Designing Fitness: Probes for Motivation

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Submitted to the School of Design, Carnegie Mellon University,
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Executive summary

What motivates behavior change with regards to fitness?
What alternative models of the human can user-centered designers assume while conceptualizing solutions?
How can cultural probes mediate people's understanding of their own motivations?

Fitness tracking is a major phenomenon at the intersection of design, technology, health and behavior change. In 2015, one in five American adults owned at least one wearable.[1] 78.1 million wearable devices were sold in 2016; 171.6% more than in 2015. [2] M-health solutions, through mobile applications and wearable devices, encourage physical activity by tracking movement ambiently and providing immediate feedback. However, studies suggest that users' engagement varies over time. Between 30% to 40% of people stop using the devices after 6-12 months.[3] It is worth examining these relationships for insight into wider questions regarding the role of technology in designing for behavior change.

Initially, I examined the nature of quantitative and qualitative fitness data, which raised issues regarding perception, effectiveness and impact. From these issues, I will focus my discussions on the questions of the generation and sustainment of motivation, the relationship between designers and users and the potential of design probes in revealing the subconscious and provoking self-reflection.

User interviews with 15 people who used or still use fitness trackers or other m-health applications, showed that fitness trackers are unable to recognize and address changes in people's needs and motivations. The level of feedback provided does not help to manage fitness independently. To find out more about why and how people bought and used fitness trackers, I wrote a Python program to parse through 33,688 Amazon reviews of the top seven products. The sentiment analysis did not reveal any significant insights into the behavior change aspect of people's experience, so instead I examined how people perceive and evaluate the risks of physical inactivity and of security issues around fitness trackers. Doctors' biases, affect and the disconnect between fundamental and means objectives helped create principles for redesign.[4] I generated concepts based on different stages of the user journey and across a spectrum from Prescriptive to Ambient.

1. Jonah Comstock, "PwC: 1 in 5 Americans Owns a Wearable, 1 in 10 Wears Them Daily." *MobiHealthNews.* 2014. Accessed April 15, 2017. http://www.mobihealthnews.com/37543/pwc-1-in-5-americans-owns-a-wearable-1-in-10-wears-them-daily.

2. "The Worldwide Wearables Market Leaps 126.9% in the Fourth Quarter and 171.6% in 2015, According to IDC." Www.idc.com. Accessed September 28, 2016. http://www.idc.com/getdoc.jsp?containerId=prUS41037416.

3. Eric A. Finkelstein, Benjamin A. Haaland, Marcel Bilger, Aarti Sahasranaman, Robert A. Sloan, Ei Ei Khaing Nang, and Kelly R. Evenson. "Effectiveness of activity trackers with and without incentives to increase physical activity (TRIPPA): a randomised controlled trial." *The Lancet Diabetes & Endocrinology* 4, no. 12 (2016): 983-95. doi:10.1016/s2213-8587(16)30284-4.

4. Melissa L. Finucane, Ali Alhakami, Paul Slovic, and Stephen M. Johnson. "The Affect Heuristic in Judgments of Risks and Benefits." *Journal of Behavioral Decision Making* 13, no. 1 (2000): 1-17. doi:10.1002/(sici)1099-0771(200001/03)13:13.0.co;2-s.

Paul Slovic, "Perception of Risk." Science 236, no. 4799 (1987): 280-85. doi:10.1126/science.3563507.

Using these sketches as starting points for discussion, I studied Motivational Interviewing and the Self Determination Theory.[5] I conducted expert interviews with a doctor, a teacher and a game designer to understand how they design for motivation. The principles were used in conjunction with techniques like the 5 Whys, design research methods such as collages, personas, annotations and Day in the Life of charts; and constructs like physical representations of mental models and the Dear Data project to design, iterate and prototype seven different cultural probes.[6] Each set of probes was deployed among five participants. This was followed by interviews and debriefings.

Designing Fitness involves a system of interconnected services that aim to build intrinsic motivation, which is defined as the self-desire to seek out new things, to analyze one's capacity and to gain knowledge.[7] This system enables people to uncover their own motivations through strategic and structured prompting in service moments. One of the service moments takes the form of design probes; this is what has been prototyped and tested within the scope of this thesis. The family of probes enables people to uncover their needs and reflect on their own motivations around fitness through strategic prompts and interactions with tangible artefacts. Learning better from people's own self-reflected motivations could enable a new level of understanding for designers working in areas of fitness and also around behavior change more widely.

5. William Miller and Stephen Rollnick, *Motivational interviewing: Preparing people to change addictive behavior (*New York: Guilford Press, 1991).

Edward L. Deci, and Richard M. Ryan, *Intrinsic motivation and self-determination in human behavior (*New York: Springer Science Business Media, 2014).

6. Oliver Serrat, The five whys technique. Washington, DC: Asian Development Bank (2010)

'THE PROJECT.' Dear Data. Accessed April 28, 2017. http://www.dear-data.com/theproject/.

7. Deci and Ryan, *Intrinsic motivation and self-determination in human behavior.*

The Self-Reflective Probes of the Designing Fitness System

This section details each of the probes, with details of the information given to participants, the materials used, and the kinds of outcomes produced. The background to, and development of, the probes, is described in the section 'Designed service system'

Probe 1: Collages

Details provided to participants

Background

Collages are an abstract way of expressing ideas and emotions. The goal isn't to make a beautiful collage (though you're welcome to do it!) but to understand what fitness means to you personally and what you exclude from your idea of fitness.

Instructions

1. Use the images provided in the envelope to create a collage of what fitness means to you currently.
2. Create a second collage of what you would like your relationship with fitness to be in the future

Feel free to cut the images into shapes, draw your own images or print out photographs.

Completed Collages

Probe 2: Personas

Details provided to participants

Background

Designers create personas as representations of archetypes of users. Personas are fictional but based on user research. They help designers create a shared understanding of user needs, aspirations, drives and blocks in order to suggest appropriate solutions.

Instructions

1. Go through the personas provided to you. They are based on interviews of real people.
2. Cut out the quotes that you empathize with. You may find that you have things in common with many different people regardless of suggested age, race and gender
3. Choose the ones you agree with the most
4. Order them by how much you agree with them, if you can
5. Stick them on the card marked “Me”

Completed Personas

Probe 3: Day in the Life of

Details provided to participants

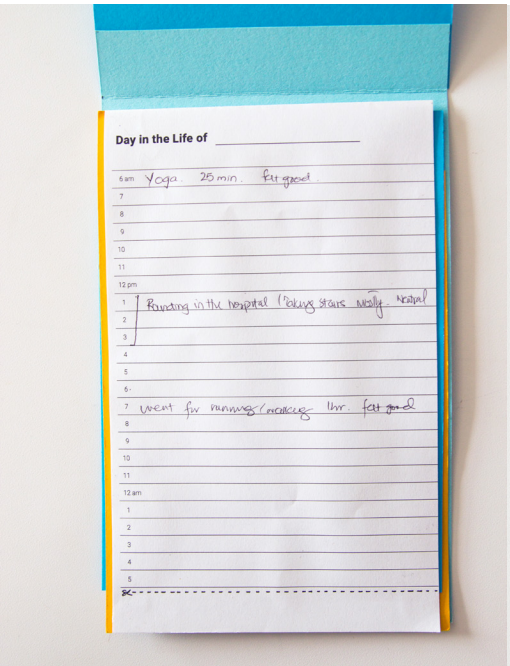
Background

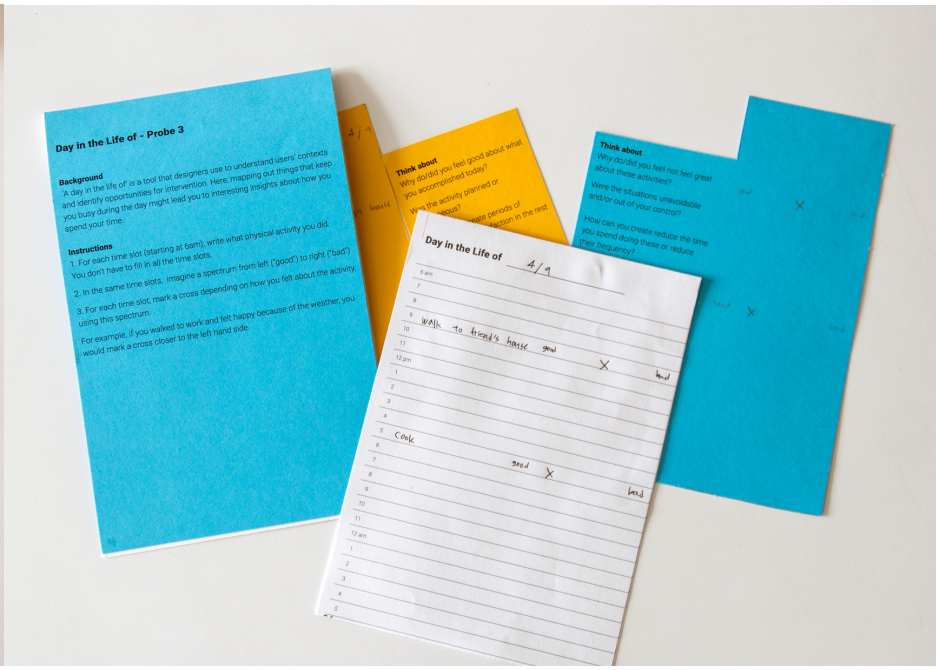
'A day in the life of' (DILO) is a tool that designers use to understand users' contexts and identify opportunities for intervention. Here, mapping out things that keep you busy during the day might lead you to interesting insights about how you spend your time.

Instructions

1. For each time slot (starting at 6am), write what physical activity you did. You don't have to fill in all the time slots.
2. In the same time slots, imagine a spectrum from left ("good") to right ("bad")
3. For each time slot, mark a cross depending on how you felt about the activity, using this spectrum. For example, if you walked to work and felt happy because of the weather, you would mark a cross closer to the left hand side.
4. Cut the card along the dotted line and read what follows.

Completed DILOs





Probe 4: Dear Data

Details provided to participants

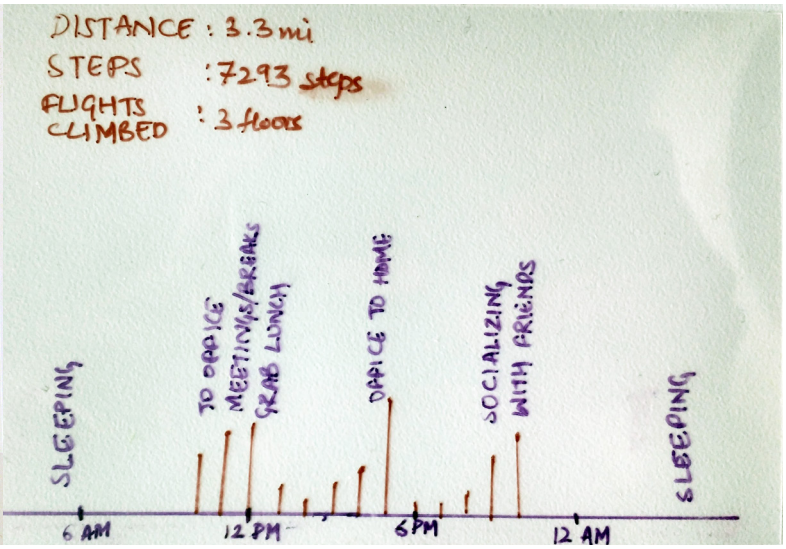
Background

Giorgia Lupi and Stefanie Posavec worked on a project called Dear Data.[8] They hand drew their "data" from various aspects to their lives for 52 weeks and shared it with each other, through postcards, across continents. The experience made them "become more humane and (helped them) connect with (them)selves and others at a deeper level".

Instructions

1. Take a screenshot of your "quantitative" fitness data as recorded by your fitness app for today and the last 4 days.
2. Each page of this booklet corresponds to 1 day. Place the first page on your actual phone screen and mark the high and low points of your physical activity
3. Now write what you were doing during those points. Write what your data shows you beyond the number and think about why.
4. Continue doing the same for all the pages
5. The last page is meant to help you set goals for yourself for tomorrow. Draw what you'd like your data to tell you when you look at it later.

Created Dear Data notebooks



8. 'THE PROJECT.' Dear Data. Accessed April 28, 2017. http://www.dear-data.com/theproject/.

Probe 5: 5 Whys

Details provided to participants

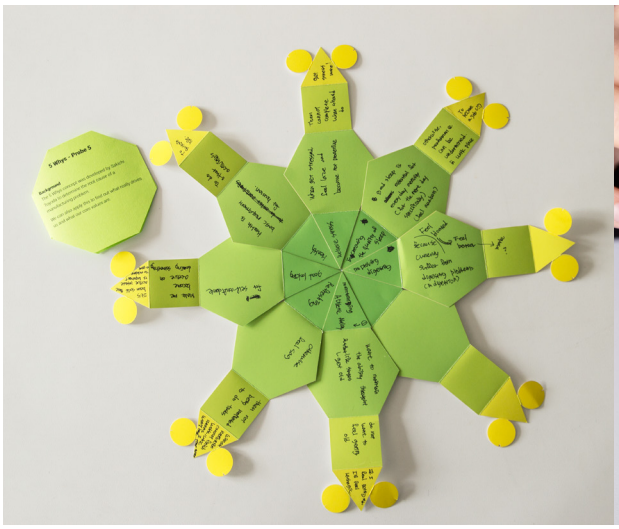
Background

The 5 Whys concept was developed by Sakichi Toyoda to determine the root cause of a manufacturing problem. We can also apply this to find out what really drives us and what our core values are.

Instructions

1. In each triangular section of the octagon provided, write down one reason why fitness is important. You'll end up with up to 8 different reasons.
2. Now, choose one of the reasons and open the first flap
3. On the hexagon, write down why that reason is important.
4. Open the second flap and on the square, write why the reason/s on the previous hexagon is important.
5. Continue doing this till you reach the end
6. Follow steps 2 to 5 till you fill in 5 levels of why for all of your original answer

Completed 5 Whys models



Probe 6: Mental Models

Details provided to participants

Background

A mental model is a representation of the surrounding world, the relationships between its various parts and a person's intuitive perception about his or her own acts and their consequences. In this exercise, participants will build physical representations of the model.

