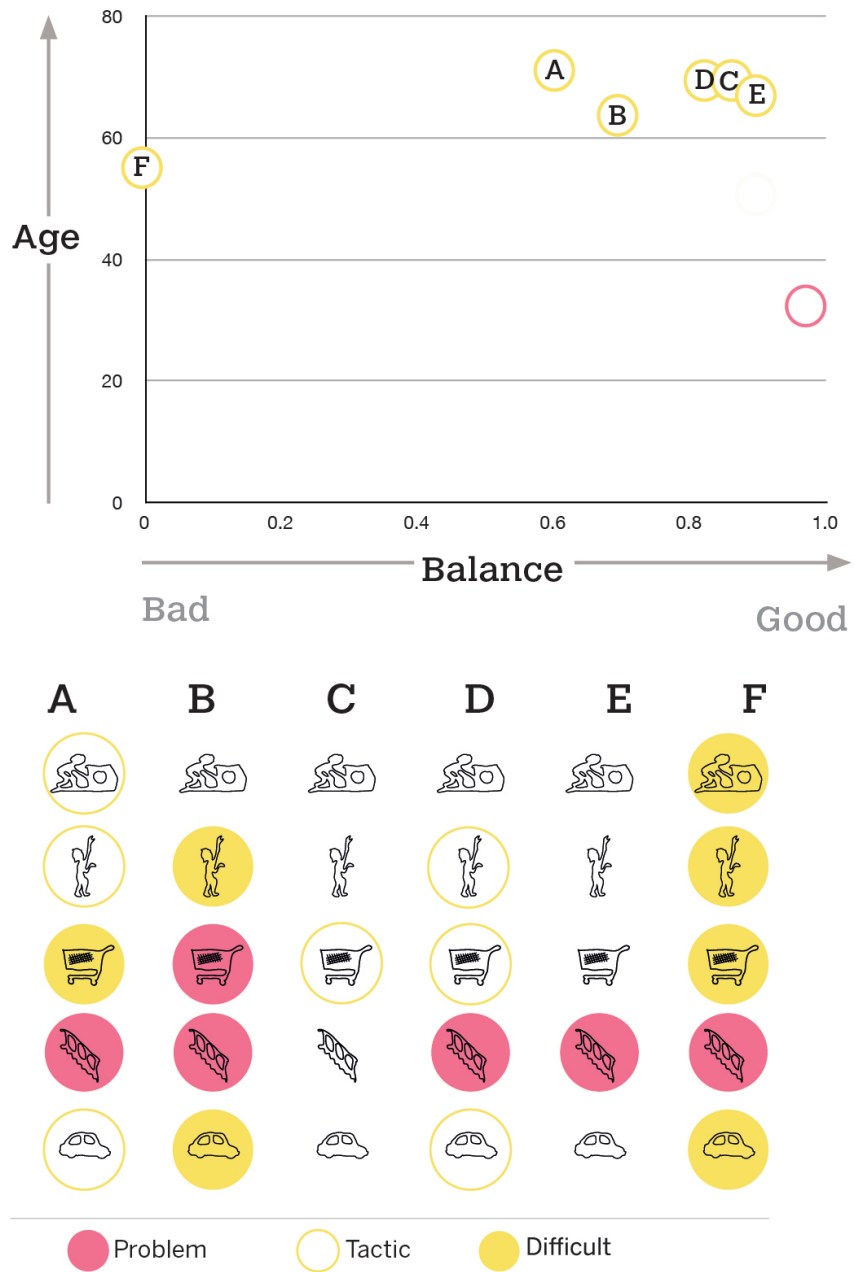


Figure 15. Initial Analysis of the first Dyad.



Figure 16. A participant re-enacting a prompt.

Average Steps / Day

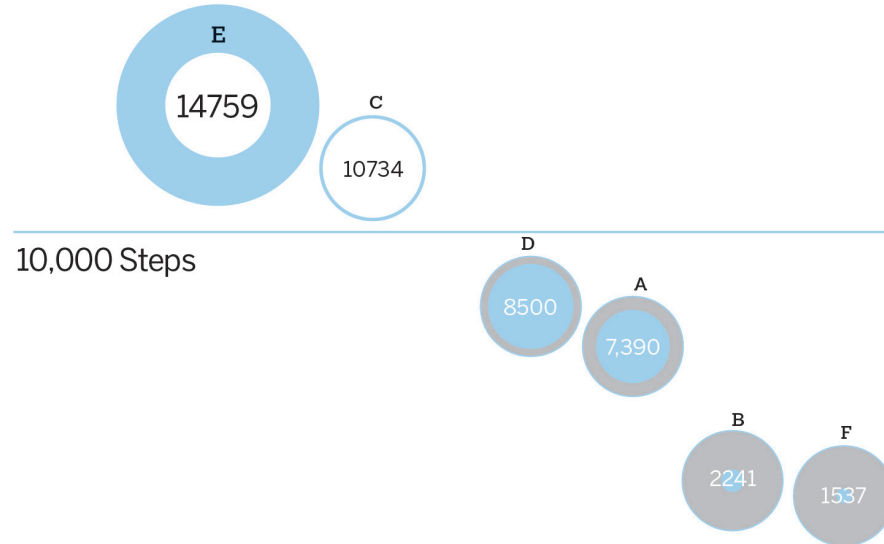


Figure 17. A comparison of the participants energy levels.



