A DIY Self-Experimentation Toolkit for Behavior Change

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Abstract
Within personal informatics and Quantified Self (QS), great emphasis has been placed on creating the systems for gathering and visualizing data to support self-discovery. While this is a vital first step, a logical next step is the development of self-experimentation tools focused on not only tracking but also testing of alternative strategies for behavior change. Many behavior change technologies provide the "solution" to a problem rather than give individuals the tools to self-experiment with alternative solutions; a tactic that fits particularly well with QS. In this paper, we will briefly describe the conceptual frameworks relevant to habit formation, particularly those that emphasize context, and then we describe the Game as Life, Life as Game (GaLLaG) system developed by Burelson et al. and how this tool along with other QS tools could be used as the starting point of a DIY self-experimentation toolkit.

Author Keywords
Personal Informatics; self-experimentation; Co-Design; Ubiquitous Computing; behavior change technologies

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous. See:

General Terms
Design, Experimentation, Human Factors

Introduction

As defined by Li et al [10]:

> Personal informatics systems are interactive applications that support users in collecting personal information about various aspects of their life, behaviors, habits, and thoughts. These systems help their users improve self-knowledge by providing a personal history and tools for its review or analysis.

A key emphasis within personal informatics therefore is to develop the underlying systems and applications that could be used to support improvements in self-knowledge. A strong emphasis within personal informatics and the broader Quantified Self (QS) movement has focused on the development of systems for self-tracking and visualization (e.g., [3,11,14]). In addition, an increasingly large number of systems are being developed in the HCI community for creating "solutions" for promoting behavior change in a variety of domains such as health [2,6] or sustainability [5]. While these are important and logical first steps, a complementary pathway that is in line with the DIY culture of QS would be to develop tools that can facilitate self-experimentation of alternative strategies for improving behavior beyond self-knowledge acquisition, self-monitoring, and pre-packaged behavior change solutions.

As is well evidenced within behavioral science, knowledge alone is often not sufficient to promote behavior change [12]. Even self-monitoring, which is an effective strategy for behavior change, is often accompanied with high burn out rates, thereby reducing the long-term utility for sustained behavior change [12]. Even the more comprehensive solutions to promote behavior change may be effective [2], but it is likely that no one solution will be effective for everyone. Based on this, new systems are required that build on the previous QS tools and behavior change technologies but go beyond them to allow more flexible development and testing of different behavior change strategies.

While the number of different behavior change techniques is vast and continually growing [16], a group of techniques focused on manipulating context is likely to be both a fruitful area of inquiry for developing effective interventions that are also customizable enough to warrant their use within a DIY self-experimentation toolkit. In this paper, we will briefly describe current thinking about habit formation within behavioral science with particular focus on the linkage between context and behaviors. We will then describe the GaLLag system and discuss how it can be used, along with other QS tools as the starting point for a larger DIY self-experimentation toolkit.

Rational vs. Intuitive Processes

As has been discussed by a variety of psychologists, our current mental energies and processes can largely be divided between active "rational" vs. more passive and automatic "intuitive" processes [7,8,9]. A full description of this is beyond the scope of this paper but it is important to note that the vast majority of our daily tasks are driven and selected by our intuitive processes rather than our rational processes. Put differently, we rely on our intuitive processes to function as a sort of "autopilot" for most of the actions and behaviors we take. This is true even for many decisions that we may perceive as rational. As Haidt

has eloquently pointed out in his work [7,8], many "rational" decisions are often secondary explanations for decisions that were made by our intuitive processes.

While it may seem problematic that much of our life is dictated by our intuitive autopilot, there are many important reasons for this (see Kahneman for a detailed discussion [9]). Of particular relevance to the discussion of behavior change technologies, Baumeister and colleagues have conducted research and found that our rational processes function much like a muscle and therefore can become increasingly more tired and nonfunctional over sustained use [13]. Based on this, we need our autopilot partially because it allows us to only use our rational processes when they are truly needed and thereby reduce the overall exhaustion we experience with sustained rational engagement.

While the power of our "autopilot" to dictate our actions is largely known, this observation is not well integrated into most of our current interventions to promote behavior change. Indeed, many of our current interventions emphasize utilizing our rational processes rather than programming the autopilot [16]. For example, goal-setting, self-monitoring, problem-solving, numeric feedback, or education are all strategies that largely focus on strengthening our rational processes to counteract the autopilot. This strategy, however, would require us to engage in increasingly longer periods of time of conscious rational thought, something that we know to be exhausting and largely impossible over a sustained period [13]. Based on this, while it is often important to have some knowledge about what to change, it is often not sufficient to use this knowledge and these other rational self-regulatory skills alone to promote sustained behavior change.

Habit Formation: Programming the Autopilot

Interestingly, much of the research on habit formation has started to place much greater emphasis on the impact of context driving our autopilot rather than attempting to overtake our intuitive autopilot via reason. Specifically, Wendy Wood has explored the underlying research and processes whereby automated behavioral routines or habits occur and has identified the importance of contextual triggers such as environmental cues (e.g., the refrigerator as a cue for eating), social cues (e.g., having lunch with friends), previous behaviors (e.g., flossing right after brushing your teeth), and time of day (e.g., always brushing your teeth at the same time each evening; [15]). Indeed, the impact of context on behavior was a central tenet behind BJ Fogg's Three Tiny Habits System [4]. In Three Tiny Habits, an individual is instructed on developing behavior-linked routines (e.g., after you brush your teeth, floss one tooth). This strategy built on the importance of linking new behaviors with previously established behavioral routines. There are a variety of other context cues that might be useful to foster habits. These context cues will likely be highly idiosyncratic and therefore require individuals to do self-experimentation to find the best context cues to foster the desired behavior change of interest.

GALLAG

GaLLaG (Game as Life, Life as Game) is a research agenda and system advanced by the Motivational Environments Research group directed by Dr. Winslow Burleson [1]. It aims to support personal motivation and self-actualization through ubiquitous computing by

providing the opportunity to integrate virtual and physical domains with interactions informed by the social sciences. Specifically, GaLLag is a ubiquitous computing toolkit intended to facilitate the customization of readily deployable, interactive, smart environments, in conjunction with participatory design approaches that include end-user-programming.

It enables rapid prototyping of simple rule and event-based systems that include physical sensing, data storage, and media event components. A suite of tools are integrated in a GALLAG development toolkit. Sensing is provided by an array of devices, including but not limited to X10 and Insteon home automation components. It integrates wireless speakers, mobile devices, visual displays, etc. in delivering a variety of responses such as music, narration, text, and graphical responses. The commercially available Indigo home automation software is employed for communication with hardware, as well as a platform for running GALLAG applications. It has been used as a platform for researchers who want to explore context-aware applications. A variety of ready-to-use examples have been produced based on scenarios generated by participants in their preliminary field study as well as researchers themselves. Basically, they employ scripted sequences of media events that are triggered based on time, sensed activity, and/or history of behavior to invite and sustain desired behaviors.

GaLLaG as a DIY self-experimentation tool

The design of the GaLLag system, with its shallow learning curve and ease of use for customization and programming, and its emphasis on embedded sensing and feedback, make it well-suited as a key component of a DIY self-experimentation toolkit for promoting behavior change. We see it as particularly complementary to other QS tools such as [3] to facilitate testing of alternative strategies for promoting behavior change. Within the workshop, we would like to bring the GaLLag scenarios to the hackathon on Saturday and then, with others in the workshop, work on devising strategies to use this system along with other tools to develop a DIY self-experimentation toolkit for behavior change.

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