Instructions

Use the interlocking disks to create a mental model of your behavior around fitness. Feel free to expand beyond exercise and diet. If you're stuck at any point, refer to the prompts on the other side

1. On the smallest disks write down your everyday 'acts' of fitness.
2. Connect the smallest disks and group them into habits.
3. Write down your 'habits' in the second largest disks and connect them to the groups of acts
4. On the largest disks, write down broader 'social practices'
5. Connect these habits to the largest disks of practices

Prompts

1. Think of the last time you took engaged in a fitness related activity. What was it? What environment was it in?
Were other people involved? What are the implications?
2. How can you actively make fitness a priority given your current circumstances and environment? How might you plan other activities to support fitness?
3. Think beyond fitness to health and well-being. Connect it with what you learned about yourself in the previous exercise

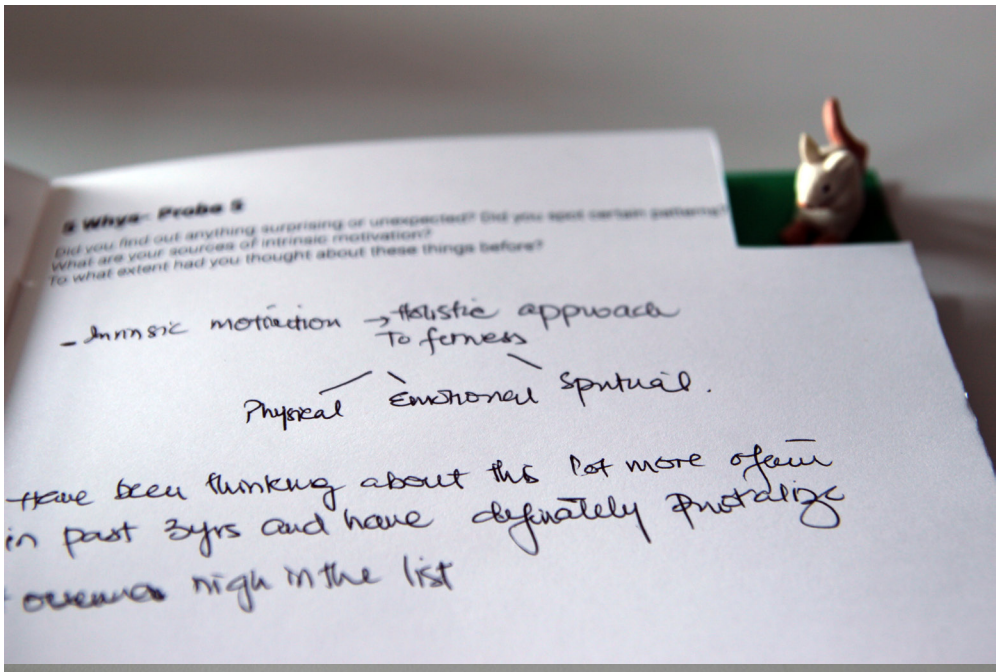
Completed Mental Models

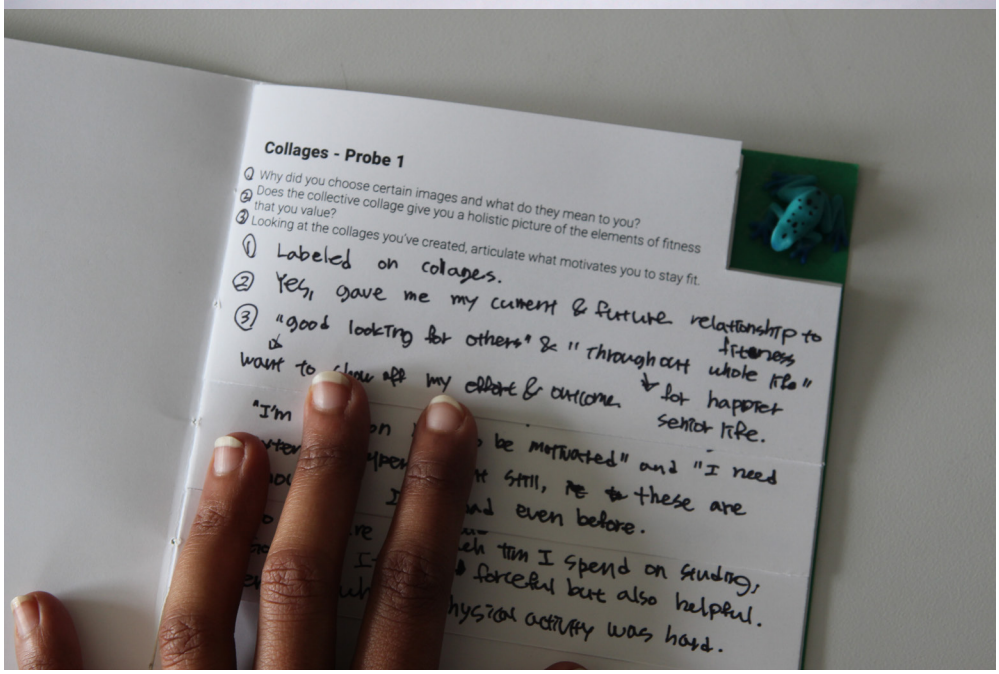
Probe 7: Reflective journal

Details provided to participants

Follow the prompts in this journal to document your thoughts after completing each probe. Ideally, fill in the journal the day after you've completed the probe but you could choose to reflect here immediately after the activity as well.

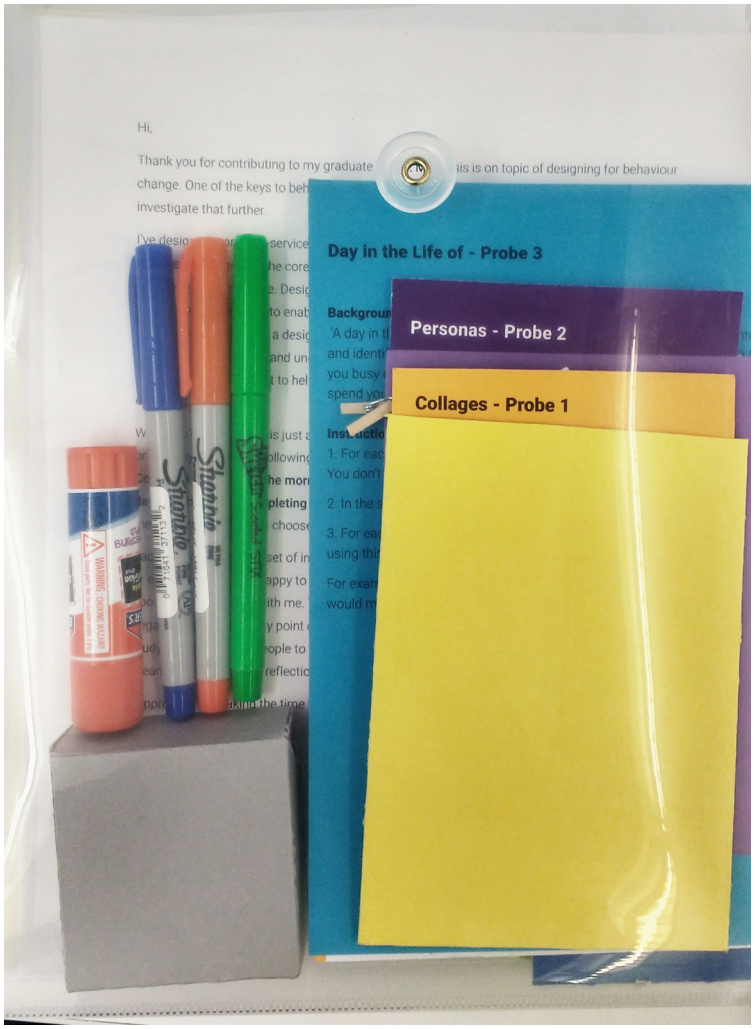
Completed Reflective Journals





The kits

Each participant received a clear envelope with the material for each probe, glue, paper and sharpies.



Background: Dominant Paradigms around Fitness, Technology and Design

Currently there are some dominant themes in the narratives around fitness, technology and design. In order to reconceptualize a design system, it was important for me to analyze and think critically about these existing paradigms and frames.

Fitness and physical activity

According to a report by the World Health Organization, physical inactivity accounts for 1 in 10 deaths each year and was among the leading global risks for mortality (2009).[9] However, much of the fitness industry still focuses on losing weight for aesthetics as opposed to health reasons, maintaining good health or avoiding chronic diseases at the scale of epidemics. The current popular image of fitness centers around the gym, aesthetics and competition, which may be seen as having a hyper-masculine perspective.[10] This imagery excludes a large proportion of the population who are at a higher risk of ill-health from physical inactivity, but lacking the resources to go to a gym. People have different relationships with fitness that includes physical activity but is also linked to diet, stress and social networks.

Physical activity is perceived as something that's good for you. However, this discourse allows it to appear as a lifestyle choice as opposed to necessary for health it allows people to ignore it and exclude it from their daily lives. Rather than framing physical activity as good for health, one approach might be to frame physical inactivity as detrimental.

Warning

Physical inactivity has been shown to be associated with increased mortality, morbidity and lower quality of life.

Please consult with your physician if you decide not to engage in regular periods of daily physical activity.[11]

9 "Global Health Risks: Mortality and Burden of Disease ... - WHO."; Accessed October 25, 2016. http://www.who.int/healthinfo/global_burden_disease/GlobalHealthRisks_report_full.pdf.

10. Jennifer Wesely, January 01, 1998. Feminist and Foucaultian Perspectives of the Engendered Body: An Application to the Hypermasculine Identity. *Society for the Study of Social Problems*, (accessed May 08, 2017).

11. John M Jakicic, Lecture, Mobile health, Carnegie Mellon University, Pittsburgh, PA, February 14, 2016

Technology

The Quantified Self movement is about tracking data from different aspects of one's life and correlating data points to find opportunities for self-improvement. The premise is that technology can help you access 'hidden' data, quantify it, visualize it, track it over time and ultimately, results in more knowledge that helps to make better decisions. It presumes that providing quantified data is enough to motivate behavior change. However, simply being presented with objective data does not always help. In fact, a purely numerical perspective limits users' understanding of their bodies. Tools and technology are not neutral and purely functional. Malafouris references Iriki and Sakura when he says, "T hus, tool use may lead to the ability to disembody the sense of self from the literal flesh-and-blood boundaries of one's skin….In other words, tool use might prepare the mind of the emergence of the concept of the meta-self".[12] Tools and technology mediate our view of our bodies and ourselves and the world. They indicate specific ways of being. Therefore, it is designers who shape this engagement with material artefacts such as fitness trackers.

A significant limitation of fitness trackers is that they target a specific group of people and exclude those which may have greater health needs. Dr. Jakicic is a professor in the Department of Health and Physical Activity at the University of Pittsburgh. Through a longitudinal study, he found that adding a wearable technology device to a standard behavioral intervention resulted in less weight loss over 2 years.[13] According to him, "Fitness trackers are more likely to be bought by people who already lead a healthy lifestyle and want to monitor their progress. So it's hard to say if they are useful for everybody." [14] The other problematic aspect of current fitness trackers that is that they tend to have normative metrics of fitness.[15] People have individual and constantly changing needs and may not be able to achieve those metrics of 30 minutes of continuous aerobic exercise or 10,000 steps a day and may individually require more or less than that.

12. Lambros Malafouris. How Things Shape the Mind: A Theory of Material Engagement (Cambridge, MA: MIT Press, 2013).

Atsushi Iriki and Osamu Sakura, "The neuroscience of primate intellectual evolution: natural selection and passive and intentional niche construction." *Philosophical Transactions of the Royal Society B: Biological Sciences* 363, no. 1500 (2008): 2229-241. doi:10.1098/rstb.2008.2274.

13. John M. Jakicic, Kelliann K. Davis, Renee J. Rogers, Wendy C. King, Marsha D. Marcus, Diane Helsel, Amy D. Rickman, Abdus S. Wahed, and Steven H. Belle. "Effect of Wearable Technology Combined With a Lifestyle Intervention on Long-term Weight Loss." *Jama* 316, no. 11 (2016): 1161. doi:10.1001/jama.2016.12858.

14. John M. Jakicic, Lecture, Mobile health, Carnegie Mellon University, Pittsburgh, PA, February 14, 2016

15. Michelle Roberts, "'No proof' fitness trackers promote weight loss." BBC News. September 20, 2016. Accessed April 24, 2017. http://www.bbc.com/news/health-37417018.

Sara M. Watson,"Stepping Down: Rethinking the Fitness Tracker." The Atlantic. September 25, 2014. Accessed April 24, 2017. https://www.theatlantic.com/technology/archive/2014/09/hacking-the-fitness-tracker-to-move-less-not-more/380742/.

Design

Designers at the intersection of technology and fitness have been inspired by behavioral economics. One design approach is to tap into people's cognitive biases. In the user experience domain, the focus is on user onboarding, creating engagement and providing delight through seamless experiences or extrinsic rewards like points or leaderboards. The focus is on building trust, emotion and persuasion and leveraging them to increase product engagement. Stephen Wendel is a behavioral social scientist who wrote 'Designing Behavior Change'. He presents a Spectrum of Thinking Interventions ranging from information that is very familiar to users - that require no thinking, to those that are unfamiliar and require intensive thinking.[16] The design interventions for the beginning to the end of the spectrum are "Cheat: Use automation", "Build habits", "Build associations", "Make action 'Easy' and 'Simple'" and "Educate user".[17]

This spectrum limits interventions to the realm of basic usability; making actions easy and simple. Automation is the same as the fundamental concept of human-computer interaction; function allocation. Function allocation is the automatic assignment of appropriate actions to computers and humans. Educating the user is at the other end of the spectrum but we know from anti-smoking campaigns that simply providing information and educating users is not enough.[18] This spectrum fails to address deeper motivation and how it can affect long term behavior change. This model perpetuates the perspective that users don't want to think and that educating the user and making them think intensively is a last resort. What if we were to instead, design to allow people to exercise their intellect and creativity and design intelligently for cognitive load?

Wendel proposes a "Understand-Discover-Design-Refine" cycle. This itself is a re-framing of design processes, but Wendel relegates design to mysterious magic. He assumes that design is the application of the "right" interface design patterns to functional constraints and behavior models. Instead, I argue that designers should consider facilitating self-driven change through building skills and including technology in the larger omni-channel design of the service.

