

# Understanding Personal Informatics Needs of Unique User Groups

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## 1. INTRODUCTION

Humans have always exhibited a drive for self-knowledge. Even as far back as 399 B.C. [7], there have been examples of men searching for knowledge about themselves, when the Greek philosopher Socrates learns from the oracle at Delphi that the wisest man is one who knows he is not wise, and understands how much he has to learn. More recently, this drive for self-knowledge has manifested itself through the use of personal informatics systems, which allow people to collect and reflect on data related to their personal lives. These systems allow people to better understand their behaviour. Once their behaviour is better understood, these systems can help users to change their behaviour, by encouraging them to set and work towards goals.

Myfitnesspal [11], for instance, is a site focused on helping users to lose weight by tracking their calorie intake and fitness activities. It provides the user with a variety of tools including a recipe calorie counter, basic metabolic rate calculator, and body mass index (BMI) calculator, which educate the user about his/her behaviour and assists him/her in setting healthy goals. The BMI calculator, for example, takes data about users' height and current weight, and provides them with information about their ideal weight, and how far they are from that target. The site allows users to enter information from a mobile device, or even to collect data automatically using Fitbit Ultra, a wireless tracker that automatically measures steps taken, stairs climbed, and calories burned.

If these tools do not meet the needs of their target users, the users may abandon the tools in favor of different tools or methods, or even abandon their quest for self-knowledge entirely. While there have been efforts made in past research to identify common problems that users experience when using personal informatics systems, that research has been focused on large general populations; little heed has so far been paid to the likelihood that different users may use tools differently; they may well collect different types of data, for different purposes, and have different motivations for doing so. It is important, then, that designers of these tools have a thorough understanding of the characteristics of their target users, and the differences in their needs. This understanding will allow for systems to provide much more thorough customization based on these differences in usage.

## 2. RELATED WORK

There has been considerable effort by researchers to break down personal informatics systems into smaller pieces in an effort to increase the usability of systems at each stage. Li, Dey, and Forlizzi [4] outlined a model for these systems based on five stages – *preparation*, *collection*, *integration*, *reflection*, and *action* – with the goal of improving the diagnosis, assessment and mitigation of problems associated with using personal informatics tools. The *preparation* stage encompasses the users' initial

decisions about the information they will collect (i.e. what kind of data they are collecting, how they will collect it, and why they are collecting it). As the name implies, users in the *collection* stage are actually collecting the data. In the *integration* stage, the system transforms and prepares the data for users to observe. This is followed by the *reflection* stage, in which users reflect on the results of their data collection. In the final stage, *action*, users choose a course of action based on the knowledge they've gained.

In the reflection stage, it becomes possible to better understand the types of questions users are asking about their data. These questions can be grouped into two phases of reflection [5]: discovery and maintenance. In the discovery phase, users are still figuring out what their actual goals are and therefore collect different types of data with the goal of establishing or discovering correlations between them. In the maintenance phase, users reflect on their data to maintain awareness and monitor behaviour, specifically comparing their current state with their goal state.

Additionally, there have been increased efforts in both academia and the media to understand self-experimentation. Individuals who frequently self-experiment express an appreciation of the freedom that comes from the studying of oneself without concern for grants or publishable results or even deadlines [9]. They have also come to recognize the value and power of introducing quantification – a longstanding practice in the fields of science and commerce – into their personal lives [10]. This movement has been made manifest in the relatively recent transition from a language-centric description of aspects of human behaviour to the construction of a quantified self, which uses numeric data to describe the human condition.

A great deal of research has been undertaken within the realm of behavioural psychology in the interest of developing learning theories, and that research has become the fundament for many of the design strategies provided by computer scientists for persuasive technologies that aim to assist people in changing aspects of their everyday behaviour. Skinner's work on operant conditioning, for example, emphasizes the importance and impact of reinforcement and conditioning on behaviour change [1]. This theory of behaviour modification is straightforward: eliminating an undesirable behaviour's reinforcement can end the action, while the introduction of a new reward for desirable behaviour can strengthen that behaviour. There also does not seem to be any dispute that there is a clear relationship between the difficulty and specificity of a goal and the likelihood of it being accomplished; Locke [6] found that goals that were more specific and difficult were more attainable than vague, easy goals. Additionally, the transtheoretical model of behaviour change outlines various stages of change and portrays behaviour change as a process over time, rather than a single event [8]. Finally, cognitive dissonance theory proposes that learning and behaviour change are compelled by a

discrepant relationship between an individual's desired and actual state, and that behaviour change is driven by the adjustments that must be made for those two states to harmonize [3].

