The Inbodied5: a provisional Wellbeing model for Users and Interactive Technology Designers

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TECH REPORT, AIC GROUP,
ELECTRONICS AND COMPUTER
SCIENCE - 2013

ABSTRACT

Most of us have weak models of wellbeing. This lack of an effective practical model of wellbeing, may be a strong factor for why health and wellbeing apps have had only mixed success. To help address this lack, we propose the inbodied5, a holistic model that represents five fundamental inter-related processes – eating, moving, cogitating, engaging and sleeping - to help designers and users debug our wellbeing towards better wellbeing self-efficacy.

Categories and Subject Descriptors

H.1.2 [**User/Machine Systems**]: Human information processing

General Terms

Performance, Design, Human Factors.

Keywords

Wellbeing, Wellbeing Design, Interaction, Health, Models

1. INTRODUCTION

If we were to understand health and wellbeing through a review of applications on smartphone app stores, and devices for sale, we would see it as an act of counting. Step counters count steps taken in a day; gps loggers count miles run or cycled; food loggers track calories consumed; workout trackers count calories burned. Actigraphy counts hours slept. The ethos of these tools is simple: either get a count higher (more steps, more miles, more sleep) or get a count lower (fewer pounds, fewer calories) for change. Such simple heuristics are a joy for programming, as these applications are straightforward to produce. Sensors on our mobiles like accelerometers, gyroscopes and GPS are fabulous at tracking these measures in the background with little user intervention.

The overall effectiveness of mobile wellbeing apps, of which such loggers are the most popular, seems at best, mixed [17]. There are a variety of theories as to why these tools have less impact than desired. In what we'll call Critique1 (summarized by [14]) apps are analyzed as effectively incomplete: a logger is only one component of a theory and/or evidence-based approach to support success around behavior change. Critque2 (represented by [9]), somewhat in tension with the first, challenges the framing of all this space as entirely the provenance of "behavior change." The argument is that many people already know what it means to eat better: the challenge is access to time and resources to operationalize these aspirations.

Based on our interviews with both designers of commercial and research wellbeing prototypes and users of commercially available wellbeing applications (such as the Fitbit One, Jawbone Up, Nike Fuel) [presented in [1]], we wish to propose a third reason why these suffer from both critiques. Overall, we found that both developers and users often have what may be called weak models of wellbeing. For instance designers and users may both believe they need to eat less to lose weight, but not understand how one food (usually a whole food) may leave them satisfied and another (usually processed) with the same calories may not [2]. They believe they need to workout to get stronger, but not understand lack of sleep is holding back their progress; they may want to advance at work, but not understand how time for physical activity can help their mental processes better than longer hours at a desk. Consequently, as a community we have designed tools that are, as per Critiques 1&2 both incomplete and potentially misdirected. That is, our tools privilege logging – something easy to support with current sensors and mobile computing - rather than offering support for skills and knowledge to increase wellbeing self-efficacy.[1] Consequently, neither developers nor users have a model to debug our wellbeing.

A challenge we set ourselves, has been to develop a model that helps both designers and users understand fundamental processes around our in-bodied-ness (explained below). This in-bodied-ness is also, embodied, or situated within the necessities and qualities of our daily lives: eating lives beside thinking; moving with sleeping. We are complex; our models of wellbeing, our early evaluations show, work better for people when respecting that complexity rather than trying to isolate it down to a set of habits rather than understanding. Our hope is that with such an holistic perspective, designers will have the framework through which to create more complete tools (response to critique 1) and balance persuasion with skills and knowledge (response to critique 2).

In the following note, we describe our work on one such model, the inbodied5. We describe its components and their basis in the literature, and review how the model can be used to inform contexts for application design in particular. For brevity, we situate related work and sample design opportunities throughout.

2. Models of the Body: Background

There are a variety of models of the body from philosophy to physiology. In Human Computer Interaction where there has been considerable research around wellbeing application design (an exemplar is [4]), the body is usually framed in terms of "embodiment." This concept is perhaps best known through Paul Dourish's *Where the Action Is*. Embodiment moved research in HCI to consider the phenomenological role of the body in mediating interaction in a social ecosystem. How we actually use a technology, for instance to convey cultural norms, is an example

[1] According to Bandura's theory, self-efficacy refers to the extent to which a person believes that they have the ability to perform a task or manage a situation.

context for embodied design consideration. Both the physical world, and our interaction as physical beings in social contexts informs meaning. As such, the person (rather than the task), in context, becomes a key locus for design. Embodied interaction also foregrounds the concept of values expressed through daily practice. Evaluating our wellbeing designs in terms of how they align with and help us to tune our existing actual daily practices to better support, inform and enhance wellbeing seems a useful way to engage both critiques1&2..

