

A psychometric tool for longitudinal measurements of subjective well-being

1. Methods to study subjective well-being in daily life

In order to better understand subjective well-being and its dynamics, measurements should be taken on several occasions from many participants, resulting in so-called *intensive* longitudinal data (ILD; Walls & Schafer, 2006) on SWB changes over time. Collecting single self-reports from multiple individuals risks neglecting the intra-individual changes in SWB that occur from one moment to the next. Investigating intra-individual patterns can lead to a more high-level understanding of SWB dynamics and can prevent erroneous conclusions based on only looking at relationships on the population level (cross-sectionally; see Hamaker, 2012; Kievit, Frankenhuys, Waldorp, & Borsboom, 2013). Furthermore, measuring SWB at only a single time point invites the possibility that the results become biased by the current mood of the respondent (see, e.g., Schwarz & Strack, 1999). Stone, Schiffman, and De Vries (1999) argue that collecting multiple, immediate reports from people in their typical environment provides accurate data on experiences, while Kahneman (1999) also makes the case for experience sampling studies of good-bad evaluation over time for objectively measuring well-being.

SWB is best measured during everyday life. While laboratory experiments can exert strict control over nuisance variables, they also necessarily reduce the number of variables that affect behavior, so that the ecological validity of these experiments is limited. In contrast, field research (including field experiments) does not strive for strict control over all possible variables, but allows one to observe behavior in natural settings. We distinguish between two types of methods to collect self-reports in natural settings: *momentary assessments* and *retrospective surveys*. The first category includes the Experience Sampling Method¹ (ESM, Bolger, Davis, & Rafaeli, 2003; Csikszentmihalyi & Larson, 1987) which taps directly into people's ongoing everyday experience. This method strives to eliminate retrospective distortion and has been successfully applied to measuring affective experience and "flow" experience (the mental state of being completely immersed in an activity). Retrospective surveys on the other hand study an already cognitively structured, perceived experience. While the dynamical modeling approach that we plan to develop as part of the project (an n -dimensional process model, see later) is fit to analyze data coming from either setting, in this project we will focus on frequently administered retrospective surveys, as these are more appropriate for measuring the cognitive elements in which we are primarily interested.

The largest disadvantage commonly described in retrospective surveys is that these self-evaluations are heavily influenced by memory recall processes. While we agree that motivational and cognitive processes indeed alter momentary experience, we think of these phenomena as natural, integral parts of cognitive processing that should be taken into account when describing long-term dynamics of SWB. Therefore, our focus will be on the cognitive/evaluative elements,

¹ ESM falls into the larger category of Ecological Momentary Assessment (Stone & Shiffman, 1994) when physiological variables are also measured.

while we will also measure positive emotions. Also, our proposed data collection routines will be based on retrospective surveys. However, to render these surveys suitable for our goal of studying SWB dynamics, they will be administered to the participants at least once per day.

2. Elements of SWB: the PERMA model

When investigating the dynamics of SWB, we distinguish several requisite components; that is, we take a *construct* approach (Seligman, 2011) to describing SWB. We stipulate that SWB has a number of separable elements, none of them sufficient, but all necessary. Our model will allow for interplay between these components to reach a better understanding of what affects SWB and to explore and explain inter-individual differences in these aspects.

Our working model of SWB will be based on Seligman’s (2011) PERMA model. As the PERMA approach emphasizes on the eudaimonic elements, we depart from the typical definition of SWB that describes it in terms of positive and negative affect and satisfaction with life (Diener, 1999). Seligman’s model describes five dimensions of SWB, containing hedonic as well as eudaimonic aspects, providing a more complex perspective on what contributes to a “life worth living”. PERMA goes beyond the idea of understanding why people are happy *in the moment*, by aiming at empowering “human flourishing” *in the long term*. We will embed the PERMA model in a hierarchical Bayesian longitudinal process modeling framework, which itself will be sufficiently flexible to incorporate future updates to the componential structure of SWB. That is to say, while we will develop the formal modeling framework with PERMA as a principled substantive basis, the mathematical formulation will be general enough to be used for alternatively defined SWB dimensions.

The five elements of the PERMA model are: Positive emotions, Engagement, positive Relationships, Meaning and Accomplishment. As none of these elements individually operationalizes SWB, they should not be reduced to a single compound measure (see also Forgeard, Jayawickreme, Kern, & Seligman, 2011). In order to avoid such simplifications, visualization techniques of measures along the five dimensions simultaneously should be developed; an example of which can be seen in Figure 1.