Figure 18. A graph comparing energy levels (as reported in energy diaries) to actual activity levels.

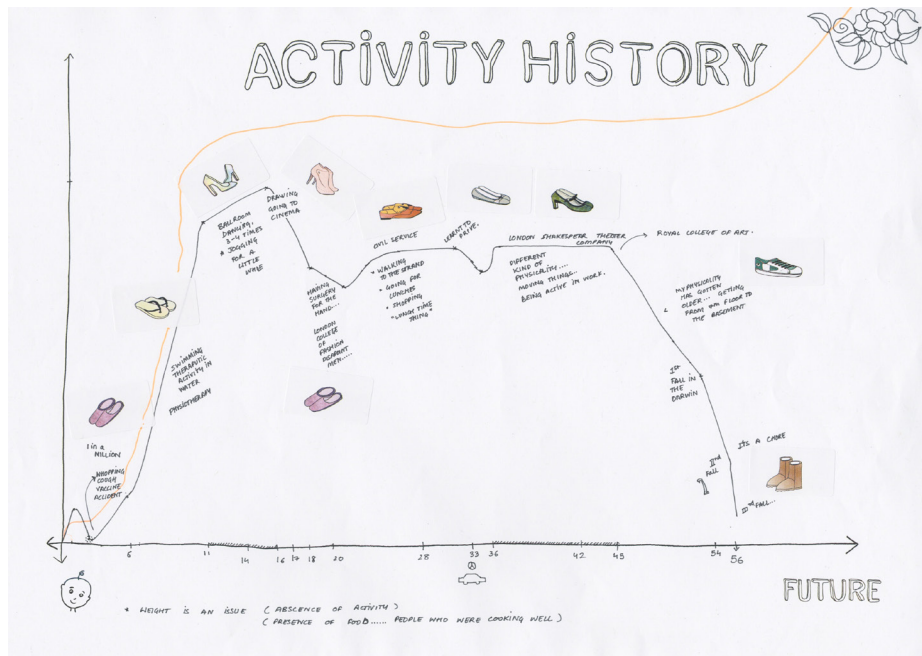


Figure 19. An activity history sheet.

Energy diaries, shown in Figure 18, heightened participant awareness about changing energy levels during the day. Participants were specific about the patterns they had noticed: “I get my second wind at about 11’o clock in the evening. About 3’o clock is my low energy time and that is when I get sluggish, I do something to revitalise me, shopping or something.” A participant with high activity levels and chronic pain disorder reported: “Sometimes its just like stages in your days and you just want to tick them off and say, ‘Right, I have done that.’”

This dyad helped us establish that activities are a recurring response to triggers, and the trigger itself plays a role on the perceived energy level during the activity. For compliance during an exercise experience, an intervention at the right time (taking into account previous activities and subsequent structured tasks) was important, along with engaging the mind in a purposeful way.

Figure 19 shows a filled out activity history tool. This analysis gave a background to the ‘Present’ information which the dyads collected. Finally, Comparing the first and second dyad highlighted the vague vocabulary around balance health and lack of body knowledge compared to the richness of vocabulary and personal narratives around weight issues and general fitness.

Discussion and Conclusions

Considerations for Quant Qual Methodology

The quant-qual dyads used two QS devices which helped to expedite the activation period and provide us comparable quantitative data. Areas and choices which we would be more mindful of in the future include:

a) Participant Comfort

Our participants reported some form of relief while handling in the activity tracker; “Felt a bit alien, don’t like wearing it at night. Couldn’t get it to go to sleep. If knocked, it lights up at night.”

b) Addressing data privacy concerns

Participants expressed concern about the researchers being aware of their whereabouts due to the tracker, even though the nature of the device was explained.

c) Accuracy of Data Collected

A device conveys a certain amount of ‘Scientific Proof’, while the application we tested was a prototype. For this, a stronger disclaimer about the validity of the said device could be considered.



d) Blind vs Constructive Tracking

The first dyad involved a few minutes of tracking, whereas the second dyad involved four days tracking. For longer tracking periods, constructive tracking; that is one in which the participant can have access to the data being collected (and perhaps modify the same) could be considered to reduce dissonance caused by a) and b).

e) Active Triggering

The tools in the dyads we designed worked independently of each other. It would be interesting to explore the possibility of one tool mechanically prompting the user to interact with the second tool.

Steps Ahead

Visualising Qualitative Complexity for Generative Design with Participants

Over the course of the research we have collected a large amount of data, and our attempt currently is to make the “unfiltered, unsorted, and unframed information, digestible.” (Thackara 2005). Three clear themes emerged, which have been made tangible in the form of three functioning prototypes (Figure 20)

We view these prototypes as toiles, which we can co-design with each participant, based on the analysis of information gathered. Our attempt is to create qualitative visualisations for each participant, aggregating the data gathered from the dyads and supporting tools. The Sightline project (Atkin and Myserson 2010) and Tales of Retirement (McGinley 2014) present examples of Qualitative Visualisations which clarify intangible but salient aspects of the lives of the people they describe.