By drawing attention to the role of the mundane in meaningful action – that that is where the action is – it offers a potential salutary reflection on the limited self-efficacy afforded within current health logger-oriented apps. Unlike for instance Theory of Planned Behavior, or the Transtheoretic Model, both frequently applied in health intervention design, embodiment is (a) not aligned with behavior change and (b) is particularly focused on what it means to interact physically in the world, embodied. That said, in embodied interaction, the body itself remains largely a black box. The lid as it were, in terms of how the body works as a physical system, is not lifted. To support wellbeing, which does engage with physical processes like movement and eating, we do need some model with which to understand those processes.

There are numerous models of the body. It is generally categorized as 11 systems, from skin to bone, muscle, nervous system, heart, lungs, lymph, hormones, waste, reproduction, digestion.[2] These models are largely descriptive of components, rather than processes. Models for the body's processes, however, also exist, ranging from bioenergetics (the translation of nutrients to materials to support the 11 systems), to electro-chemical and bio-chemical, to keep that system moving, to the neuro-mechanical mechanisms of movement, and of course, to the neuro-cognitive processes translating signals from each of these systems to actions and thoughts.

While each of these models is an abstraction, each is also a field of study unto itself and a labyrinth of complexity. Practically, therefore, we need a model for non-domain expert designers in wellbeing, and for the rest of us trying to get healthier, that both respects the situated-ness of embodiment while enabling us to engage sufficiently with these complex processes in an accessible, meaningful and practicable without being overwhelming. To paraphrase, Einstein, we need to make things simple enough, but not simpler. To this end we propose the inbodied5.

3. The Inbodied5 model

The inbodied5 model is proposed as a complement to embodied-ness. Where embodiment situates the body in a larger context of social interaction, inbodied-ness turns the lens in the other direction to consider the internal complexity that can have such a strong baring on the external, social, embodied manifestation. The inbodied5 also focuses on processes rather than states. As we have seen above, there are models that describe the attributes of the body in terms of 11 systems, but, from a consideration of emphasis on interactive design for wellbeing, wellbeing is about an ongoing active state. While alive, that is, the heart is always beating; the nervous system always firing; the gut always processing; cells always growing and being purged. We are, effectively, actually, always on, always adapting. Even sleep is an active process of muscle regeneration and memory building.

Thus our inbodied5 model features five fundamental processes: eating, sleeping, engaging, cogitating, moving. By fundamental, we mean life sustaining. Each of these components has four things in common: (1) they are each processes we do regularly, usually daily, (2) they are essential: an absence of any one of them has been shown to accelerate mortality; (3) similarly the quality of one has been shown to have a direct relationship on the others (4) each of these can be developed/enhanced/improved with skills, knowledge and practice – thus offering huge novel opportunities for interactive wellbeing design.

We consider each of the five and some of their interactions briefly in turn, and propose example interaction design opportunities.

3.1 Eating

To eat is an obvious essential activity to fend off death at the extreme, but also to support wellbeing. While food loggers treat food as fuel for a thermogenic reaction, food is far more than calories. We have evolved to require nutrients from food – from macro nutrients to phyto nutrients to provide for every one of the processes in our bodies. Recent research is showing that processed foods make maintaining a healthy weight harder, for instance, because they remove the food components that signal satiety: thus we tend to eat more trying to feel satisfied. Food and its preparation is also a source of both physical pleasure and social engagement, attributes which also support wellbeing. Work that has looked at comparing calorie counting approaches (treating food as fuel) and learning about the roles of foods for healthy eating shows that such approaches tend to lead to healthier weights and critically longer term healthy weight maintenance without relapse [12]. Such work suggests that we might want to consider helping users identify healthy foods and food practices, and logging progress with these, rather than counting calories.

3.2 Movement

Our bodies, including our brains as part of our bodies, are dependent on movement. We are evolved it seems to move, not be sedentary. Indeed, the Whitehall Cohort study II shows that the longer we are sedentary the more stupid we become, compared with our more consistently active colleagues [16l]. Lack of movement leads to weakness, illness, disease: we are use it or lose it systems. Many of our hormonal reactions for example are designed to support movement. For instance, the fight or flight hormones like cortisol, usually associated with stress, are a signal that prepares the body for movement. When we do not move in response to that stress response, the signal comes on again. And again. Hence movement is a fantastic way to blow off – to answer – these hormones. All tissue has an energy cost to support, so our bodies shed what we don't use, resulting in bone loss and atrophy.