16. Stephen Wendel. Designing for Behavior Change Applying Psychology and Behavioral Economics (Sebastopol, CA: O'Reilly Media, 2013). Figure Preface-4, xvii

17. Ibid.

18. Paul Slovic, "Cigarette Smokers: Rational Actors or Rational Fools?" *Smoking: Risk, Perception, & Policy*: 97-125. doi:10.4135/9781452232652.n6

Research Questions

Based on these dominant paradigms, I wanted to explore some key questions in this thesis.

What motivates behavior change with regards to fitness?

How can cultural probes mediate people's understanding of their own motivations?

What alternative models of the human do user-centered designers assume while conceptualizing solutions?

My thesis directly investigates the first two questions. However, this project was also an opportunity for me to explore my own philosophy as a designer. Rather than making services that are seamless and merely increase efficiency under the assumption that users are flawed in some way, if we consider people's intelligence and creative ability, it could lead to more interesting and meaningful solutions. In exploring what this may mean in practice and how to go about creating such an experience, I have engaged in a process of continual cycling between practice and theory, trying things out and then exploring relevant theory, then going back to practice again. The literature review is woven throughout the whole project, rather than just at the beginning since it determined conceptual and design decisions made along the way. The literature doesn't just support the final design but shapes the framework and constituent prototypes

User Research through Interviews

I conducted hour long, one on one interviews with 15 people who still use or used fitness trackers in the past. I recruited participants by posting a request on Facebook and then conducted open ended interviews over Skype or in person.

Participant	Age	Gender	Location at the time of using tracker	Type of fitness tracker used	Still used?
A	27	Male	Ankara, Pittsburgh	Pebble	Yes
B	26	Male	Bangalore	GoQii	No
C	28	Female	Chicago	Fitbit Flex	No
D	28	Male	Connecticut, Pittsburgh, San Francisco	Multiple	Yes
E	33	Female	London, Pittsburgh	Fitbit, Garmin	Yes
F	26	Female	Pittsburgh	Jawbone	No
G	30	Female	Pittsburgh	Fitbit	No
H	32	Male	Tokyo, Pittsburgh	Misfit	No
I	30	Female	Pittsburgh	Apple Watch	Yes
J	28	Male	Pittsburgh	Apple Watch	Yes
K	27	Female	Bangalore, Los Angeles, New Delhi	Multiple	No
L	40	Male	Pittsburgh	GoogleFit App	Yes
M	57	Male	Mumbai	Fitbit	No
N	31	Male	New York	Ticwatch	No
O	25	Female	London	Fitbit	No

Table I - Participant matrix for user interviews

Participants' usage patterns were similar; the initial excitement of getting a new gadget created a kind of commitment to good behavior. They set up goals and followed directions for a few months. However, the occurrence of events such as falling ill for a few days, or a monsoon would make it impossible to run outdoors for the next 3 months. Eventually the novelty would wear off and people would forget to charge their trackers. They would ignore the constant reminders to go

for a walk. It would annoy them in the middle of a meeting. Eventually, the tracker would break apart and they wouldn't bother fixing it. This overall motivation curve was constant, even if the individual details and shape varied. Within three months, usage fell drastically and very few used it beyond six months.

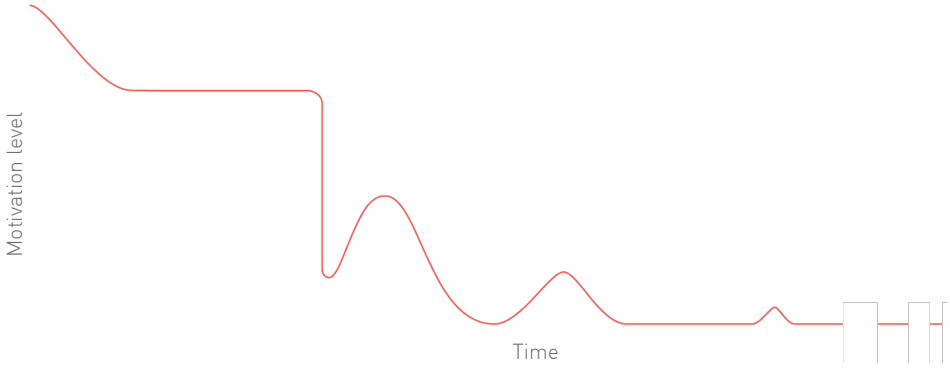


Figure 1 - Typical motivation curve for fitness trackers

I was interested in what motivated them to get a fitness tracker in the first place. Participant E said, "I was running about 5km quite happily but looking to run further so I thought it would help me set goals to support my running progress." Like her, some people bought fitness trackers to achieve a very specific goal; to recover from illness, run a marathon, or lose x number of pounds. Once they achieved that goal, the device was meaningless. Or if they didn't see any noticeable difference, they gave up on their tracker. Participant I said, " After a while, I got tired of checking that data - what was the point? It was hard to see the impact/result from my share. I couldn't feel any change."

Others had a general goal of being healthier. Participant C said, "My goal is that at (the age of) 50-60 I should be able to run." For some of these people, once the device made them aware of their existing patterns, it was not much use. For example, Participant H said, "In the daily ritual, putting myself in a situation where I have to walk more has really nothing to do with...there is no variation in distance. Because for me it meant that instead of taking the subway I would walk to school and back. And that's the same distance everywhere; there's no variation And I don't need anything to tell me how far that was. The purpose of having bars is to compare yourself to the past and feel a sense of achievement. But there's no improvement because it's the same everyday. Unless I walk somewhere else for no reason and that goes back to the original problem where I'm just walking to fill the bar, I'm not trying to get anywhere. And I don't want to walk just for the sake of walking."

The influence of culture and gender on fitness activities was also unexpected. Participant K who had moved from Los Angeles to New Delhi said, "It's much harder to run. I have to run in a park. Also the thing is running with community, I don't like synchronizing running with people. Men feel like they need to race you so I slow down to give them a sense of accomplishment." Devices

(and their designers) that aren't at least aware of situations like these end up being inflexible. The influence of other things in a schedule were not accounted for either. Participant G said, "For the first week, I did pretty well. And then I was pretty inconsistent and then I felt pretty discouraged. Mostly because I was able to see my past record falling short. It might have worked better when I wore it on a day to day basis. I had a pretty tight schedule, I was sleeping more on some days than others. It wasn't a very consistent so it wasn't working out too well. And then I felt bad that I didn't have control over that. And that I should be doing better." Participant E was quite frustrated with the 'negative conversation" in her head. She said, "I felt a bit uncomfortable that I had become so reliant on this watch that I could no longer judge what I'm doing. It probably shouldn't be all about the watch. If I want to slow down, I should slow down, And if I want to run faster, then I (should be able to) run faster. And I was a little bit angry that Garmin thinks I should run a marathon faster than I can. And I was like "FU Garmin!" I'm still running 26.2 miles just because I'm not doing it in your allotted time frame. This is not the most important thing about the run."

For most of the people I interviewed, one of the major limitations of current fitness trackers is their inability to recognize and adapt to changes in context. The product and service want to take on the role of a coach but the technological infrastructure doesn't support flexible and personalized relationships with people. The communication is normative and hierarchical. Furthermore, the motivation provided through numbers and graphs provides only short-lived, extrinsic motivation. Due to its inflexibility, users often abandoned it. This was not due to a lack of information, but rather the technology's inability to fit into users' daily practices and so cannot create conditions for fundamental change. It did not always make people skilled and self-reliant in thinking about interlinked practices and connections between fitness and time management, financial management or the social aspect of life.

According to Dr. Jakicic, it's one thing to change behavior but another to change behavior outcomes. Someone may walk 10,000 steps in one day because their tracker reminds them but what matters from a health perspective, is if it is a stroll or brisk walk. He also speaks of the minimum effective dose of physical activity, which is on average, 30 minutes of activity. This means that if someone were to walk 10,000 steps a day, but it was at a leisurely pace only for 2 minutes at a time, it's not going to be an effective form of exercise. In fact, his research found that people who wore fitness trackers actually gained more weight than those who didn't. He attributed this to the possibility that people feel like they have achieved a goal of 10,000 steps and treat themselves with unhealthy food or much higher portions than they should. And this leads to a net increase in weight because the physical activity was of poor quality.[19] Dan Ariely, a behavioral economist, echoes this reasoning. He says, "We're very fast to celebrate success and not so fast to punish ourselves. It changes how we reward ourselves and maybe we reward ourselves in an asymmetric way that causes us to overly compensate for the benefit of increased activity".[20] He also speculated that perhaps we celebrate the partial success of simply measuring our activity.

19. John M. Jakicic, Lecture, Mobile health

20. "Dan Ariely" Dan Ariely - Activity tracking? This week a paper came... Accessed April 27, 2017. https://www.facebook.com/dan.ariely/videos/10100976614139238/.

Theory: Applications of Decision and Behavior Science Theories

Research in the field of risk perception and communication helped me understand possible reasons why people behave the way they do in different situations. In particular, I studied the perceptions of the risks of physical inactivity.

A study conducted to measure the accuracy of health risk perceptions among obese individuals and those with normal weights found that they significantly underestimate their risks of developing arthritis or rheumatism, and hypertension within the following five years.[21] Another study found that though people did perceive an increased risk of mortality due to weight gain, they significantly underestimated the risks.[22] One possible reason for this "false optimism" is the lack of actionable information from healthcare providers. Men, particularly those who are not highly educated and those not suffering from diabetes mellitus are less likely to receive any advice from their doctors.[23] This leads to a vicious cycle in which people who need the information the most, do not receive any and may consequently adopt a fatalistic attitude.

Fundamental objectives are the ends we try to achieve and means objectives are significant ways of achieving them. Even when the importance of physical activity is communicated, the means objective is emphasized rather than the fundamental objectives that give a broader perspective of health. Another explanation is that historically 'activity' has been framed as something positive, but 'inactivity' isn't framed negatively. If physical inactivity isn't framed as something that has a negative effect, it doesn't have an effect on motivation. The affect heuristic and availability heuristic also mean that people perceive low risks with events that don't create strong negative feelings and that don't show results immediately.[24] Due to the comparatively long term consequences of inactivity, the diseases are not associated with 'dread' which also impacts people's willingness to take precautionary measures.[25] People also suffer from an optimism bias that leads them to believe that they are less at risk compared to others.

21. John Cawley and Christopher Ruhm. "The Economics of Risky Health Behaviors"; 2011. doi:10.3386/w17081

22. Joachim Winterand Amelie Wuppermann."Do They Know What Is At Risk? Health Risk Perception Among The Obese"; *Health Economics* 23, no. 5 (2013): 564-85. doi:10.1002/hec.2933.

23. Galuska, Deborah A. "Are Health Care Professionals Advising Obese Patients to Lose Weight?"; *Jama* 282, no.16 (1999): 1576. doi:10.1001/jama.282.16.1576.

24. Kahneman, Daniel, Paul Slovic, and Amos Tversky. *Judgment under Uncertainty: Heuristics and Biases* (New York: Cambridge University Press, 2008).

Melissa L. Finucane, Ali Alhakami, Paul Slovic, and Stephen M. Johnson "The Affect Heuristic in Judgments of Risks and Benefits" *Journal of Behavioral Decision Making* 13, no. 1 (2000): 1-17. doi:10.1002/(sici)1099-0771(200001/03)13:13.0.co;2-s.

25. Paul Slovic. "Perception of Risk"; *Science* 236, no. 4799 (1987): 280-85. doi:10.1126/science.3563507.

Theory: Product Ecologies

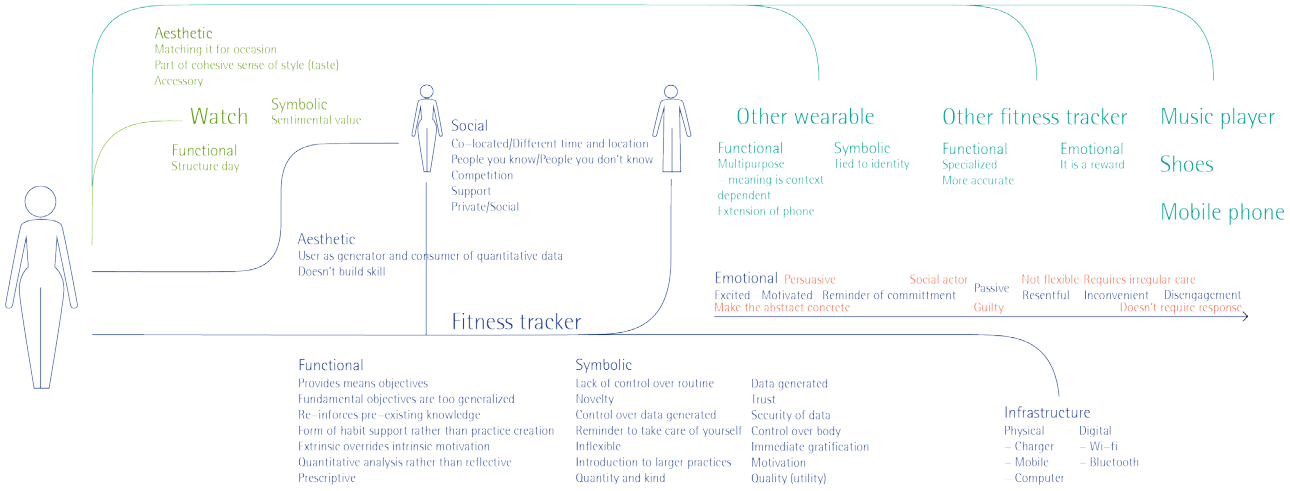


Figure 2 - Product ecology of a fitness tracker

Forlizzi defines product ecology as a design framework to describe how products evoke social behavior.[26] It is based on social ecology theory, which is broadly concerned with the dynamic relationship between an individual and the social environment but this places the product at the center of the analysis. The social, emotional, symbolic, aesthetic and functional factors are analysed. Here, I've created a schematic of these factors within fitness trackers and how practices and emotional engagement are built over time.

Each product within the ecology implies distinct functional, symbolic and aesthetic characteristics. The exercise of creating this map didn't necessarily reveal any new points but helped draw connections and at the same time, distinguish between them. It also helped me map the insights form the user research within the larger system. Categorizing the insights into "functional", "symbolic", "emotional", "social", "infrastructure" and "aesthetic" also helped me synthesize the interview findings. The idea of the emotional journey and symbolic aspects of fitness trackers informed the next phase of research.