From these theories of behaviour change, computer science researchers have gained a better understanding of how a system must be designed if it purports to facilitate change in behaviour. A number of qualities and patterns have been suggested to shape the design of personal informatics tools in a way that effectively enables this change [2]. The first design goal, *abstract & reflective*, suggests that data abstraction be used to display information in a way that encourages reflection, rather than raw data. Tools should also be *unobtrusive*, implying that the tool is to be available when the user needs it, but is not to interrupt or draw attention to itself. It has also been recommended that the tool be comfortable in *public*. This becomes important when personal information is stored in a tool that can be seen in the presence of others. A tool should also be *aesthetic*, and match the user's personal style so the user will not abandon the tool in favor of maintaining a certain image. The tool should be *positive* and reward the user for changes in behaviour. The user should also find the tool to be *controllable*, so that data may be added, edited, deleted or manipulated as appropriate.

Many of these works have successfully identified problems with personal informatics tools, and made design recommendations based on those problems. Those problems, however, were identified by interviewing widely divergent groups of users who had little in common aside from their experience in using these tools. There is reason to consider whether or not all of the identified problems apply to all of the users interviewed.

This study hypothesizes that users, if studied as individuals, or grouped according to common characteristics, would experience different barriers based on their motivations and reasons for collecting data. Moreover, while there has been increased interest in understanding self-experimenters, there has been little effort towards understanding other groups of personal informatics system users. This research will provide three main contributions: 1) to identify different types of users based on type of data collection, motivation for collection of data, and problems encountered, 2) to introduce a model of user groups that will allow the designers of these systems to better assess the needs of their target population when making decisions regarding a system's functionality, and 3) to provide a conceptual framework for creating new personal informatics tools that are more focused on meeting the needs of these user groups, and eliminate many of the problems these users experience.

### 3. APPROACH

This research is intended to identify different types of data collected and problems encountered by different types of users (i.e. users categorized according to reasons and motivation for data collection). It will introduce and discuss a set of profiles of user types, and make user-specific recommendations for ways to improve existing systems and build new ones. Finally, it will compare and analyze an existing system to assess problems each user group may encounter when using that particular system.

Recruitment of participants for the study will be focused on users who have previously used at least one personal informatics tool. To do this, a combination of two recruitment techniques will be used. First, participants will be recruited from websites that focus on personal informatics, such as <http://quantifiedself.com>. Second, snowball sampling will be used to create an interest in participating in the study. As part of this snowball recruitment,

various health organizations will be contacted (e.g. the Alberta Diabetes Foundation, the Epilepsy Association of Calgary) as well as websites of a similar nature.

To identify different types of users, an interview study will be conducted. Each user will be asked a series of questions on the following topics:

#### Topic 1: General

Describe an average day in your life. Does your lifestyle impact the kind of data that you collect? What kind of data do you collect about yourself? How long have you been collecting this data?

#### Topic 2: Motivations

Why do you collect this data? How would your life be different if you weren't collecting this data? Why did you initially begin collecting this data?

#### Topic 3: Tools

What kinds of tools do you use to log this data? How often do you log this data? Do you ever miss logging some of this data? What are the consequences when this happens?

#### Topic 4: Reflection

What do you do with the data after it is collected? What are you hoping to accomplish by collecting this data? Have you changed your behaviours or activities because of what you have collected? Do you analyze this data? How do you analyze this data? What do you find out when you analyze this data?

#### Topic 5: Barriers

What are some things you wish you could do with your data that you cannot? Are there any challenges that you face when collecting this data, or analyzing this data? If you could collect more data, or more detailed (finer-grained) data, what would you collect?