3.3 Cogitation

Challenging our brains to express topics deeply, richly, seems to have a protective function physically for at least our brains if not the rest of our being. In the Nun study, in samples of autopsied brains of deceased nuns, many that looked physically like the nun would have manifested Alzheimer's Disease did not in life show signs of the disease. One correlation to date has been that these nuns seem to have demonstrated in their writing greater "idea density" [7] than sisters who had both appearance of the disease in their brain tissue and who manifested it in life. While the mechanisms are not clear, idea density suggests that challenging oneself cognitively towards rich expression triggers brain plasticity: the (re)creation of multiple neural pathways through the brain and body [11].

[2] http://www.innerbody.com/

3.4 Engagement

We are literally wired to engage. We produce oxytocin a neurohormone that seems to mediate social saliency [3] influencing social approach, trust and bond formation. Singing together or walking together as well as hugging are some triggers of oxytocin. Likewise, long term observational studies (meta-analysis [6]) show that in person social engagement affects both longevity and quality of life: the more numerate the number of social interactions, the greater the quality of the interactions, from volunteering to personal relationships, the better and longer, one's life. According to Holt-Lunstad[3] who lead the most recent meta-review of social relationships and mortality risks, it's not clear if these benefits accrue in the digital as well as the physical. Considering its known importance not only to our quality of life but to our social and often professional success, which can relate to very fundamental success of having the resources to survive or not, supporting skills for social interaction seems to be a significantly under developed category of wellbeing tech design.

3.5 Recovery/Sleep

The neuroscience of sleep is an amazing area of research. We still do not know why we have evolved to spend a third of our lives unconscious. But it is in this state that essential physiological and neurological processes take place: in deep sleep, we build muscle tissue; in light sleep we build memory and learning; in REM, neruotransmitters regenerate. Even slight chronic sleep deficits lead to cognitive impairment [15], and have been shown to increase levels of perceived chronic pain, depression and fatigue. Even apps that record sleep do little to help make the connection between sleep quality and recovery (measurable by attributes like Heart Rate Variability (HRV). There is an opportunity to blend these two measures to suggest tuning for better wellbeing

3.6 Sample Interactions for Wellbeing

The above sections have defined the individual attributes of the fundamental attributes of the inbodied5. As previously described these attributes are carried out to better or worse degrees often daily if not more frequently. They each therefore have significant effects on mortality and quality of life. A particular strength of the inbodied5 model for design, however, is in the interactions of the inbodied5. One can effect any attribute by interacting with any other attribute. This aspect of the model means that designers have a richer palette to approach a particular focus. If their aim is to support weight loss, they can explore the relationship to engagement, or sleep. Similarly if the focus is on movement development, they can help debug perceived problems there by exploring related attributes. A few such interactions are below.

Weight Loss and Sleep. Each element of the inbodied5 interacts with the others. Wellbeing applications that can be sensitive to these interactions will better support users keen to improve their self-efficacy in their wellbeing performance. For example, when trying to lose weight, a key question to explore is how well is someone sleeping? Poor sleep leads to elevated cortisol. Cortisol, for fight or flight, privileges hanging onto fat as a fuel reserve.

Movement and Minerals. As stated, minerals to support healthy bones are only taken up when we put stress on our bones from resistance exercise or stop/start activities like squash or football/soccer. Having more muscle itself acts as load on bone in terms of the stresses the tendons from larger muscle exerts on their bony attachments. These facts are particularly important for women who tend to fear putting on lean muscle, when in fact it is a key inhibitor of osteoporosis.

Nutrition and Cognitive Performance. Nutrient timing (when we eat certain foods) can have a significant effect on cognitive performance. Starchy carbs seem a great aid to muscle recovery after workouts when muscle glycogen stores are depleted, but at other times, can lead to too much sugar in the bloodstream. Recent work on sugar and the brain has proposed that Alzheimer's Disease is Type 3 diabetes [8]. Type II diabetes is where the body can no longer process the glucose in the bloodstream – because there is too much sugar available too much of the time – the body become insulin resistant – the insulin hormone can no longer do its job. The brain, which relies on sugar as glucose for its fuel, can also get too much sugar and become insulin resistant. Cognitive function such as memory in particular is significantly impaired. The prevalence of processed foods with their high starch/sugar content, the work suggests, places us at increased risk of brain-based insulin resistance. Conversely, whole foods can have a significant benefit on the brain. Eating berries for instance [10] helps resist neural inflammation reducing neural damage and improving both motor control and cognition.

