Self-Guiding Behavior Change using a Mobile App

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ABSTRACT
Based on the expanding usage of smartphones as the platform for computer applications, this paper addresses the information asymmetry between personal and factual observations that inform a decision-making process. The purpose of this paper is to propose a model to help self-guided behavioral change based on collection of personal information. A mobile application exemplifies self-guiding behavioral change through the collection of daily quantitative data and the retrieval of descriptive statistics during decision-making.

INTRODUCTION
The widespread use of the smartphone introduced a behavioral change in daily decision making. Many people use smartphones to store, retrieve, and search for information. Smartphones communicate with a variety of services over the internet, and the applications used create a plethora of metadata about how people use them (Azar 2003; van Velsen, 2013). The internet is a medium for widespread data distribution and collection, which has been proposed as a medium for behavioral interventions (Ritterband, 2009).
People's perspectives about the use of mobile applications to achieve health related behavior changes is understudied according to Dennison et al. (Dennison, 2013). Taking advantage of smartphones' growing computational power and mobility in order to self-guide behavioral changes, requires that the technology allows storage and retrieval of data in ways we deem helpful to decision making.
Kahneman and Tversky developed their *prospect theory* to analyze decision making by considering risks (Kahneman, 1979). The authors posit that expectations drive people's perspective in characterizing changes either as gain or as loss. People have different attitudes, each of which alters judgement differently. The difference between what we think is going on and what is actually going on is information asymmetry. The concept of *information asymmetry* is related to transactions between agents that possess different levels of information.
In the context of decision making, information asymmetry manifests as a lack of knowledge that alters the perception of the situation. People often address a lack of information with information from past experience if available. In other words, people link previously experienced prospects to similar prospects that are under consideration.
Hadar and Fox investigated how decisions differ based on whether described conditions have been experienced by the decision maker before or not (Hadar, 2009). The authors found that decision making outcomes based on descriptions of prospects that have been previously experienced will differ from decision making outcomes based on prospects that have not been previously experienced. Such divergence between decision making with and without prior experience is attributed to the information surplus on prospects due to having prior experience.
This paper is concerned with personal development from a self-guiding point of view. Self-guiding behavior depends on the readiness of a person to change habits, and self-perspectives about which changes are required for the desired outcome. Boyatzis and Akrivou discuss how perspectives of the ideal self, transform into visions of personal development (Boyatzis, 2006). However, having personal visions and even increased awareness of what are causes of personal problems are not enough to bring about change (Prochaska, 1992). Self-guiding behavior change needs to assess the prospects of the attempt to change in order to prepare for different stages of

changing behavior. Blanchard, Zigarmi and Nelson discuss the evolution of leadership theories and in particular the situational approach to leadership, which is relevant to self-guided personal development (Blanchard, 1993). The authors reflect on the changes between the first and second models of situational leadership. Specifically, the authors point out that the first situational leadership model categorized people in levels of "employee development" and the first level included people falsely assumed to be "unwilling and unable" to perform their work tasks. While in the revised (second) model of situational leadership, the first level of employee development includes people who are assumed to be "low in competence" and "have high commitment" (Blanchard, 1993, p. 27).

The current paper equates employee development with personal development. Behavior change is a process of both contemplation and action. Contemplation is necessary for the alteration of expectations and self-representations, while commitment is necessary to maintain action towards change.

The second personal development level is being competent but having low commitment. The current research suggests computing, here the use of an application on a smartphone (mobile) platform, enables people to collect self-data and compute descriptive statistics. However, such competence development is not possible without being committed to the development of such skills. This paper's proposed model labels the behavioral development from the first to the second personal development level as *computational competence development.*

The third personal development level is being highly competent and having variable commitment. People's experience alters their expectations and perspectives when considering previously experienced prospects. There is an information asymmetry between decision making with previously experienced and with novel prospects. This paper's proposed model labels the behavioral development from the second to the third personal development level as *experience development.*

