Leefplezier: Personalized Well-being

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Abstract—Each person is different and should be treated as such. Comparing personal data to group averages can give basic ideas about personal conditions, but does not suffice for providing 'true' personalized feedback. In health psychology, a paradigm shift is taking place from a general population approach towards a more person-centered one. Instead of comparing a person with population averages, the focus shifts towards comparing people with themselves over time. The 'Leefplezier' project elaborates on this focus shift, by helping to sustain or improve the well-being of elderly people. The participating elderly people are asked to keep track of various psychological factors for a period of time, by means of repetitive questionnaires via a mobile phone application. At the end of this period, feedback is automatically generated, based on the resulting time series dataset and by means of automated vector autoregression.

I. INTRODUCTION

In the Netherlands, a large care group organization (Espria[1]) has initiated a project for assessing, improving and enhancing well-being of its elderly members and elderly people in general, by researching various factors influencing well-being. Limitations exist in the traditional group-based (*nomothetic*) method of conducting research, with regards to the flexibility and generalizability of such research. The alternative is to *personalize* research, by using a person-centered (*idiographic*) approach [1]. With the Leefplezier project, we aim to apply an idiographic approach and to assess and provide feedback for each individual in isolation, instead of focussing on the group of elderly as a whole. To do so, researchers from the *University Medical Center Groningen* (UMCG) and *University of Groningen* (RUG) cooperate with Espria to develop a system for measurement and analysis that provides meaningful and personal feedback. Since we intend to measure fluctuations of certain psychological, physiological and other factors over time, each participant should be measured multiple times per day, for several days in a row. The goal of each measurement is to quantify various psychological or physiological factors, which might influence well-being, together with the subjective well-being at that moment in time. The resulting temporal data contains well-being and factors that might influence it. This allows us to determine whether and how much certain factors influence fluctuations of well-being. In this project, we focus on novel and effective ways to analyze the collected data, and to provide the participants with insightful, personalized feedback about their well-being. To determine causal relations between well-being and its potential indicators, we generate feedback with automated vector autoregression (VAR), a statistical technique from the domain of time series analysis

[1]Website: http://www.espria.nl

in econometrics [2]. This feedback provides insight into the factors that influence well-being and might help to sustain or enhance well-being.

II. METHODOLOGY

The Leefplezier project is divided into two main phases: (i) gathering of general information, and (ii) capturing and analyzing experiences on a daily basis. In the first phase, we gather information about the target population. We develop a web application that allows participants to fill out a series of questionnaires that help us to derive general knowledge about and insight into the well-being of the participants from a cross sectional point of view, that is, from the point of view of the population sample. The selected questionnaires measure various psychological constructs, such as well-being, mood, anxiety, personality, depression, stress and various general demographic factors. For each questionnaire, the application provides feedback, including a comparison of the individual results to the group averages. This comparison aligns with the more traditional, nomothetic approach, viz., generating a population average and generalizing individuals to this average.

In the second phase, we capture and analyze personal experiences over time. Instead of considering the population as a whole, we analyze each individual participant in isolation. We use a technique for repeatedly conducting questionnaires with a method known as *Ecological Momentary Assessment* (EMA), a way to capture experiences on a daily basis as questionnaire data, known as a diary study [3]. These data enable for the creation of personalized statistical models representing the (causal) relationships between the participant's wellbeing and influencing factors, using an automated VAR modeling application known as *Autovar* [4], [5]. VAR models show, for one participant in isolation, how certain measured factors influence each other over time. For each participant a VAR model is generated based on their measurements. The strongest effects in the model are presented as feedback to the participant (e.g. 'An increase in factor α precedes a decrease in factor β'). To facilitate these measurements and provide such feedback we design and develop a mobile phone application.

III. INITIAL EVALUATION

The scientific contribution of this project can be summarized as finding novel ways to effectively and automatically analyze time-series data gathered using repetitive questionnaires, and to provide insightful and interactive feedback to the participants. Besides the automated feedback, intensive momentary assessments are only occasionally carried out on

a large scale, especially in combination with elderly people. To the best of our knowledge, our application will be the first to provide automated personalized feedback based on the application of VAR models to EMA data of elderly persons.