26. Jodi Forlizzi, The product ecology: Understanding social product use and supporting design culture. *International Journal of Design*, 2(1), 11-20

Theory: Philosophy of Technology

After the initial interviews, I did an applied literature review to help me analyze the emerging issues that I was finding. This kind of research uncovered aspects of technologies and practices beyond a stakeholder map or system diagram. The also raises questions and points to possible directions that design could and should take. The examination of Weight Watchers, fitness trackers and fitness VHS tapes through the lenses of Michel Foucault, Bruno Latour and Annemarie Mol provide interesting points of overlap and disconnect that inform future design practices and approaches.

Foucault

Technologies of the self and Weight Watchers

Foucault focused on ideas of technologies, power and subject. Technologies according to Foucault are methods or exercises. He analysed disciplinary technologies; how institutions exercise disciplinary power over individual subjects through real or assumed surveillance. There is a distinct sense of hierarchy and control. Later, his view shifted and he was drawn to the idea of disciplinary power subjecting people towards practical arts of living whereby people fashioned and governed themselves. He re-conceptualized power as 'care of the self' and how people cope with external influences. He referred to this as technologies of the self. He focused on the "practices by which people try to structure and stylize their way of practices of living", how people present and police their "selves" within a societal and technological frameworks that simultaneously enable and constrain them.[27]

Weight Watchers became a global phenomenon in the 1960's. The starting point is that people's motivation to lose weight is intrinsic. The founder, Jean Nidetch, said that she does not believe in telling people they need to lose weight. If they tell her they want to lose weight, she gives them the support and help they need.[28] There is a rule and moral-enforcing force that is used to facilitate conversations among people. Receiving and, just as importantly, providing emotional support creates a sense of accountability that is reviewed by the group but is self-enforced. It helps people take control of their own bodies and shift the frame from the guilt of being 'subjects' of the 'weakness of the will' to well-supported individuals responsible for their own behavior. The disciplinary technologies of empathy, rapport and mutual understanding are consistent with Foucault's technologies of the self and the government of oneself or 'the self by the self'. Dorrestijn says that 'the subject is not seen as opposed to external influences but as an experience of oneself which is produced or that emerges within relations to other and to things'.[29]

Latour

Actor Network Theory and Fitness Trackers

Latour's definition of 'technology' is not as broad as Foucault's but it does include all non-human objects. According to him, the direct basis of many social changes accompanying the use of a technology seems to lie in social representations about what a technology is and what it does. This raises several important questions; what are the dominant social representations of today's fitness trackers? What are the assumed and desired relationships between humans and technology.[30] The following analysis aims to uncover these questions. The Actor Network Theory consists of some key concepts – actants, their programs of action and antiprograms, mediation and translation of these programs. The components are made concrete in the context of fitness track ers in the following diagrams and description.

Figure 3 - Multiple actants in the act of fitness tracking

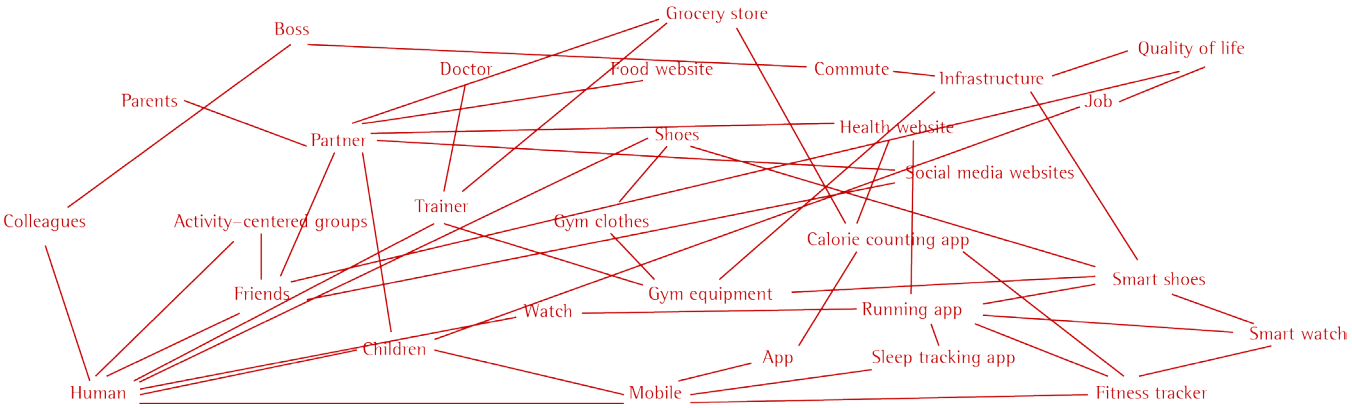


Figure 4 - Networks between actants

Figure 5 - Limiting the scope to three actants for this exercise

Figure 6 - Defining the anti-program and the program of action

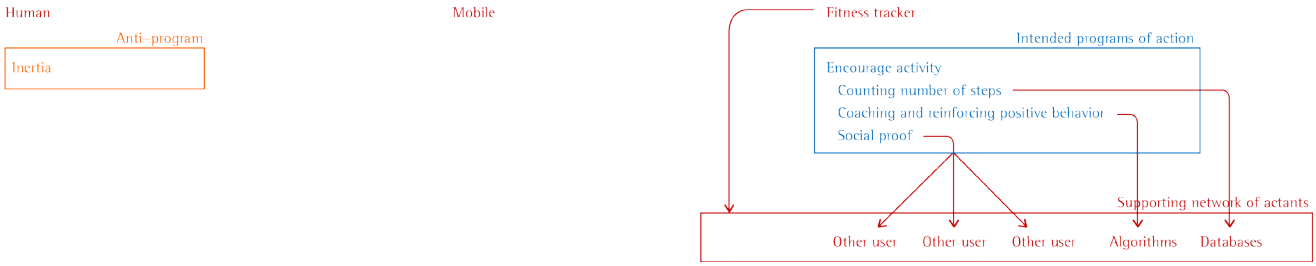


Figure 7 - New supporting actants

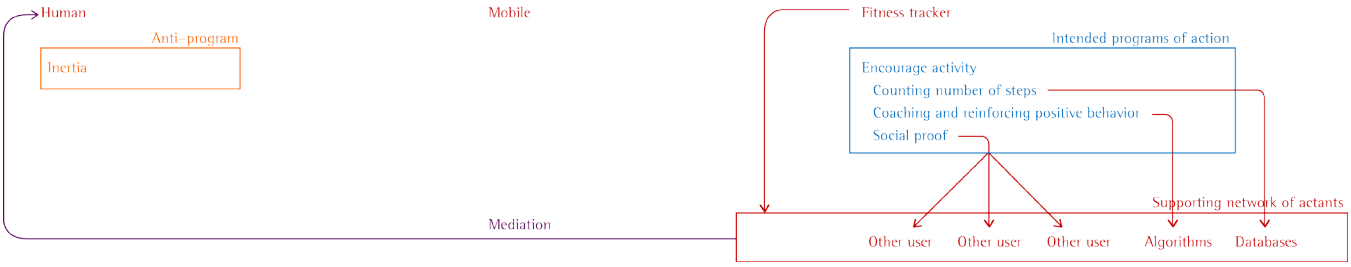


Figure 8 - How the programs of action translate from one actant to the other through mediation

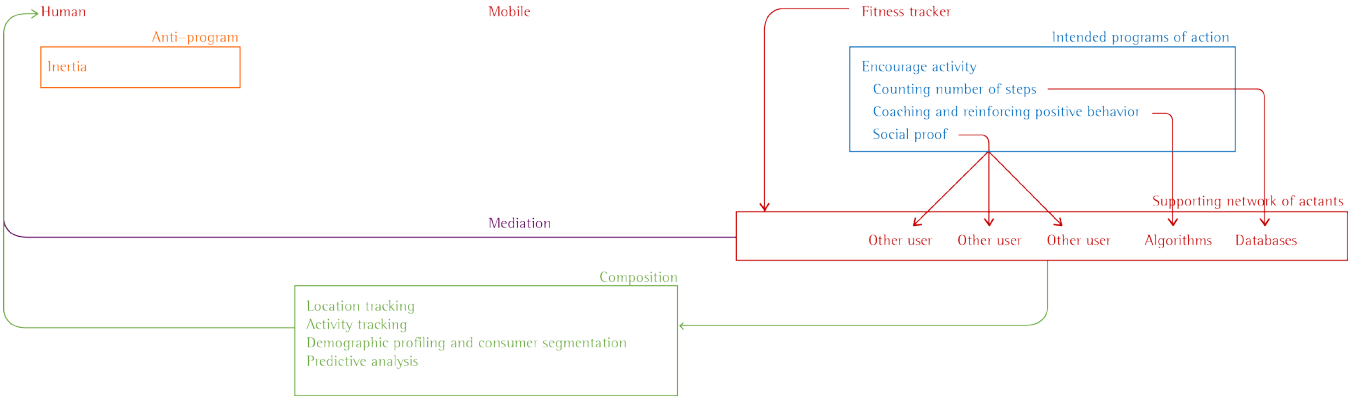


Figure 9 - Composition or new relationships between the actants

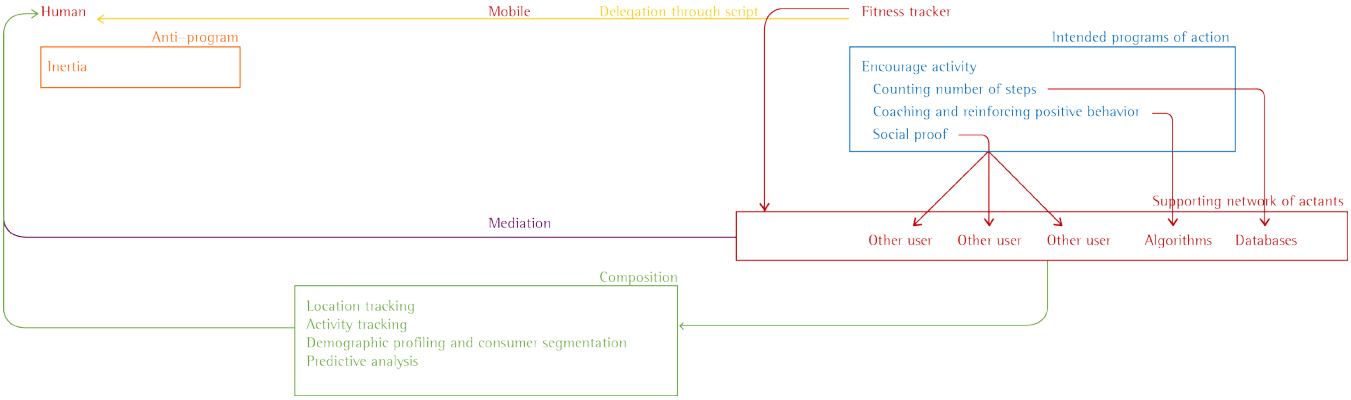


Figure 10 - Delegation through other actants

In the actor-network, all the arrows are moving from the fitness tracker to the human. Instead of the human using the fitness tracker, it appears that the fitness tracker acts on humans. All the programs of action are directed at resolving the antiprogram of inaction. Unintentionally, this creates a subject-object dichotomy. The human can't communicate with the fitness tracker other than through inaction. This diagram describes ways in which scripts are associated with technologies but in reality, human actants have multiple scripts (goals) that respond to the script of the technology. This continuous conversation changes the relationship among actants and leads to a constantly evolving network. Fitness tracker manufacturers assume a static 'human script' and that humans have to be "actioned" into forming somnambulist-like habits. Borgman in his defence of "things" versus "technological devices" said that "a thing does not provide the most convenient path to achieve a goal but involves its users in the realization of it".[31] Latour did not intend for the ANT to be applied so directly to the analysis of an artefact but it is useful in understanding what the moving parts are: "the knot of actor-networks".[32] It is hard to use it to visualize changing networks over time. The objectiveness and concreteness of the diagram also limits important aspects of practise- of the 'meaning' and 'skills' involved in interactions.

Mol

Logic of care and Workout VCRs

When 'Jane Fonda's Workout' video cassette was released in 1982, it sold just 3000 copies in the first month, but more than 200,000 were sold in the first year. A year later, Fonda was the first artist to have three titles on Billboard's Top Video-Cassettes Sales chart with 'Jane Fonda's Workout' on the list for 145 weeks, longer than any previous title. The aesthetics of her videos, namely leotards, leg warmers and tights, not only became iconic of that generation, but helped to redefine fitness. Her videos made it acceptable, and eventually the norm, for women to actively exercise even if it was within the confines (or privacy) of their home.

In 'Logic of Care' , Mol presents the logic of care as the alternative to the dominant way of thinking about health, in terms of choice.[33] She argues that the logic of choice perpetuates the practice of treating diabetes patients as 'objects and made passive.' Patients need to be viewed as active patients but active goes beyond choice. The logic of choice points to an underlying logic of control. Building on the logic of care, she presents patientism as an alternative paradigm for care. "While citizenship requires us to control our bodies, to silence them, or to discard them, patientism seeks ways to be kind to our bodies, to allow them to exist, and even to cherish them." [34] She also writes about the nature of conversations, that 'good conversations in a consulting room do not take the shape of a confrontation between arguments but are marked by an exchange of experiences, knowledge, suggestions, words of comfort. How have things been lately? What might be done differently and how might it be done?" The design of technologies shouldn't be confrontational programs of actions but be structured to facilitate conversations, enable active participation and change practices.

A similar re-framing of health led to a personal fitness revolution in the early 1980's. The frame moved quickly from reactionary healthcare to preventative care made accessible through VCRs. It signified a shift from the passive role of the 'patient' in the process of doctoring (doctors will provide treatment when I really need it) to active participation in self-care (I will take care of myself all the time as a form of preventative care).

Fitness VHS tapes didn't offer personalized support, a counterbalance or active ways to change practices. The relationship was similar to the unidirectional communication or broadcasting of 'programs of action' in the ANT diagram above. It is perhaps the same paradigms for conversations between people and (digital) technologies of care that have carried over from the 1980s until now. Technology then and now allows for care, rather than actively facilitating care. The current metaphors for technologies of the self, specifically technologies around health, are related to machine-like efficiency. This logic of productivity and that of commerce are often mistaken for the logic of care. Care needs to be reconceptualised, not as a limited product, but as Mol calls it, an ongoing process. Wearable technologies and the networks of data and technologies it gives birth to, have tremendous potential to cause this shift in care. Mol describes the patterns of conversations that doctors and patients have: "Doctors and patients sometimes laugh about the irreducibilities, the things that do not fit....It does not help to moralize. So instead they may say: 'Gosh, this isn't going well, is it? What is going on' or: 'What is troubling you?'" [35] Such conversations bring out insights that could enable people to take better care of themselves.