The fourth personal development level is being highly competent and having high commitment. Maintaining a high level of behavioral commitment after having developed high computational competence depends on the expectations for, and perspectives on the goals at hand, which are moderated by prior experience. Simply, self-motivation empowers commitment. Motivation is an affective state driven by people's expectations and their different self-perspectives. Motivation manifests as behavioral repetition driven by commitment in a specific behavior. The proposed model labels the behavioral development from the third to the fourth personal development level as *behavioral commitment development.*

PROPOSED MODEL

Figure 1 depicts a model for self-guiding behavior change based on the development of computational competence. The proposed model is based on two hypotheses. The first is that prospect awareness and computational competence are positively correlated, and the second is that prior experience and information asymmetry between goal expectations and prospect awareness are negatively correlated.

People set goals based on their expectations and self-perspectives. People's experience alters expectations and self-perspectives; thus, the development of experience reduces the information asymmetry between the consideration of previously experienced prospects and novel prospects. The ability to collect self-behavioral data to inform expectations and self-perspectives addresses information asymmetries and discrepancies that regulate prospect awareness. Prospects are judged in order to make choices.

Decision-making in real-world situations is usually concerned with multiple objectives that may be conflicting with each other to various degrees. Moreover, rationality in decision-making is modulating based on situational and personal factors (Kahneman, 2003; Campitelli, 2010). The situational leadership theory was briefly discussed in combination with the principle of information asymmetry due to prior experience.

This paper proposes a computer-aided, via a mobile application, self-guiding behavioral change

model that follows the prescriptive analysis approach. Proposed design needs for a mobile application are described and to the most part implemented in a working prototype with the aim of conducting future empirical research with users of the application to inform design needs and collect feedback as well as feature requests.

PROPOSED MODEL

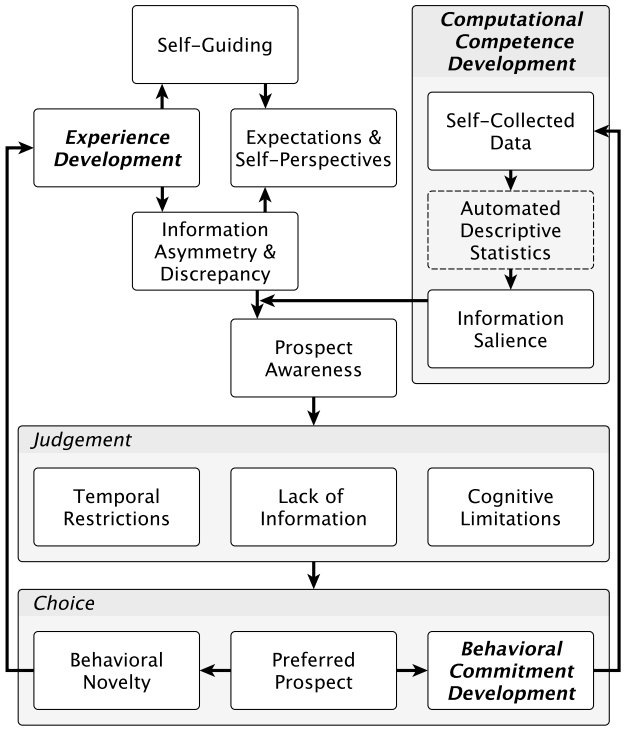

Fig 1. Self-Guiding Behavior Change Model.

Design Needs

- A taxonomy of data-labels that is editable by the user.
- The user can use a date picker to store or change a daily data value per label.
- The user can use a date picker to visit a view of descriptive statistics per month. The user is able to navigate in time and among the types of statistics.
- A list of different profiles allows for multiple user-profiles to be used for data collection.
- Encrypted data repository.
- No internet access needed.
- Import from and export to CSV data files.
- A list of different views allows the differentiation of the graphical user interface to enable different types of data collection (i.e., health, financial, household, etc.)

Design Limitations

- Only one value per day per data-label can be stored.
- Descriptive statistics are computed and presented per calendar month.