In December 2013, we started a pilot study for the Leefplezier project called *HowNutsAreTheDutch* (Dutch: HoeGekIsNL[2]) [6]. HowNutsAreTheDutch focusses on all people aged 18 or over in the Netherlands. The project design for HowNutsAreTheDutch is comparable to the Leefplezier project; it was built for the same two research phases and provides comparable functionality, albeit web-based (i.e., no actual mobile application was developed). This pilot study currently has 12,690 participants that have completed 61,773 questionnaires in the cross-sectional analysis (the first phase, recorded on November 25th, 2014). At the end of May 2014, we launched a diary study as the second phase of HowNutsAreTheDutch (the daily questionnaires), to which approximately 600 participants have subscribed (recorded on November 25th, 2014). Analysis of the data from phase one has yielded various interesting results. For instance, we measured that approximately 10% of the population suffers from severe depressive symptoms, but at the same time, 75% rate their happiness 6 out of 10, or higher (in fact, 25% rate it 8 out of 10, or higher). Furthermore, we observed large individual variation in positive and negative affect measured with the Dutch version of the Positive and Negative Affect Schedule (PANAS) [7]. Analysis on a subset of the HowNutsAreTheDutch participants ($n = 6895$) shows that participants with identical levels of negative affect varied substantially in their positive affect. The distribution of positive and negative affect of these participants is depicted in Figure 1. The gray level signifies the density of the participant distribution, ranging from light-gray (sparse) to black (dense). The dots in the image depict the measured combinations of positive and negative affect, the lines depict the average of positive (horizontal line) and negative affect (vertical line). This supports our approach in which we focus on individuals, rather than averages, because it would be unrealistic to come up with one generalized measure for all participants.

The first phase of the Leefplezier project started in May 2014. Currently 677 people have registered for the project (recorded on November 25th, 2014). At the end of January 2015, the second phase of the project will be launched.

IV. FUTURE WORK AND DISCUSSION

The Leefplezier project is still in its infancy. Although phase one has successfully been completed, the most important phase (phase 2) is yet to be started. During the pilot study, progress was made with regards to the data analysis, but it shall be interesting to see whether the general analysis tools will also work for our elderly population. The pilot study showed that nomothetic research would not be sufficient, because of the large variance between participants. Applying idiographic research would in this case be more suitable.

The next step is to refine the process and mobile application in such a way that most people will understand and feel comfortable working with the application. This is covered by a usability analysis. Furthermore, we will research and apply other techniques to analyze the data and perform simulations
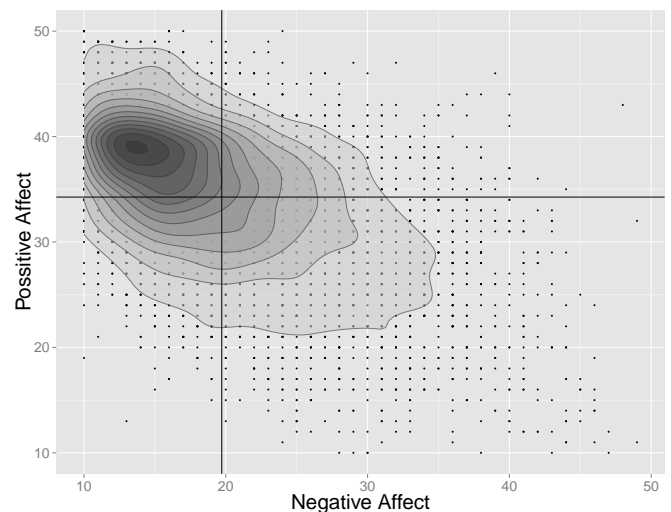

Fig. 1. Distribution of positive and negative affect in HowNutsAreTheDutch participants ($n = 6895$), measured using the PANAS questionnaire [7].

based on the established models. For instance, when a personal model has been determined, we could allow participants to virtually influence the factors in the model and simulate how these changes propagate through the model to the other factors. For example, if one would increase factor α at time step $t = 0$, what would happen to the other factors in the model at time step $t = 1..n$?

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