Implications

Technologies of the self also need to mediate meaningful and self-reflective conversations with people. They should not just be limited to digital interfaces or physical artefacts connected to digital systems. Designers can lead the reconceptualization of digital networks, artefacts, practices, engendered networks, interactions and models of the human that make up service systems. Conversations within the logic of care influence internal conversations that people have with themselves. These in turn are affected by conversations or 'scripts' that technologies impose and affect behavior change. Therefore, a careful consideration of the technologies that people use can change how they think about themselves beyond just externalized short term behavior.

27. Steven Dorrestijn, T*he Design of Our Own Lives: Technical Mediation and Subjectivation after Foucault.* S.l.: S.n., 2012, 44-48

28. Nanci Hellmich, *USA Today*. March 22, 2010. Accessed May 13, 2017. http://usatoday30.usatoday.com/news/health/weightloss/2010-03-23-jeannidetch23_ST_N.htm.

29. Dorrestijn, T*he Design of Our Own Lives,* 48.

30. Peter-Paul Verbeek, What Things Do: Philosophical Reflections on Technology, Agency, and Design. University Park, PA: Pennsylvania State University Press, 2005.

31. Ibid., 186.

32. Philip Brey, 'Artifacts as Social Agents' in *Inside the Politics of Technology. Agency and Normativity in the Co-Production of Technology and Society* (ed. H. Harbers), Amsterdam University Press, 61-84.

33. Annemarie Mol, *The logic of care: health and the problem of patient choice* (London: Routledge, 2011).

34. Ibid., 31.

35. Ibid., 37.

Research through Speculation

Whilst I was conducting this research, I was also thinking of possible ways to make the theories concrete. The idea of the models of humans fascinated me and I was interested in frameworks that would help me extrapolate service ideas.

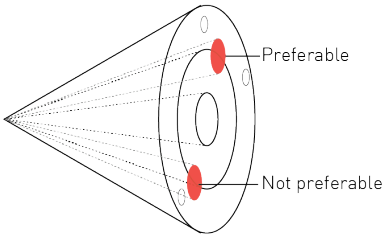


Figure 11 - Adapted from Voros' Cone of futures [36]

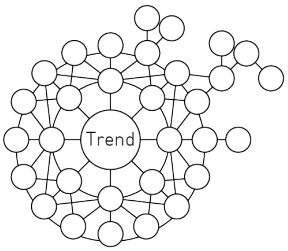


Figure 12 - Glenn's Futures Wheel [37]

Figure 13 - Adapted from Lockton's Models of the user [38]

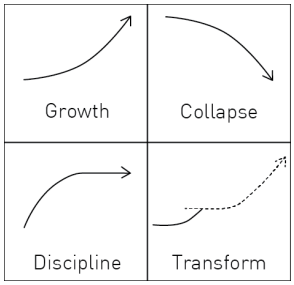


Figure 14 - Candy's Arc based futures [39]

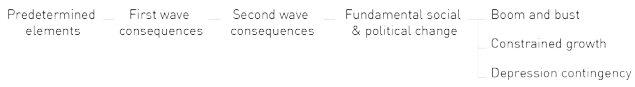


Figure 15 - Wack's Scenario Planning [40]

36. Joseph Voros, "On examining Preposterous! futures." The Voroscope. January 28, 2016. Accessed May 08, 2017. https://thevoroscope.com/2015/12/28/on-examining-preposterous-futures/.

37. Jerome C. Glenn, "Futurizing Teaching vs Futures Course," *Social Science Record*, Syracuse University, Volume IX, No. 3 Spring 1972

38. Dan Lockton, David Harrison, and Neville A. Stanton, "Models of the user: designers' perspectives on influencing sustainable behaviour." J. *of Design Research* 10, no. 1/2 (2012): 7. doi:10.1504/jdr.2012.046137.

39. The Thing From The Future." Visit Situation Lab's website. Accessed May 09, 2017. http://situationlab.org/projects/the-thing-from-the-future/.

40. Pierre Wack, "Scenarios: Shooting the Rapids", Harvard Business Review. November-December, 1985.

	Most postive	Postive	Negative	Most negative
Personal	Self-actualized Body is a vessel for the mind Spirituality > physicality	Have a long term view of themselves and world Know what is best for them and society and act on it Motivated Empathetic Efficient	Short term and immediate goal focused Know what is right but don't act Irrational and selfish Need to be controlled All different, don't understand each other's mental models	Most don't know what is right and don't care. Almost somnambulistic Unconcerned and ambivalent Can't be educated or controlled Some are hyper-aware of the situation but can't control it
Social	Egalitarian	Willing to compromise for larger goals Collaboration is key Specialization is important	Survival of the fittest Healthy get healthier, unhealthy die Competition is key	Sharp divide Those in power are unmotivated Those not in power are highly motivated
Infrastructure	Optimum needed for leading a self-actualized life	Everything works perfectly all the time. No seams	Unequal opportunities Basic needs need to be met	Deep inequities
Political	Don't need external regulation	High levels of trust in authority, high levels of trust in others	No trust in authority, experts and non-self generated knowledge	High surveillance of a certain population
Practise		Hyper efficient Fitness is perfectly integrated with other practices Well-functioning 'flows' of activity Abundant resources Stabilized population	Need to balance and prioritize activities because of scarce resources caused due to exponential population growth globally and reduced inhabitable land mass	Bare minimum for survival - some catastrophic event/ technology that wipes out other non-food species and allows humans to remain at status quo (which actually leads to degradation of the species
Implications and Design solutions	No solution needed!	Need – disruption 1. Creating moments of friction to combat ennui 2. Maps that make you get lost – so you are challenged and forced to acquire new tacit knowledge Need – Leisure 3. Hyper-efficiency can only be more efficient if there are moments of leisure 4. Focused de-focusing time.	Perceived need – increase inequality 1. Have to qualify to enroll in fitness regimens. This causes a black market for it 2. Physicality = brute force 3. Self-organizing tribes based on short term allegiances 4. Designers design genes 5. All activity focused towards physical fitness – not as an art or larger practice, just instrumental fitness 6. Need to justify calories consumed by proving strength 7. People are made smell sensitive/color blind so they eat less	Need – Forced physical activity 1. Need to be physically moved to prevent atrophy 2, Subversive fitness – People have to pretend to be somnambulistic (reverse zombies?) 3. Have to design moments of stress 4. Inducing restless leg syndrome so they feel compelled to move 5. Heavy handed negative reinforcement of physical inactivity

Table II - Speculative models of the human

Early Concepts

This research led me to create phases of an ideal user journey; beginning with before self-awareness, then self-awareness, action, reflection and finally ending the relationship with the service. I used this as a frame to design new technological artefacts along a scale from 'Prescriptive' to 'Background'. They were designed as solutions for problems that people face at the different stages and included small personal artefacts and ideas for large product-service systems. Two example ideas are explained here to illustrate the diversity of concepts.

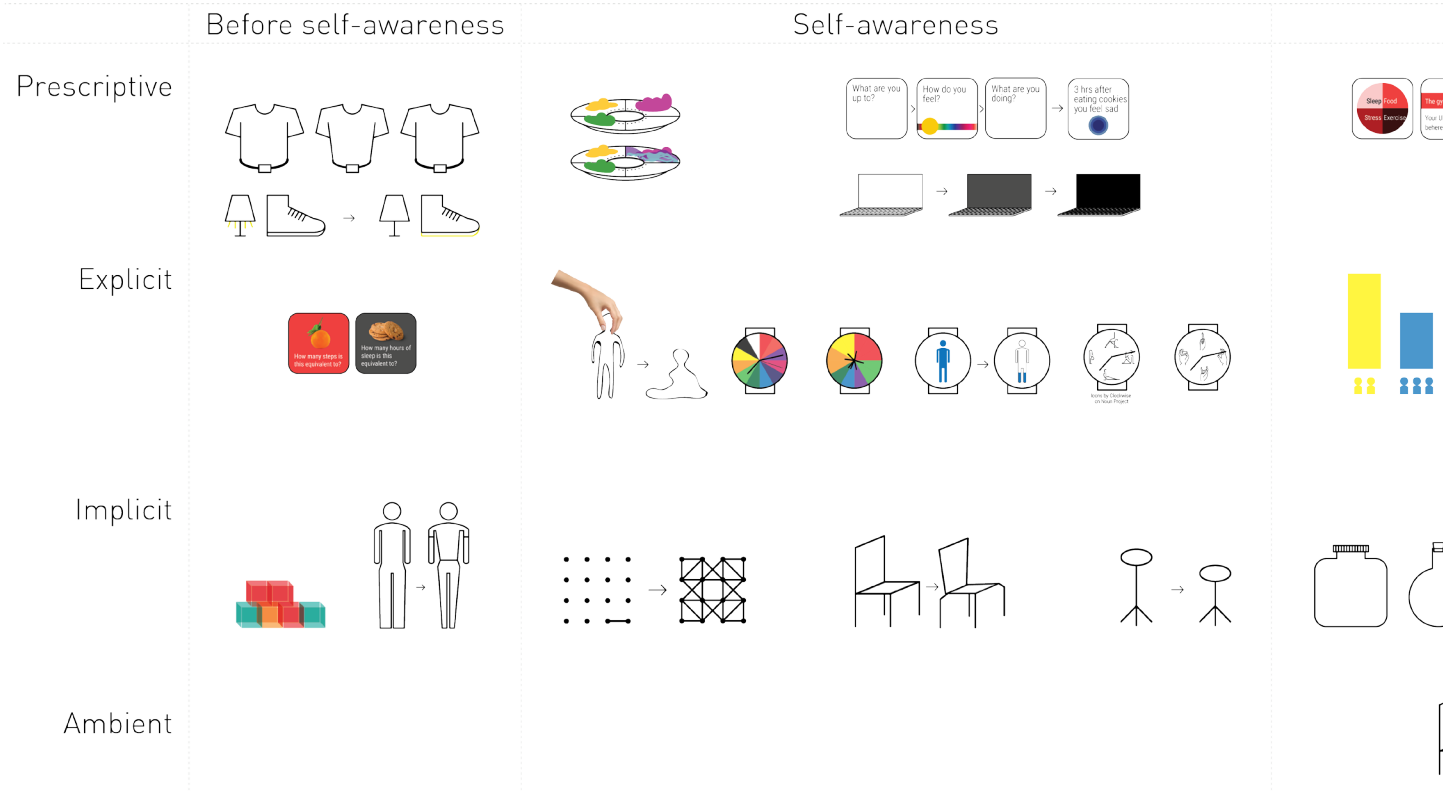


Table III - Early concepts based on a typical user journey

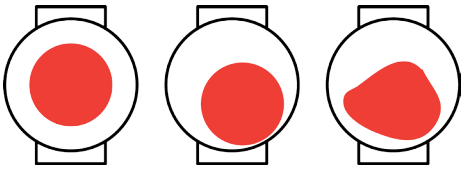


Figure 16 - Concept for a wearable with a qualitative visualization

This concept promotes action through implicit data visualization (Action-Implicit). It is digital watch with a circle that gets misshapen if you don't do physical activity. This leverages people's innate desire for symmetry and order.

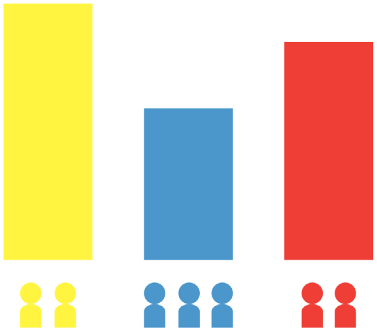
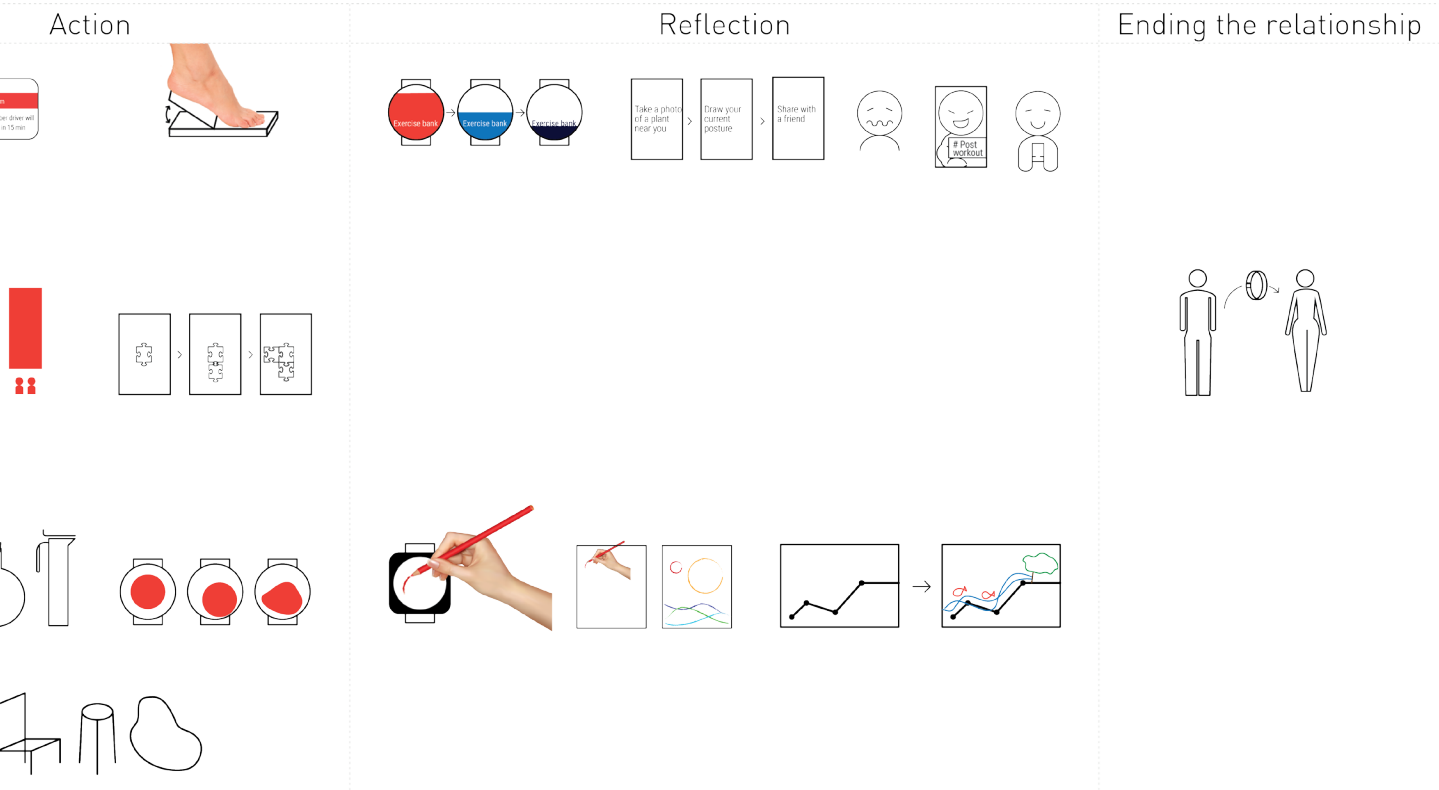


Figure 17 - Concept for group-based motivation

In contrast, Figure 17 uses explicit information to motivate action (Action-Explicit) is a concept in which people belong to teams and through exercise, contribute anonymously within those teams for the benefits of groups without the pressure of competition.