Because of the limited timeline of this research, it may not be possible to interview enough subjects to gain a statistically significant profile of each user group. One way to address this would be to limit this research to one specific user group (e.g. only interview people who use the tool because they have diabetes and want to monitor their glucose levels). Because the goal of this research is to identify and respond to the needs of individual users, and to strengthen the weaknesses and failings of existing informatics tools, there is a danger in setting forth definitional criteria from an external perspective. It is important that the motivation and reasoning for the use of these systems be identified by users, and not by researchers. While it is possible to speculate on what user groups might exist (section 3.1), and to speculate about the issue-specific needs that these users might require in an informatics tool, it would be folly to claim with any degree of certainty that these speculations are exhaustive and correct. For that reason, this research will interview individuals from a generic collection of tool users, and aim to derive a possible model for categorizing users based on commonalities and cluster analysis. Further research could build upon the profiles of each specific group by increasing the number of interviews conducted.

A qualitative analysis of the interview responses will be performed throughout the entire interview process, and final observations will be set forth once the interviews are complete. This analysis will involve transcribing interviews, labeling interesting ideas, and creating affinity diagrams to identify common theme areas. This analysis process will be iterative as

more interviews are conducted. Users will be categorized based primarily on their motivation and reasoning for collecting the data, and what type of data they are collecting. Within each group of users, commonalities in usage problems will be identified, and recommendations will be made to address each of these problem areas for each user group. These recommendations will lead to design implications for personal informatics tools for these populations.

### 3.1 CURRENT ASSUMPTIONS

This study proposes that there are three or even four categories of users who use these tools. The first category represents those individuals who collect and make use of data for self-experimentation purposes. These individuals might be motivated by curiosity about the outcome of changing certain behaviours (e.g. an individual who alters his sleep schedule because he is curious about how this may alter his productivity), or they could be motivated by a desire for self-betterment (e.g. an individual who alters his eating and drinking habits to sleep better at night). The category is seen as ‘experimental’ because the user does not yet know the relationships between the variables being tracked and manipulated.

The second category, similar to the first in many respects, is comprised of individuals who set goals to improve aspects of their lives, such as people trying to lose weight by tracking their fitness levels and calorie intake, or people trying to save money by tracking their spending habits. These individuals use personal informatics tools for self-betterment, but are different from the self-experimenter group (category one) in that they are not experimenting with possible causes and variables for their goal – they are typically aiming to better themselves by achieving common and well-understood goals with known variables (e.g. it is common knowledge that weight loss can be achieved by increasing exercise levels and decreasing calorie intake. There is no need to experiment with different variables.)

The third category includes people for whom self-data collection directly impacts their health, such as diabetics who monitor their insulin levels, or epileptics who keep journals to monitor the circumstances under which seizures are triggered.

A possible fourth category involves people who are curious about their behaviour or keep track of data simply so they can refer to it at a later date if desired. An example would be people who keep track of past appointments or other scheduled events so they can look back and be reminded where they were on a certain date at a certain time. The purpose for their data collection is not to bring about a desired behaviour change or to track the relationship between two variables, but rather to have a bank of information available. At some point in the future this bank of information could be examined to derive patterns and apparent relationships between as-yet unidentified variables, and it could serve as a baseline for future behaviour change. Likewise, it could serve as a reference point of cumulative behaviour for individuals who might be attempting to complete a fairly elaborate behavioural series. An example might be people who keep an inventory of films they’ve watched as they randomly work their way through the IMDB Top 250 Movies-Of-All-Time list.

## 4. TIMELINE

Date	Task
January 9 – January 27	Initial brainstorming and literature review
January 17	Ethics tutorial completed
January 20	Outline of project proposal prepared
January 24	Draft project proposal prepared
January 27	Project proposal completed and submitted
January 30	Draft ethics proposal prepared
February 1	Ethics proposal completed, and submitted
February 1 – February 24	Refine concepts
February 24 – March 16	Interviews, Intermediate analysis
March 17 – March 23	Final Analysis
March 23	Outline of final paper prepared
March 30	Draft of final paper prepared
April 4	Final paper completed
April 4 – April 9	Preparation for final presentation
April 5	Submit final paper
April 9 – April 13	Final presentation

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