These visualisations will be presented back to the participants (an example is depicted in Figure 21) to help facilitate the process of “designing Tools, and aesthetic notions, that help us understand – and act mindfully in – the big picture.” (Thackara 2005). However, within the scope of this paper we can definitely conclude that there exists an opportunity for research through design, to understand an individual's perception of their activity and to compare this existing self knowledge (or the lack of;) to factual quantitative data in-order to design Qualified Self technology devices.

Endnotes

¹ Postural Sway is the movement of the body in a still position. A certain amount of sway is essential and inevitable due to small perturbations within the body (e.g., breathing, shifting body weight for one foot to the other) or from external triggers (e.g., visual distortions).



Figure 20. Prototypes.

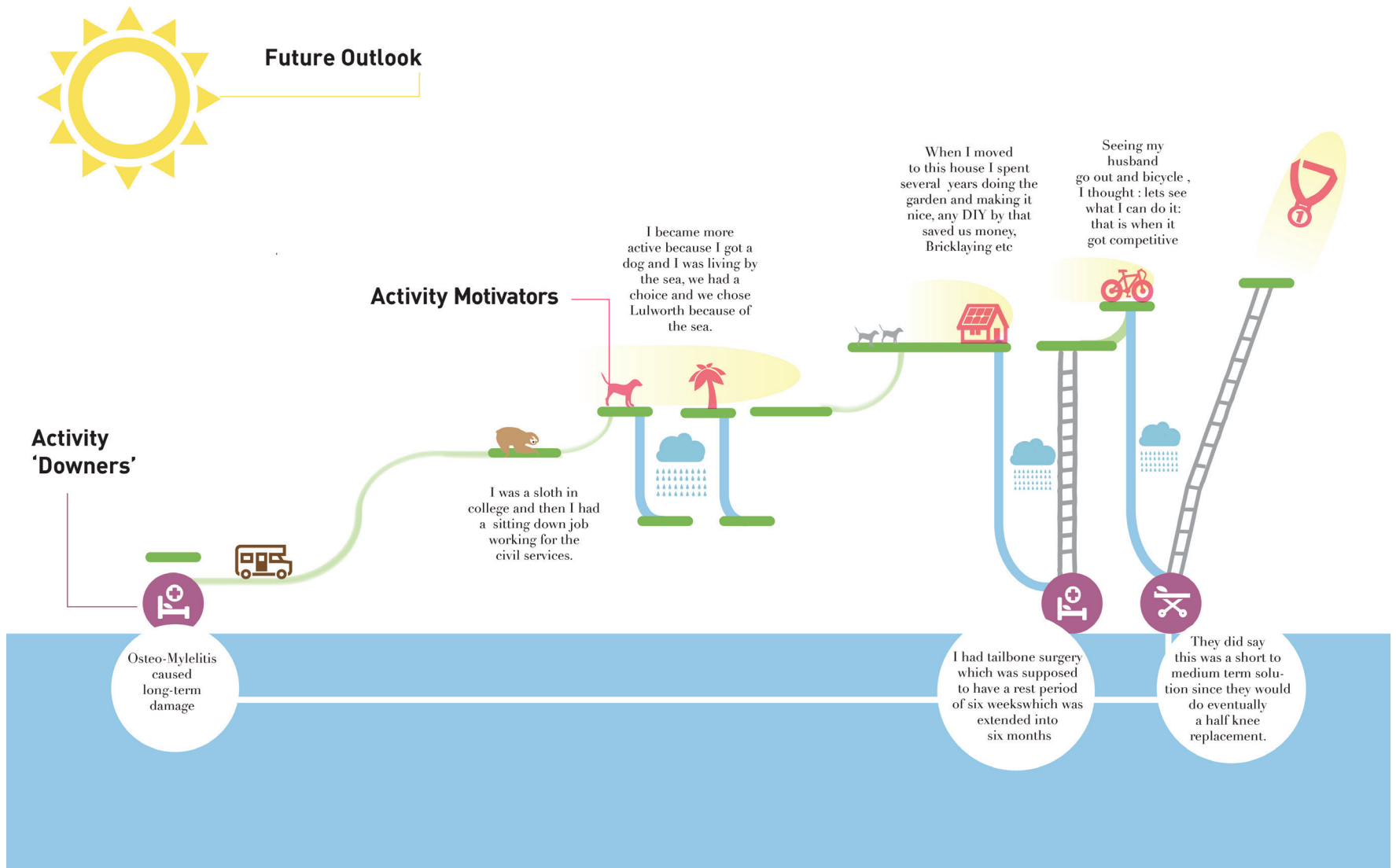


Figure 21. A qualitative visualisation.

² Dynamic balance is keeping balance while moving. Testing Dynamic Balance is the primary aim of the Falls Service Multi Factorial Falls Assessment.

³ This was for internal purposes only, The application is currently being tested.

⁴ Health and Safety reasons prohibited the testing of the application on the sixth participant.

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