Design Implementation

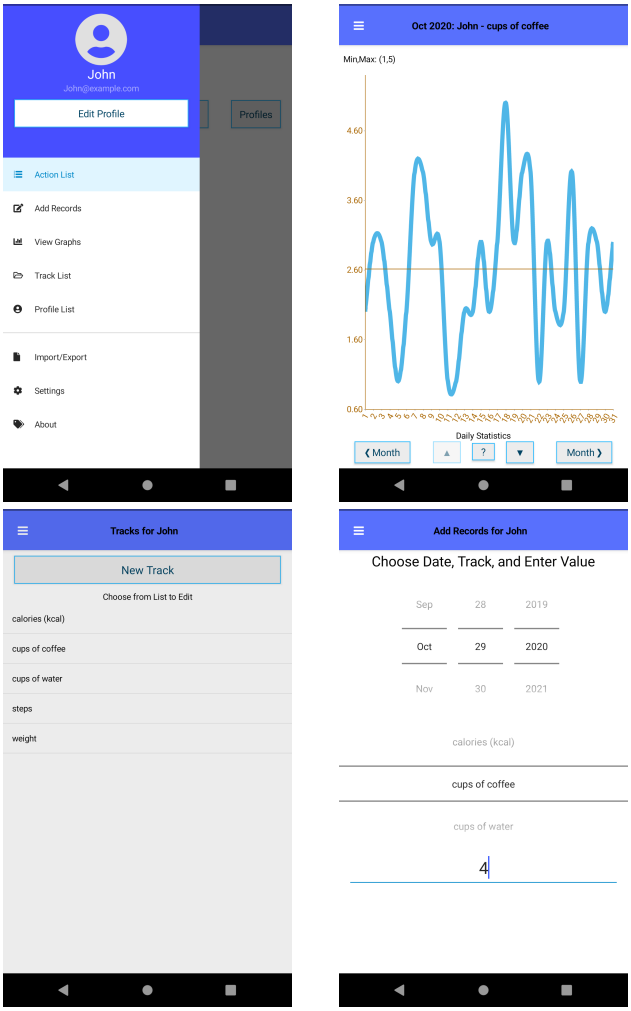

Fig 2. Example Screenshots of the User Interface.

Automated Descriptive Statistics

- Daily records: Each daily value per month.
- Difference from goal: The difference (%) of each daily value from a predefined goal value.

- Tendency: Smoothed out daily values per month.
- Difference from average: The difference of each daily value of the month from the month's average.
- Progressive average difference: The difference of each daily value from the average of daily values from the beginning of each month up to each daily value of the month.

DISCUSSION

Research Needs

After the development of the proposed application reaches the beta stage, then the collection of empirical data is needed to investigate how often users store and browse data, as well as their taxonomies of data-labels. Such empirical evidence will inform a human-centered approach to the design of the user interface so as to offer multiple views and alternative functionality tailored to different types of data collection.

Features Under Development

The current features under development include:
1) a machine learning algorithm based on naïve Bayes classifiers for active learning of data-label statistical salience, and
2) an alternative function that allows to record multiple datapoints per day and a statistical view that presents datapoints on a 24-hour chart.

Contribution

This paper contributes a self-guiding, computer-aided behavior change model to the literature of personal development by building on the construct of employee development in the theory of situational leadership, and on the construct of information asymmetry between decision-making of previously experienced and novel prospects.
To enable future research, a prototype mobile application was developed to allow for downloading and testing:
https://play.google.com/apps/testing/com.labsloft.healthtrack
An implication for the situational leadership theory is that employee development is essentially personal development. However, leaders ought to provide employees with necessary tools for the work tasks (developing competence), and place employees in roles that result in self-motivated work (developing commitment).

Conclusion

In conclusion, people can increase their cognitive abilities by using computers and software for data storage and analysis. However, free or low-cost tools tend to serve their developers' intention to collect data from people's use of their applications. Self-guiding behavioral change is possible when people are self-motivated to pursue change. However, self-collection of behavioral data can reveal discrepancies between self-representations of and actual behavior. The accuracy of factual information during decision making is critical to people's awareness of possible prospects, because misrepresentations of self-data obscure the consideration of possible solutions as well as the contemplation on the causes of problem.

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