But these still attempt to change specific instances of behavior rather than practices and deeper motivations.



Convergence

Using these early ideas as starting points, I decided to focus on the role of conversation and motivation in behavior change. I was interested in exploring how conversations between people and technology could be designed to build intrinsic motivation.

Conversation

Dr. Dave Pao is a practising doctor in the field of sexual health and HIV medicine who is also doing a design PhD. He spoke with me about how the role of doctors has changed over the years from a doctor who is viewed as the single source of truth and knowledge to practising 'doctoring' in order to help others achieve their goals. His challenge is adherence to medication. Based on his experience, intrinsic motivation as a result of reflection formed through conversation is more effective than just reducing barriers to take medication and making it more convenient. One of the ways Dr. Pao does this is through Motivational Interviewing. It is a specific clinical method that is "a collaborative conversation style for strengthening a person's own motivation and commitment to change."[41]

According to him, the role of a doctor is to encourage patients to ask why and help them arrive at their own answers instead of relying just on his expert opinion. This resonated with me because as a designer, I wanted to provide a framework for intrinsic motivation that is more inclusive than the concepts I had previously thought of.

Motivation

With this focus on intrinsic motivation, I interviewed Stephen Neely, a professor in the School of Music at Carnegie Mellon University, who teaches eurhythmics. He spoke of the importance of building trust and getting buy-in, laddering activities and starting with small tasks to make his students comfortable. He makes a conscious effort of moving students incrementally from the known to the unknown. He gets students to "recognize something about themselves, challenging you to be a better version of themselves and to reveal themselves".

41. Miller and Rollnick, *Motivational Interviewing: Helping People Change.*

I also interviewed Greg Costikyan, a game designer and science fiction writer also known as Designer X. He spoke about motivations in games and the value of understanding people's core fantasies. For example, he created a game called Market Street, about managing a shop including selling and restocking. But he felt that "in reality, the core fantasy is that I'm sharing things I really love, and sharing them with others and showing off my taste as well." He also spoke about building game systems and designing enough complexity so it's non-trivial but also not so simple that it quickly stops being fun.

Psychology

Next, I considered various approaches to behavior change within the fields of psychology and decision sciences. I was particularly interested in the Self Determination Theory, which includes Motivational Interviewing as a technique. According to the Self Determination Theory, autonomy, competence and relatedness are key to intrinsic motivation. The need for autonomy refers to the experience of being the initiator of one's actions and to a sense of psychological freedom when engaging in an activity. The need for competence refers to the feeling of being effective and to the experience of confidence in achieving desired outcomes. The need for relatedness refers to experiences of positive and mutually satisfying relationships, characterized by a sense of closeness and trust. The Self Determination Theory is the most widely applied theory of motivation in the fields of design and human-computer interaction.

At this point, I wanted to explore ways in which people could discover their own motivations and delve deeper into their need for autonomy, competence and relatedness. The design research process typically involves direct user research in some form or the other. This helps designers identify needs, current processes and opportunities for intervention. Designers use a variety of methods to understand the target groups motivations around a particular phenomenon to define a problem. I wondered if any of these methods could be used by people to change themselves without too much external influence. Cultural probes consist of activities used by designers to analyse and understand users of systems or interfaces. Participants use them to record aspects of their lives in situ and independent of the designer. The designer than gathers the probes and analyses them qualitatively. Could they be used to help people understand their own needs, drives and values in a fun and engaging way? What could this reveal about motivation around fitness and the design of probes themselves?

I looked into the Health Belief Model (Rosenstock, 1974), the Protection Motivation Theory (Rogers, 1975), the Extended Parallel Process Model (Witte, 1992), the Self-regulation Model (Leventhal, Meyer and Nerenz, 1980), the Theory of Reasoned Action (Fishbein and Ajzen, 1975), the Theory of planned behavior (Ajzem, 1985), the Subjective Utility theory (Ronis, 1992) and Libertarian or "Asymmetric" Paternalism (Lowenstein et al, 2007, Thaler & Sunstein, 2009). .

Designed Service System

My final proposal is a system of interconnected services that aims to build intrinsic motivation. It is meant for people who have a hard time keeping themselves motivated and want to be engaged with managing their fitness. The system is across six months since previous research shows that that timeframe is crucial to maintain change with regards to fitness. In this program or system, people use various micro-services in different weeks. Some of these use fitness tracking technology, while others are analog. The focus isn't on the nature of the physical activity but on the self-reflection that accompanies it. The self-reflection components are individual experiences for the initial period, supplemented by group support and followed by individual engagemenent. Each activity is backed by theory in terms of the meta-activity. In a way, this is a training plan for instrinsic motivation for physical fitness. The service compenents are mapped below with the corresponding meta-activities

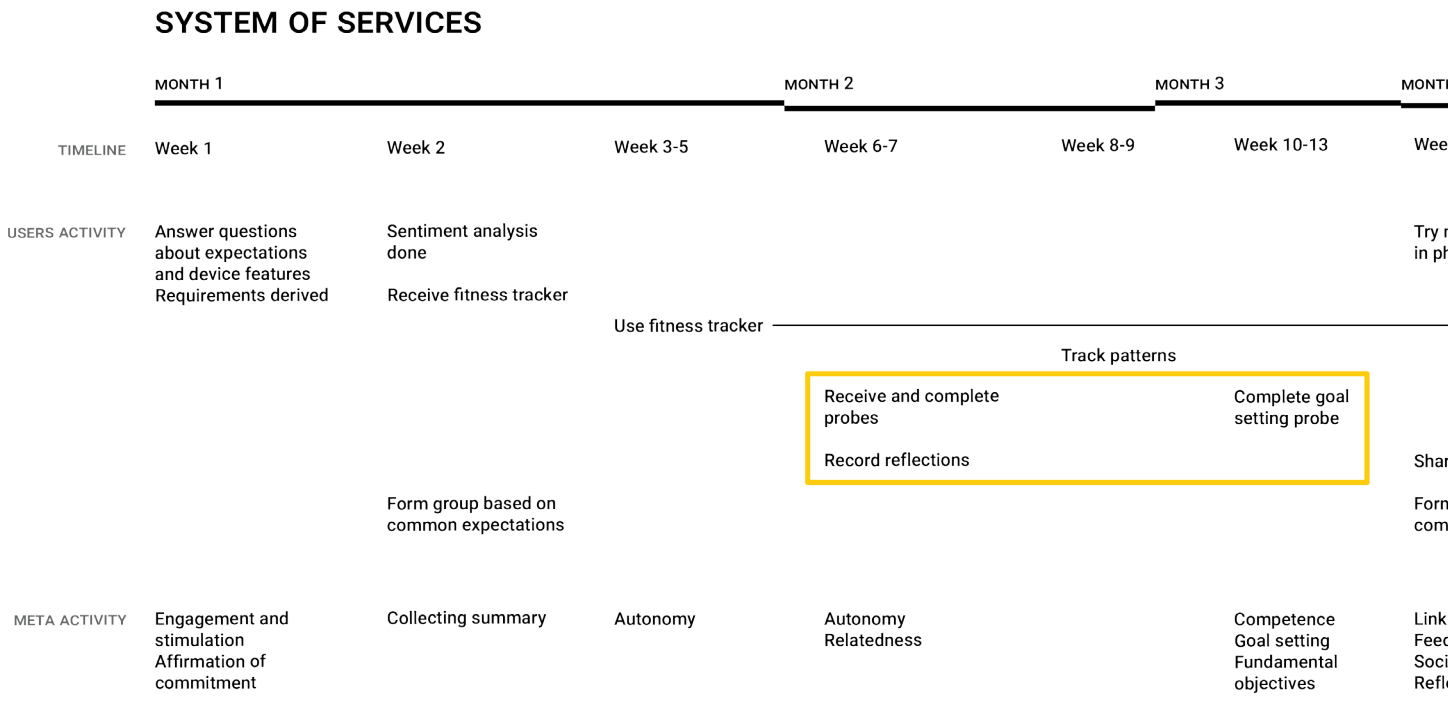
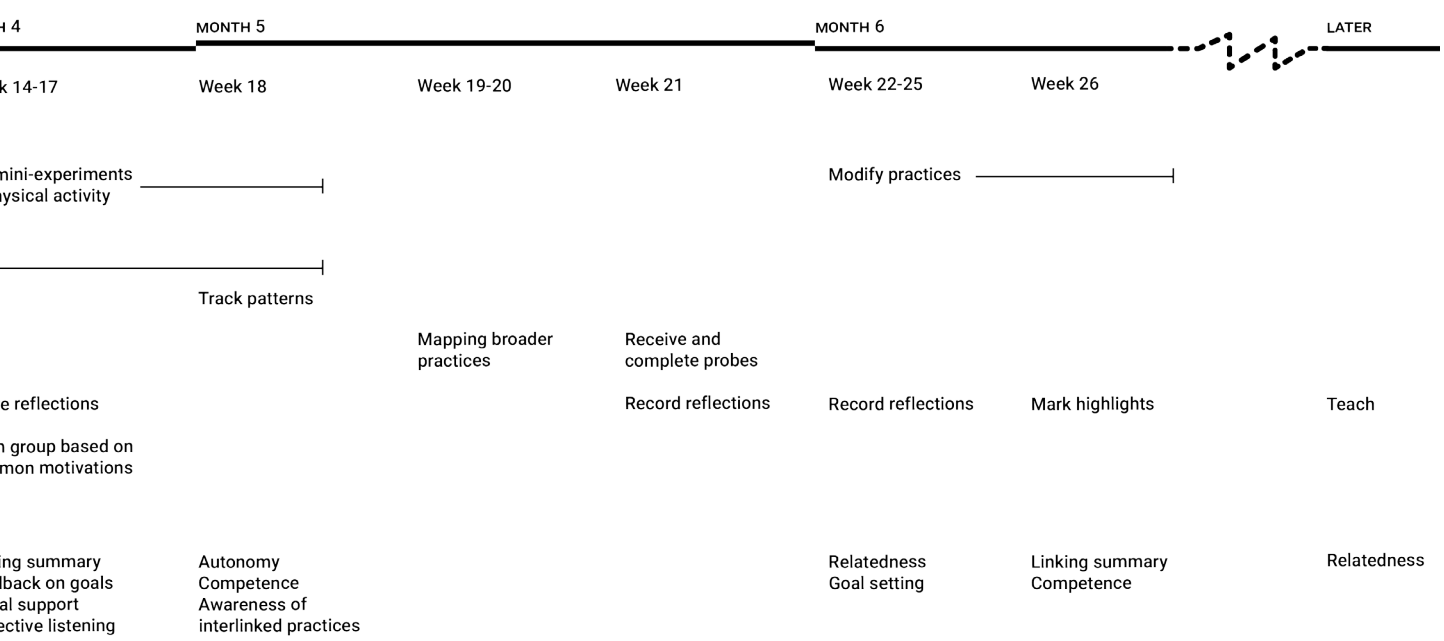


Figure 18 - Envisioned system of services


H 4
MONTH 5
MONTH 6
LATER
k 14-17
Week 18
Week 19-20
Week 21
Week 22-25
Week 26
nini-experiments
ysical activity
Modify practices
Track patterns
Mapping broader practices
Receive and complete probes
e reflections
Record reflections
Record reflections
Mark highlights
Teach
n group based on
mon motivations
ing summary
lback on goals
al support
ective listening
Autonomy
Competence
Awareness of interlinked practices
Relatedness
Goal setting
Linking summary
Competence
Relatedness

Week 1: People start by answering questions about their expectations and what features they think they need. This affirms their commitment to change.

Week 2: Based on their responses and their self-reported past behaviors, requirements are derived and the optimum fitness tracker (based on features) is sent to them. This information is compiled into a Collecting Summary. These common expectations and needs are also the basis on which groups or cohorts are created.

Week 3 to 5: People use their fitness trackers and experience a sense of autonomy through engaging with a new device and being stimulated by the feedback. The continue using the trackers up to Week 18 if not up to the end of Week 26.

Week 6-7: When interest in the fitness trackers begins to wane, they receive cultural probes. They record their reflections but can also see other people's anonymous reflections. This builds on the need for autonomy and relatedness. The design and testing of this micro-service has been explained in detail in the next section.

Week 8-9: They track the patterns on their fitness trackers more consciously.

Week 10-13: Once they have a better understanding of their existing patterns, they complete a probe that helps them set and achieve goals. This gives them a perspective of their fundamental objectives and acts on their need for competence and seeing results.

Week 14-17: People try mini experiments in physical activity. They share their learnings with the groups, receiving and providing social support and partaking in reflective listening. They receive feedback on their goals and a linking summary connects different aspects of their behavior.

Week 18: They continue tracking their patterns, with an awareness of interlinked practices.

Week 19-20: People start mapping their broader practices.

Week 21:They receive and complete cultural probes to help them understand social practices and record their reflections.

Week 22-25: They move from modifying actions to modifying practices by setting goals.

Week 26: They review on their previous reflections, feel a sense of competence regarding their achievements and creating a linking summary for themselves.