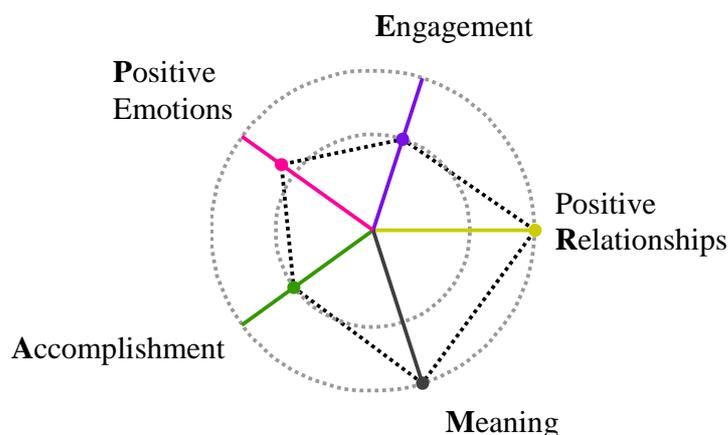


Figure 1. Visualization of the five elements of the PERMA model. Each radial represents one component of SWB. A pentagon touching the outer circle at each

vertex implies high scores on all dimensions. The irregular shape depicted above corresponds to a person profile with high scores of *Positive Relationship* and *Meaning* but a moderate-level balanced profile of *Positive Emotions*, *Engagement* and *Accomplishment*.

We will use the PERMA model (with some modifications) as a substantive basis for studying SWB. As we are interested in the underlying change mechanism in these elements and their dynamic interplay, we intend to assess each element longitudinally, over the time course of two months (see later, in section 3.5) with a longitudinal measurement tool that we develop and test. As the measurement instrument will be developed to measure well-being as a state in daily life studies, we will design items that are succinct. As sampling will be carried during participants' everyday routines using smartphone browsers, short items with concise content and a discretized response scale will mitigate the temporal and cognitive load put on the participants.

Here we briefly describe the PERMA elements and the corresponding existing questionnaires, while also listing some items as an example of the proposed longitudinal measurement tool. These items are still subject to further review and psychometric testing, which will be a significant component of the proposed project. Figure 2 shows a preliminary version of the online survey with some example items.

Positive emotions

Definition

Positive emotions refer to a cheerful mood, feelings of pleasantness in the moment.

Measurement instrument

We will measure positive emotions through an *Affect balance score* derived from SPANE (Diener, Wirtz, Tov, Kim-Prieto, Choi, Oishi, & Biswas-Diener, 2009). The instrument's instructions will be modified to fit the daily sampling routine.

Engagement

Definition

Engagement refers to the feeling of being absorbed in a challenging activity that is well matched to one's strengths.

Measurement instrument

We will construct a questionnaire based on the eight characteristic dimensions of the *flow* experience (Csikszentmihályi, 1993). Some example items are:

Please think about what you were doing in the last hour. Then please indicate how well the following sentences describe your activity:

- *I was concentrated on my activities*
- *It felt like time had stopped for me*

- *I was completely absorbed in my tasks*

Engagement will be operationalized as an aggregated measure of the reported scores.

Positive Relationships

Definition

Being in a *positive relationship* refers to having a balanced social life, frequently being in the company of people who care about you.

Measurement instrument

Many instruments relating to satisfaction with relationships exist (for overviews, see, e.g., Gottlieb & Bergen, 2010). However, we will depart from these and develop our own theory and instrument which center around cognitive evaluations of feeling loved. We elaborate on this dimension further in the *Cognitive evaluations of feeling loved* section below (Appendix B).

Meaning

Definition

This dimension represents serving or belonging to something larger than oneself (e.g., helping humanity, participating in religious or community activities, etc.).

Measurement instrument

Currently, there are only few instruments available to measure the construct of meaning. Our measure will be partly based on items from Steger, Frazier, Oishi, and Kaler's (2006) *Meaning in Life Questionnaire* ("presence of meaning" subscale). For example:

Please indicate how much you agree with the following statements:

- *My life has a clear sense of purpose*
- *I did things that served a higher goal*

Accomplishment

Definition

Accomplishment refers to achieving success in life for the sake of accomplishment alone.

Measurement instrument

To measure accomplishment, we will adapt items from existing instruments, including *Missing Dimensions of Poverty Competence module* (Samman, 2007) and NEF's *National Accounts of Well-Being* (Michaelson, Abdallah, Steuer, Thompson, & Marks, 2009). For

example:

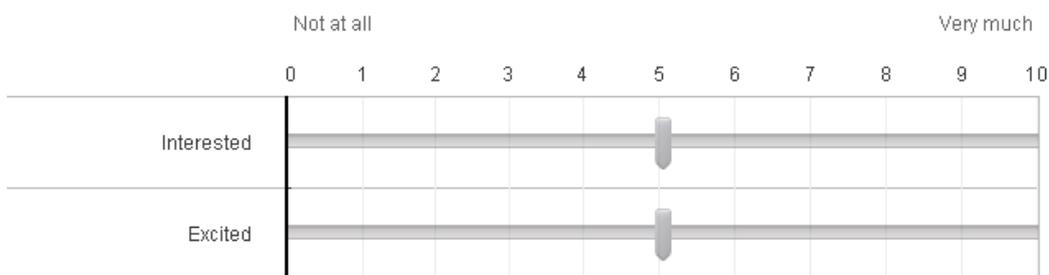
Please indicate how strongly the following statements describe you:

- *I felt really capable*
- *I made the right decisions*

3. Psychometric evaluation of longitudinal measures of SWB components

The first major undertaking of the proposed project involves a psychometric evaluation of the longitudinal SWB survey that we will develop. The new instruments will consist of short questionnaires that can be taken multiple times per day. We will assess the questionnaire's internal consistency, the joint stability of various items across time, as well as external consistency with established instruments. On the basis of these analyses (principal component analysis, item-test correlations, tests of internal consistency), we will fine-tune the questionnaires to arrive at a single, five-scale instrument that measures all components of SWB while putting minimal burden on the study participants.

Please indicate how much you feel:



Please think about what you were doing in the last hour. Then please indicate how well the following sentences describe your activity:

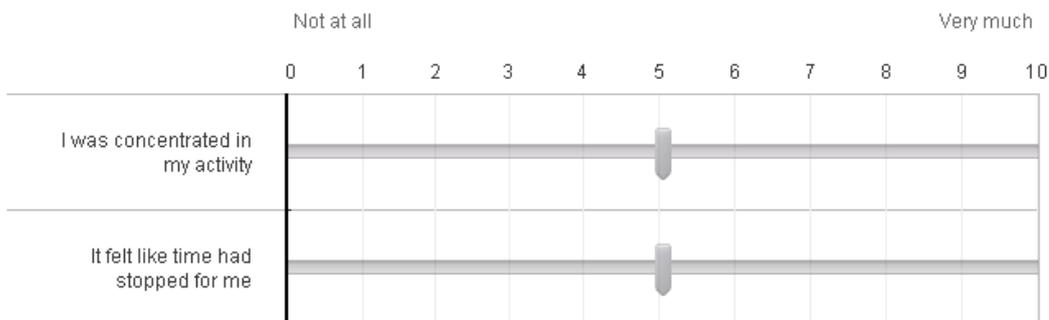


Figure 2. Screenshot of a preliminary version of the online survey to measure the dimensions of PERMA.

Internal consistency

Internal consistency is classically computed using Cronbach's α (Cronbach, 1951). Values greater than 0.7 are typically considered acceptable. In addition to α , we will use latent variable modeling such as exploratory factor analysis and principal component analysis (Bartholomew, Knott, & Moustaki, 2011) to assess convergent and discriminant validity of the various subscales that measure each SWB component. We will select items for inclusion in the SWB survey if they contribute to a scale's internal consistency.

External validity

As reviewed in Section 1.2, many of the PERMA components already have established measurement instruments. As part of our validation effort, we will compare participants' results on these established scales with our new scales.

Pilot longitudinal study

We will set up a pilot experience sampling study for two weeks to test the developed multicomponential PERMA instruments. We will measure the PERMA components twice each day, once around lunchtime and once in the evening. We will recruit 10 participants for the study, who will be given financial incentive to complete their participation.

To avoid attrition or large amounts of missing data, we will minimize the participants' workload by providing a convenient way to fill out surveys. Through a web-based experience sampling research tool for smartphones, such as Survey Signal (surveysignal.com) in combination with online survey providers (e.g., qualtrics.com), participants will be instructed to assess SWB items on their smartphones. Participants who do not own a smartphone will temporarily be provided with one by one of the participating research labs.

This will help us test and polish (1) the instructions/scripts for introductory session, (2) the experience sampling procedure, (3) the technical details of signaling and online access of questionnaire, (4) the structure of the feedback session, while also providing us with data on time-frames (recruitment, filling out questionnaires, etc.).

4. Summary of aims, expected output, and target audience of the first phase

The aim of the first phase is to develop a psychometrically sound measurement instrument that can be used to measure the five proposed components of SWB based on the PERMA model in longitudinal field studies.

The expected output of this phase has three parts. First, we will produce at least one academic paper on the psychometric properties of the SWB measures that we develop. Second, we will write a substantive paper with novel conclusions from the survey. Third, we will publish the exact details of our measurement instrument and protocol, and do so under a permissive license, allowing other researchers to use and adapt the methods freely (an "open-source" protocol).

The target audience of the academic papers consists of psychometricians and other academics with an interest in measurement and longitudinal data, and in particular in the unique advantages provided by the Bayesian statistical framework for the particular sparse-data/random effects

scenario that the ILD design will yield. The target audience of the substantive paper and the published measurement instrument also includes anyone with an interest in measuring SWB (ranging from emotion, personality and positive psychologists, to cultural anthropologists, industrial, governmental, or non-governmental agencies with an interest in measuring SWB among clients, workers, citizens, and so on).

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