Movement and Cognitive Performance. There is a growing body of work that shows that exercise has immediate benefits on all aspects of cognitive performance and seemingly at all ages [summary: see 13] From movements as small as vision exercises to grosser work that elevates heart rate for as little as 20 minutes, to assessing lifetime differences between people who have always had some exercise in their lives with those who haven't, the exercisers consistently out perform the sedentary. In terms of embodied interaction where our actions with technology reflect our values, where a growing number of us spend more and more time with a screen, privileging knowledge work, if we value our online performance, our engagement will only be enhanced by spending some time in physical movement in the world. There are already interesting hybrids of designs that blend life on the screen with movement, such as the smartphone based Zombies, Run! [4] game. People run with their mobiles telling them zombies are chasing them, while running to various safe places. Adding cognitive pre and post tests to the games would show not just cardio vascular, but cognitive benefit as well would building up more inbodied5 wellbeing options.

4. Tuning the Inbodied 5: Daily Practice

The inbodied5 models what we have presented as fundamental processes that take place daily, whether we wish them to or not: we can only put off sleep, for example, for so long; we can only be unconscious for so long. we also suggest that the quality with which we engage with each of the inbodied5 is equally critical to our wellbeing. There is a balance: do any one of these attributes to excess, all suffer. Being a sedentary knowledge worker who does not move leads to all the problems associated with sedentary decline. As the inbodied5 reflect necessary daily activities to sustain (quality of) life, they are also strongly situated within life as they interact. Indeed, the more we stack concurrent inbodied5 attributes the richer it seems our experience. Relaxing over flavorful food with loved ones (eat, recover, engage) is a restorative, quality experience. Playing pick up hockey with friends requires is a structured playful movement that requires cognitive engagement for strategy, and social skills for team play.

[3] Email communication, Aug. 2013.

[4] http://zombiesrungame.com

The inbodied5 interactions help us as users see possibilities for building on things we already do (and enjoy) within our actual real daily context, that are part of our inbodied5 lives, that can be leveraged to enhance those other attributes that may be less well developed. It is not about change (perceived often as radical and threatening) but tuning. We all already eat, move, think, engage, sleep. We could do these better. And while tracking may help us in the short term repeat concepts, we often do better, and can certainly tune our own practice better, when our tools actually help us not just record but learn, build skills and especially assess the impacts of tuning upon our whole inbodied system.

4.1 Robust Practice; self-efficacy

The model of the inbodied5 is very much one that privileges awareness of the attributes themselves, some knowledge about the interplay among attributes, and the possibility to build knowledge and skills to support what we call "robust practice" around the inbodied5. Tools that focus on robust practice would help us learn what might be considered robust knowledge: knowledge about each of the inbodied5 that would let be able to build quality options no matter the environment. At home, on the road, at a restaurant, we have the skills and knowledge to maintain quality practices for movement, eating, thinking, recovering, engaging. By privileging the inbodied5 model in wellbeing designs, we would design tools to support developing self-efficacy around each of the 5 attributes and their interactions.

This interaction between factors is critically absent from current tools that monitor multiple factors. We suggest again, this is because developers do not have an über-model of wellbeing against which to align their designs. For example applications that record data on multiple factors from food to steps to sleep (like the Jawbone Up or Fitbit One), do not represent how one attribute may influence another. Likewise they rarely offer any directed support on using current data to interrogate and build skills. For instance: an inbodied5 app could link one's calendar or GPS coordinates and the logs and see that eating changes (or is simply not recorded) when away from home. The app could draw upon strategies to help take home style "healthy" food practices on the road to develop robust practices.

5. Conclusion & Future Work

A goal with the inbodied5 is to present as a practical wellbeing model for designers to help them think through and create more effective wellbeing tools for users that address Critique 1 and 2: are more complete and can see beyond "behavior change" towards knowledge, skills, access, assessment, practice. We have provided the research rationale for why these five elements as essential to life. While they are essential, they are also mediated by skills we practice in daily life, and where there is evidence that the quality of our practice of each attribute affects overall wellbeing. We have also interleaved design possibilities against each component for wellbeing app possibilities. We offer this model for further scrutiny, evaluation and uptake.

Over the past 6m we have been road testing the inbodied5 as a concept with users around sense-making. These are early days for the model – hence this note to present the model and look forward to others beyond ourselves applying it to inform their wellbeing technology interventions. So far however, the response to the model and the processing fluency we have been exploring the inbodied5 towards self-efficacy suggest that the inbodied5 provides a model that may be simple enough but not too simple to both respect and reflect the complexity and fundamental interactivity of these core attributes of inbodied wellbeing.

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