Later: They lead group discussions and social interactions among future groups. This allows them to take on the role of teaching and fulfills their need for relatedness.

My thesis deals with the cultural probes for self-reflection that people would receive in Week 6. The probe kit consist of the following pieces.

1. Collages

Based on previous projects, I knew that collages were a good tool to ease people into the act of participating in design research. I wanted this activity to allow people to express their emotions but also felt that providing images that were too abstract would take the focus away from physical fitness. I looked for images related to different kinds of physical activity, different conceptions of fitness practices and images that implied different social situations and environments. I was also trying to disrupt existing gender expectations with different activities (for example, women doing yoga and men lifting weights).

Another important aspect of the instructions themselves was that I wanted to provide a background on how the different probes are used by designers and where possible, a description of the original context of use for those who were interested in the design of the probes themselves.

People were asked to make two collages; what fitness means to them currently and what they would like their relationship with fitness to be in the future. This allowed them to be objective about their present and at the same time, think about their ideal future self.

2. Personas

Personas can often devolve into caricatures of people, with unrealistic goals and motivations. This can happen precisely because personas are meant to describe archetypes with clearly positive or negative attitudes. Instead, I wanted to focus on personas as indicative of people, with shade of gray that everyone can relate with at some level.

Based on the previous user interviews, I created 5 personas and included quotes about behaviors and motivations around fitness specifically and learning generally. The personas formed a spectrum from those who were very self motivated in most aspects of life and those who needed encouragement from other sources. Participants were asked to pick out individual quotes that they identified with the most from all of the personas and paste them onto the ‘Me’ sheet to create a persona of themselves. This was to help them break away from the notion that there is a right or wrong answer to how they might think about fitness and that dichotomies are ok.

3. Day in the Life of

Designers typically create Day in the Life (DILO) of diagrams to understand how their product or service can fit in within a target user's day. In this case, the DILO was meant to make people think about how they spend their day and what proportion of it do they spend on physical fitness. Participants were asked to map out what physical activity they did in the day. Based on where they marked in on a spectrum from positive to negative affect, it would show up on the yellow (for positive) or blue (for negative) sheet of paper behind it; transfixed by a sheet of carbon paper. The yellow and blue sheets had questions to reflect on further. The last page allowed people to construct a new schedule for the next day based on the reflections on the current day. This helped people think about how much time they could realistically dedicate to fitness given everything else they deal with on any given day.

4. Dear Data

The fourth probe was inspired by the Dear Data project. As they say on their website, "Each week, and for a year, we collected and measured a particular type of data about our lives, used this data to make a drawing on a postcard-sized sheet of paper, and then dropped the postcard in an English "postbox" (Stefanie) or an American "mailbox" (Giorgia)!"[42] Lupi also said that the actively keeping track of the data point for the week, and then manually drawing the data made her change some of her behaviors. For example, one of the weeks when they were tracking how much they complained, she realized that through the course of the week, the number of times and the nature of her complaints changed drastically.[43] This may not work in the long term but works at a deeper level than just being presented with beautiful looking data.

To track behaviors over a week, participants were to take screenshots of the fitness tracking app that they use and annotate over the data. Like the first probe, I asked them to also extrapolate into the future; in this case, just the next day. This probe encouraged people to engage with their data and build their own patterns to make meaningful action possible.

5. 5 Whys

The concept of the 5 Whys is used in management studies but it could be applied to the study of motivations. Here, I asked participants to write why fitness was important to them follow each reason down to articulating the base reason. This helped them move beyond just the means objective to the fundamental objectives that drive their behavior and draw inspiration from them.

42. 'THE PROJECT.' Dear Data. Accessed April 28, 2017. http://www.dear-data.com/theproject/.

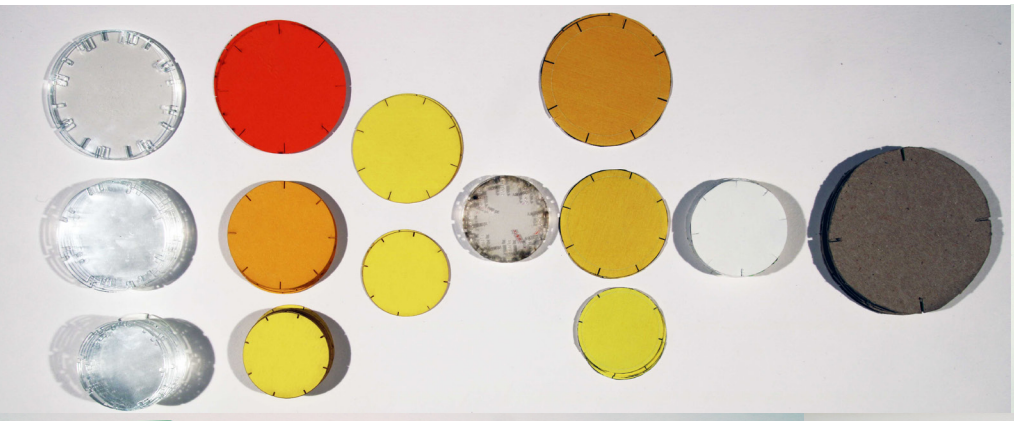
43. Lupi, Giorgia. Lecture, Dear Data,.

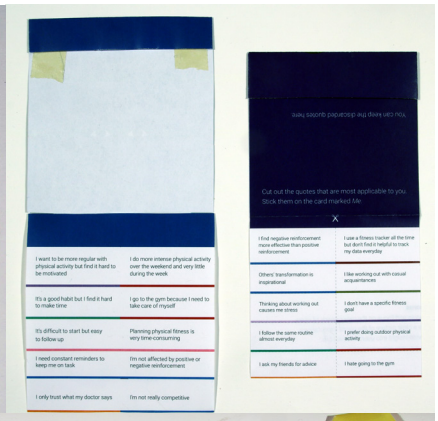
6. Mental Models

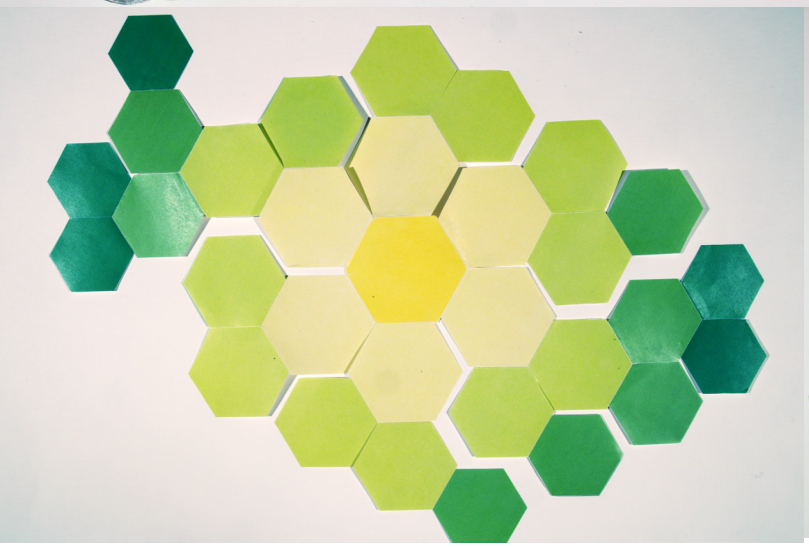
The sixth probe was intended to help people uncover their mental models around fitness by thinking of the parts or actions first, and creating a whole. The instructions were about filling the actions on the smallest cards, followed by habits and then social practices. The instructions were intentionally open-ended because I wanted to see how people would respond. I intended for people to realize how small actions that might be caused due to specific triggers could lead to a domino effect on other actions that ultimately form practices around fitness or unfitness.

Note on the process of designing the probes

I played with material to figure out what the probe would be for. I had a general idea of what kind of probes I wanted to make but didn't have a list of theoretical inspirations for which I wanted to make paper forms. Instead, I designed through cutting, coloring and folding to see that the affordances of different forms were and how people might play with them to uncover their needs or express themselves.







Testing the Probes

Five sets of probes were tested with participants. The first set of probes, meant to be pilot tests, was tested with multiple people (Participants 1a, 1b, 1c and 1d) because of time and availability constraints. These participants were design students at Carnegie Mellon University. Participants 2,3,4 and 5 were non-designers recruited through friends and colleagues who live in Pittsburgh. Participants 1c and Participant 4 were Participants H and N respectively, from the initial interviews. I met all participants, with the exception of Participant 4, in person, handed them the probes and answered any questions they had. After a week, I met with them again and talked about the experience. The probes were mailed to Participant 4 and the follow-up interview was conducted over Skype.

Participant	Age	Gender	Profession
1a	29	Female	Design student
1b	25	Female	Design student
1c	32	Male	Design student
1d	27	Female	Design student
2	29	Male	Student (studying to be a tax officer)
3	35	Female	Endocrinologist
4	31	Male	Software engineer
5	29	Female	Business owner

Table IV - Participant matrix for user testing

Following are the findings from the user testing. They are grouped by participant, and not by collage to help build a cohesive idea of each participant's experience filling out the probes

Participant 01a

Collage

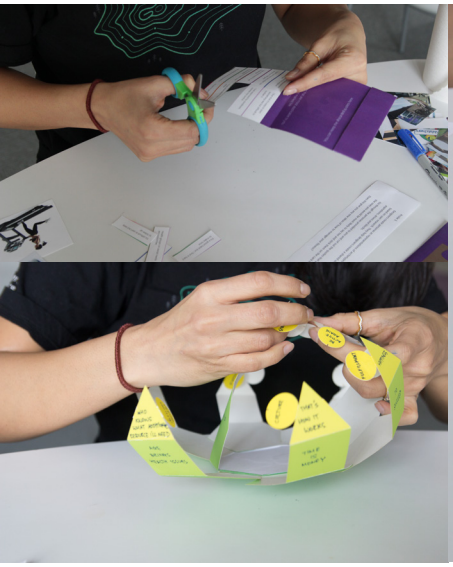
For the pilot probe, I asked the participant to make a collage of what fitness means to her and another one for what doesn't qualify as fitness. She chose images that represented what she aspired to, as well as aspects of sports, accountability through social circles and coaches and teamwork. For her, fitness didn't mean leisure or exercising outdoors in scenic beauty or drastic transformation. Interestingly the idea of pain, through pushing your body too far, was represented through two different images.

Personas

Since Participant 01a was a designer, she reacted to the person exercise slightly differently. As she was picking out quotes, she felt like if she chose more from a particular person, for example, the older man, that might mean that she is like an older man. Based on this feedback, I changed the phrasing of the instructions so that people were less conscious of what persona was most like them and were open to picking and choosing from personas that may not look like them.

5 Whys

All of the first level reasons that Participant 01a wrote down were quite divergent. They ranged from practicalities like "Cut on medicine costs", to those more directly related to fitness like "Longer run" and more personal ones like "Me-time in Gym". These in turn led to a variety of fundamental objectives like "Culture", "Societal norms", "Friends", "Money" and "My way of life"



Participant 01b

DILO

Participant 01b was also a designer. She said that she tried to incorporate physical activity by parking her car at a distance from home and school. She usually goes to the gym and has a physical trainer but on this particular day, she had work so didn't go to the gym. She found that besides the walking, she doesn't get much exercise. There are some days that her work requires her to be a bit more active but this isn't something she plans for or has control over on a daily basis.

Dear Data

For participant 01b, the most physical activity happened on days that she wasn't just in one place. So there was more activity on weekends than during the week. Going to the gym didn't increase the number of steps as much as walking did since her gym activity revolves around building strength.

Participant 01c

Mental models

When Participant 01c did the Mental models probe, he realized that he exercises in combination with other things, like watching Netflix. The things that he doesn't actively consider as fitness, like biking or hiking, are considered as more of a social activity or relaxation. There are also several things that happen before and after the workout that enable the workout. He said that doing the exercise made him more conscious of how he shapes the situation and environment to make physical activity possible.

Participant 01d

Dear Data

Participant 01d used the probe to intially just map the activities she did during the day and found that she could group most of her activities to three spaces - school, home and transient spaces. Her highest levels of physical activity were in the transient spaces so she planned for more "walking breaks" during long periods of inactivity at home and school.

Participant 02

Collage

Participant 02 hadn't made collages before and said that it helped him organize his thoughts and that "nebulous thoughts became clear because earlier there was a very vague idea that hadn't been visualized". In the version that represented what his current relationship with fitness was he visualized "what's possible" – it included activities like yoga, kick-boxing and karate but also shoulder pain and 'problem areas' on the body. The 'want to be' version included a lot more – running, fitness tracking, coaching and diet, weight, and diet.

Persona

Participant 02 grouped the quotes by those that he identified with the most and those that he identified the least. A lot of the quotes were about wanting help from friends or a coach with planning and maintaining a schedule. I found the choice of "I don't feel confident working out in a gym" and "Thinking about working out causes me stress" interesting because it implies a self-reinforcing loop. He also chose "Others' transformation is inspirational" and "I find others' transformation demotivating" which are contradictory perspectives but bring up the point that I was trying to make through the use of the Persona probes – that people are not one dimensional and feel differently about the same topic at different points of time. In the reflective journal he wrote that "I found that I feel "lazy" to do workout, "I'm a person hard to be motivated" and "I need external helper". These felt like important points to think about but he added that "But still, these are thoughts I've had before." Perhaps this probe could have used an addition where people chose a group of thoughts and actively planned how to address them positively.

DILO

Participant 02 had a difficult time determining what counted as physical activity. He used a productivity app extensively through the day but doing this made him realize how little time he dedicated to physical fitness. Later he said that it also reminded him of the need for exercise.

Dear Data

Participant 02 didn't complete this probe because his productivity app was viewable only in portrait mode, and had a pie-chart based user interface rather than the timeline I had imagined. The probe itself was designed for fitness apps, not productivity so it may not have been helpful for the participant to complete this probe anyway.

5 Whys

Most of the end reasons for Participant 02 were about things other than fitness. For example, "Increasing quality of sleep" led to "Good sleep is essential for everyday activity" which led to "Otherwise performance can be undermined in workplace" to "To secure a job". The other arms were also focused on productivity. This was consistent with what how he spends his time – studying in order to secure a job. In the Reflective Journal he wrote, "For example, stress and

refreshing associated with multiple reasons. In general, I feel like (my strongest source of) intrinsic motivation is 'to be an active and energetic person'. I am a pretty self-reflecting person. I think I've thought about almost everything I wrote down on the probe. For things above, I have also thought about them but didn't know the pattern and what is 'the strongest' source."

Mental model

Participant 02 found, through this exercise, that he has a limited social circle because of moving to a new country where he doesn't have a comfortable grasp on the language. He has a simple lifestyle but it's not necessarily an active choice. He also wrote "One thing so prominent is my daily life centers around "eating."" We also spoke about how he has current constraints of time and money so certain things are prioritized over others and hinders him from doing something about exercise. Through our discussion of the other probes, he spoke about the importance of having a companion or friends, not for accountability in the sense of blaming or nudging but because of recognition from another person, and the self-enforced idea of making a promise to someone else.

Participant 03

Collages

There wasn't a big difference between the two collages that Participant 03 made. This indicated that she's satisfied with the amount and kind of fitness activities she partakes in. She said that she has very broad goals. She said she was thin but felt unit and felt dull physically. Every year she experiments with new things but has found that consistently, her biggest motivation is talking to other people about their health in her capacity as an endocrinologist.

Personas

Participant 03 found that this probe helped her realize how other things take precedence over fitness. She also spoke about how it made her realize the importance of goal orientation to see if she's made any kind of progress.

DILO

For this participant, the DILO ended up being more of a logging exercise than reflecting on how she feels about the activity or how she can incorporate it more into her day. She did realize though that if she get up earlier, she exercises it more.

Dear Data

Participant 03 didn't complete this probe since she wasn't using fitness tracking apps at the time.

5 Whys

Participant 03 completed three of the eight arms. Her fundamental objectives were not highly connected; they were 'To maintain discipline in life', 'To relax myself' and 'To stay healthy'. This was in tune with what we spoke about but she was definitely more comfortable verbalizing in person than writing things down in a highly structured format. She described her intrinsic motivation as a "Holistic approach to fitness (that is) physical, emotional and spiritual."

Mental models

Participant 03 didn't complete this probe due to lack of time.

Participant 04

Collages

For Participant 04, the collages represented activities rather than just about bodies that look physically fit.

Personas

Participant 04 chose the quote 'I follow the same routine almost everyday' But also chose 'I find it difficult to maintain a schedule' and 'I restricted by conditions outside my control'. This indicated that it was about prioritizing activities and finding the right kind of physical activity. He wrote, "It has motivated me to find a sports group that plays sports regularly. I think that is one thing that is missing right now."

DILO

Participant 04's DILO was reflective of a regular work day. He realized that his "day is more or less the same. A lot of times, I've forced it upon myself. I know that if I maintain it, it's good for me. But I need to realign my priorities of what I do when." This was different from what he said in the previous probe. He also said, "The main reason I don't play sports is because I can't find people and I'm not interested in the sports that people I know play." This was an extension of the points raised in the previous exercise and helped him get to why he doesn't play sports regularly.

Dear Data

This probe highlighted Participant 04's routinized week. He found that the days that he works from home are when he does the least physical activity. Reflecting on the entire week encouraged him to think about when he could find time to play sports.

5 Whys

The initial reasons for Participant 04 ranged from energy, stress, health to productivity and self-esteem. A lot of the pieces were interlinked; for example, one of the initial reasons was 'Feel better about yourself' which led to 'More confident', which led to 'Better performance'. And 'Increase productivity' led to 'Perform better'. 'Boost energy' led to 'Perform better in day-to-day activities' as well. All of these can be interpreted as means objectives since seven of the eight arms eventually led to 'Feel happy' as a fundamental objective for being physically active.

Mental models

Participant 04 was a bit confused about the probe. He ended up creating a few different clusters. Mental fitness' included 'Laughing', 'Staying happy by not stressing about things I can't control' and 'Nothing box'. 'Basic routine' included 'Drinking lots of water', 'Timely meals' and 'Timely sleep'. 'Running', 'Outdoor sports', 'Walking fast' and 'exercising' were included in 'Physical fitness'. These were best practices and things that he knew he should do and tried to incorporate into his everyday life.

Participant 05

Collage

For Participant 05, the current was much more about diet, support and the idea of looking good for others while the future was about consistency, exercising for pleasure and old age. I was surprised that she interpreted the human hamster wheel-cum-standing desk as "external support" in a positive way and the standing support desk as well. The heavy emphasis on weight ("MUST TO DO, not optional") was surprising too since in other probes she spoke about looking and feeling good.

Personas

For Participant 05 the social aspect of fitness was highlighted through the persona exercise. It was interesting that she liked working out with close friends (a colleague who became a good friend and with whom the participant eventually exercised daily with) but also with acquaintances in the CrossFit gym she joined. Again, this highlighted that there is no one or the other, people form different social relations to achieve as well as because of their fitness routines.

Day in the Life of

The DILO reflected a sense of guilt for not committing to exercise and planning to but not following through because of work. Again, for Participant 05, it showed her husband's influence on her fitness routine (At 6 – "Absolutely not motivated to w/o ***(workout)*** hubby forces to run (sic) running for 45 min"

Dear Data

Participant 05 wrote "Did not exercise and felt ashamed. Did not write anything." Both the probes related to time and planning made her feel guilty rather than positive. This is in conflict with what she chose in the Person probe – "I find that positive reinforcement is more effective". Both these exercises could use a positive framing to be more encouraging rather than discouraging for participants that don't respond to negative reinforcement. In the Reflective Journal, she wrote that "Data means "0" to me. I am more of a "How do I look" type of person. This was consistent with the collages she created as well.

5 Whys

One of Participant 05's end reasons was 'More motivation' (derived from "I would be more happy if I feel healthy", from "improves overall health", from "good for breathing"). Another one was 'hate doctors' (from "less money to spend on doctors"). In the interview, she spoke about how she dislikes the fact that medical care is a business in the United States. Again, she put the emphasis on having friends to keep you on track and wanting to look younger because other "people like happy young people". She spoke about one of her friends who is older and would always be complaining about things. His wife was severely overweight and in order to take care of her, he needed to manage his own fitness. According to the participant, when he started exercising regularly, his attitude and personality changed as well and it was a lot of pleasant to hang out with him. An interesting point came up when we spoke about what she meant by "to be able to live a good life you must be healthy" and "want to be successful in fitness too". She told me that according to her husband, if someone doesn't look after their health by exercising, it implies that they're lazy when it comes to other aspects of their life too. I felt that both this and the previous points further highlighted that other people's experiences and ideas around fitness influences someone's own conception of fitness. I had designed these probes to be deeply personal and intimate but they ended up revealing a lot about chains and networks of influences outside of one's own experience. In the Reflective journal, this participant wrote, "I think I really lack exact motivation, due to lack of a specific goal". I felt that this meant that she wanted a specific goal – and perhaps helping her with goal setting in very specific ways would be helpful as a next step

Mental model

Participant 05 ended up using this to document her activities in the past week. Though this wasn't how I had imagined it would be used, it was a lot more positive that than the Day in the Life probe which might mean that having a probe that is more open-ended might make people feel less self-critical.

Insights from User Testing the Probes

Participants responded positively to all the probes. All the participants had varying levels of comfort with abstract concepts and one of them had expected that the research would include actual physical training charts and goals. For them, using the probes to think about and write down their motivations was revelatory. Others, who were more introspective, felt that they had already thought of these things before but thought the exercise helped them connect the dots. For others, it led to them thinking about how they could use their personal motivations to be more physically fit instead of trying to follow the dominant norms in fitness culture. Participant 04 said, “Eventually they (the probes) help you realize what you need to do. It tries to reinforce what you think about fitness. After all this, I realized my idea of fitness has never been the gym - it”’s always been sports - and now I”’ve started looking for groups. It reinforces your beliefs about fitness.”

People found the Collage and Personas probes the most insightful. It may be because they allowed people to relate to popular conceptions of fitness and health as well as to other people”’s feelings about fitness. I initially thought of the Collage probe as something that would make people reflect on their current practices and think of it critically. The futuring part (what you want your relationship with fitness to be in the future) was intended to be secondary. From the way people completed the probes, the secondary part helped them understand their fundamental objectives, and the disconnect between the current and future instigated them to do something about it.

They had the hardest time filling out the 5 Whys probe out but it led to the most interesting insights for me as a designer. The goal of this was to get participants to reflect on their fundamental objectives but it also helped them draw connections between their daily activities, how they prioritized things that they need to do and things that they should do. Some participants discovered a couple of core values and objectives, like being happy or being more productive, that was common through everything that they did, beyond just fitness. Others had many more core reasons why they do something and find different meanings in activities at different points of time.

People had difficulty differentiating between activities, habits and practices. It''s something that those working in the space of Social Practice Theory have a hard time defining as well. All the participants spoke about the social aspect of fitness practices but very few wrote about it on any of the probes. This realtionship between levels of daily actvities and practices of everyday life; and the social aspect of fitness activities, are potential areas for further exploration.

It's difficult to conclusively say that completing this set of probes increased people's intrinsic motivation because that itself is hard to measure or even ascertain over the course of a week. But in terms of making people aware of, and helping them draw connections between their fundamental objectives, needs, drives, blocks and the difference between what they think, say and actually do, these probes were successful. Ultimately, this would lead to a kind of behavior change that's internally driven rather than controlled by external rewards or punishments.

Key Principles

Based on the research, I derived some principles for designing for motivation. Services and systems should be designed for —

People's existing mental models and fitness goals

One person said that fitness was about a relaxed mind, someone else said it was about losing weight, someone else said they liked to be challenged physically. All 3 of these people need customized solutions that is framed around what they're comfortable with and think they need so that the initial barriers and resistance to change are overcome.

Motivations that extend beyond the individual

Social environments are also designed. People feel accountable to other people rather than technology. Two of the participants said that motivating others kept them motivated! So we should be supporting people but also providing ways in which they can support others.

People's daily lived experiences

Systems should take people's daily lived experiences into consideration. The probes like the 5 whys and mental models helped people understand their needs at a deeper level but making it action-oriented through the Collages, Dear data and Day in the Life of probes helped people realize how they actually prioritize different activities in their lives

Newness and optimum level of challenge

Rather than trying to create a subconscious habit, people want to be engaged in thinking actively about their own fitness. Trying new things is motivating in and of itself

Flux in motivation and change

Change is not static, and neither is motivation. People are not motivated by just one or two key things but find motivation in different things at different points of their lives and fitness journey.

Reflections

This thesis gave me an opportunity to think critically about design as a discipline beyond industry-led conventions. Designers can create persuasive technologies by leveraging principles in cognitive science and behavioral economics but I don't think that is the end goal of design. If the goal is to change behavior, solutions should be conceptualized as long term services instead of a purely technological product that's deployed and used 'just-in-time'. According to user-centered design, 'users' are rational and objective. Instead, I think designers should think of them as people instead of 'users'; as complex entities that are looking for opportunities to use their creativity and intelligence rather than users looking for frictionless experiences. Following are the results of some of these explorations through practise.

It's difficult to test a service moment

These probes are part of a larger solution and people will engage with the service at points before and after the probes. But this was hard to explain to participants and even harder to create an experience prototype while keeping the focus on the testing of the probes and manage their expectations accordingly.

Sequence and laddering is an important part of designing services that extend for a long period of time

A lot of time went into thinking of the structure, form and contents of the probes and how they were sequenced from personal to action oriented to reflection. It worked for people to discover their motivations gradually.

Cultural probes can be designed as a final product

Typically probes have been used in the fuzzy front-end of design research. They are "collections of evocative tasks meant to elicit inspirational responses from people...valuable in inspiring design ideas for technologies that could enrich people's lives in new and pleasurable ways."[44] In this case, they are the designed solutions that provide a structure for self-reflection. This was a slightly difficult concept to explain since participants were expecting a concrete answer to their questions or a concrete, catch-all resolution to the question of intrinsic motivation.

44. Bill Gaver, Andrew Boucher, Sarah Pennington, and Brendan Walker. "Cultural probes and the value of uncertainty." *Interactions* 11, no. 5 (2004): 53. doi:10.1145/1015530.1015555.

The effort of designing and making probes was reciprocated with quality of insights

Gaver et al say that in their probes, 'although the materials were aesthetically crafted, they were not too professionally finished. This gave them a personal and informal feeling, allowing them to escape the genres of official forms or of commercial marketing. In the end, they revealed the energy we put into them and expressed our tastes and interests to the groups'.[45] Though there was no way for me to test this, I did feel that the physical design of the probes affected how engaged participants were in the exercise and how much they revealed about themselves through the probes.

Systems and artefacts are a reflection of designers' own mental models

While designing the probes, I thought I was providing a general structure to thinking about intrinsic motivation. When I watched people complete the probes and heard how they thought of physical activity, I realized how much the form of the probe influenced what they thought and how they expressed themselves. These probes were not as neutral as I had imagined and had the ability to make people feel good, bad, hopeful or disappointed about how they manage their lives. Gaver et al say, 'Moreover, the visual frameworks we chose can be seen as somewhat sardonic comments on researchers' tendency to apply their own conceptual frameworks to the phenomena they observe'.[46]

Designers' own motivations

The phases of user research and looking at theory, though interesting, weren't motivating til the ideas were made concrete in the larger system. Formulating the larger system of services helped me visualize the bigger picture and how details might connected to each other. The process of designing the individual probes through manipulating paper. During the act of physically putting together the probes, I was thinking of the research participants who would encounter these for the first time, and that motivated me to create an engaging experience.

Relevance beyond fitness

This project was meant as a solution for people struggling with motivation but designers could use the probes individually or as a set to be find out about other people's motivations around personal finances, diets or work. The Collages probe could include abstract imagery representing people's relationship with money and participants could build collages for their relationship with personal finances at different stages of their lives. This might help them understand why their current relationship is the way it it is and plan for the future. The DILO probe extended to a week could help people reflect on actual spending patterns. For people struggling to maintain a specific kind of diet, the Personas and 5 Whys probes could help them articulate their fundamental objectives. The probe kit could also be used in project teams to mediate conversations among different stakeholders. If they created their own models of a problem, using the Mental Models probe, it could help them to come to a shared understanding of what the project needs are and how each person can contribute. Ultimately, the probes aim to uncover motivations, needs and desires to initiate behavior change.

45. Bill Gaver, Tony Dunne, and Elena Pacenti. "Design: Cultural probes." *Interactions* 6, no. 1 (1999): 21-29. doi:10.1145/291224.291235.

46. Gaver, et al. *Cultural probes and the value of uncertainty.*

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