# The Validation of Experience-Sampling Items for Self-Transcendental Experiences in Daily Life

Course: Master Thesis 1<sup>st</sup> supervisor: Dr. Matthijs L. Noordzij 2<sup>nd</sup> supervisor: Dr. Jannis T. Kraiss Student: Tim Gellings (2872897) University of Twente Faculty of Behavioural, Management and Social Sciences Date: 6.07.2022

#### Abstract

This study examined the psychometric qualities of newly developed experience-sampling method (ESM) items on the constructs of flow, awe, and mystical experiences. Until now, these self-transcendental experiences (STE's) have mostly been investigated using retrospective self-reports or within laboratory confines. No psychometric ESM research has been conducted in the field of STE's. A semi-random sampling schema was employed on 31 participants over the course of two weeks for five times per day. The findings revealed that participants reported to have an average of 16.39 on flow, 10.89 on awe, and 6.15 on mystical experience in daily life, with a substantial amount (67% to 68%) explained by within-person variance. This daily life fluctuation indicates that STE's are worthwhile to explore using ESM. Furthermore, the findings showed a high internal consistency and a low convergent validity with classical retrospective trait questionnaires. The former shows the strength of the present items to accurately capture STE's over time, and the latter shows that ESM might investigate a different construct than classical cross-sectional research. Limitations and ideas how the newly developed items can be used for research are discussed.

Keywords: Flow, Awe, Mystical-Experience, Self-Transcendental Experience, Experience-Sampling Methodology, Validity, Reliability

## The Validation of Experience-Sampling Items for Self-Transcendental Experiences in Daily Life

"Suddenly the room lit up with a great white light. I was caught up into an ecstasy which there are no words to describe. (...) I lay on the bed, but now for a time I was in another world, a new world of consciousness. All about me and through me there was a wonderful feeling of Presence, and I thought to myself, 'So this is the God of the preachers!'" (Kurtz, 1991, p. 19-20). Self-transcendental experiences (STE's) are states in which individuals move away from self-identity and self-centeredness to highly augmented levels of absorption and connectedness (Yaden et al., 2017). The most prominent and researched STE's proposed by Yaden and colleagues (2017) were mystical experiences (Johnson et al., 2019), awe (Chirico & Yaden, 2018), and flow (Nakamura & Csikszentmihalyi, 2014). These STE's may elicit "quantum changes" in individuals, which are immediately arising and long-lasting transformations in behaviors, cognitions, and emotions (Miller & Baca, 2001). However, little is known about STE's in daily life. Despite the remarkable life-changing potential of such experiences, so far, research was mostly limited to retrospective self-reports (RSR's). These RSR's have been shown to have various biases and lower ecological validity than the realtime assessment of data (Schwarz et al., 2009). Therefore, the present study aims at developing and piloting real-time assessment items to optimally investigate the patterns of flow, awe, and mystical experiences in daily life.

Yaden et al., (2017) provided extensive definitions for flow, awe, and mystical experiences and showed that they are different constructs (see Yaden et al., 2017 for an extensive review). Flow has been defined as the absorption in an activity which is both interesting and fully demanding of the experiencer's skills, which is characterized by a reduced sense of self and is often described as being a rewarding and enjoyable experience (Csikszentmihalyi, 1991). Awe was proposed as a positive emotion based on two factors: The perception of vastness and the need for accommodation (Keldner & Haidt, 2003). Vastness refers to the perception to of something larger than one's frame of reference, possibly due to physical size or perceived social status (Keldner & Haidt, 2003). Accommodation refers to the need to modify current mental structures, following the inability to reconcile an experiences of vastness with one's current understanding of the world. Mystical experiences were described as experiences of complete loss of the self, often accompanied by a deep sense of unity and love (Hood, 2002).

Classically, research on flow, awe, and mystical experiences has been mostly conducted cross-sectionally and within laboratory settings. Generally, mystical experiences are investigated in the laboratory using psychedelics such as LSD or Psilocybin (Johnson et al., 2019), making use of placebo brain stimulation by placing a "god helmet" on a subject's head (Maij & van Elk, 2018), or examining subjects after a meditation retreat (Russ & Elliott, 2017). All the outcomes are generally examined using RSR's. Similarly, awe has mainly been investigated within laboratory in which awe was elicited using videos or virtual reality (Chirico et al., 2017), or cross-sectionally using RSR's (Büssing et al., 2018). Again, the outcomes were examined using RSR's. Although flow has also mostly been investigated cross-sectionally making use of RSR's (Marsh & Jackson, 1999), the founder of flow, Csikszentmihalyi, argued intensively for the importance of capturing momentary experiences of flow in daily life (Csikszentmihalyi & Hunter, 2014). The reason for this is that it provides more experiential accounts of individuals that may differ compared to classical RSR's studies (Csikszentmihalyi & Hunter, 2014). This type of collecting data in the real world does not only improve the ecological validity of the results and reduces recall biases, but it can also be used to assess the context in which investigated phenomena occur (Myin-Germeys et al., 2009). Taken together, while the research on STE's such as flow, awe, and mystical experiences are mostly confined to cross-sectional and laboratory research, scientists have recognized the importance to investigate phenomena with the help of daily life assessments.

The main reason for this shift to momentary experiences in daily life stems from the qualitatively different sense of self that is captured by this approach – the experiencing-self (Kahneman & Riis, 2005). Compared to the traditional approach of STE research making use of RSR's and investigating the so-called remembering-self, the experiencing-self does not rely on a memory-based format in which past experiences are aggregated over a long-time period (Conner & Barrett, 2012). In contrast, the experiencing-self is investigated using methods such as the experience-sampling method (ESM), capturing individual's behaviors, thoughts, and feeling as they occur in real time (Myin-Germeys & Kuppens, 2021). This real-time assessment of the experiencing-self obtains more accurate accounts of how experiences and behaviors unfold over time, compared to the aggregated account of the remembering-self (Schwarz, 2012). In line with this, a substantial amount of evidence shows that RSR's can be confounded by current affect, availability, salience, implicit theories, priming, and memory defects (see Schwarz et al., 2009 for an extensive overview). For instance, it has been found that the coping styles that people generally report show small resemblances to the styles they engage in when assessed in real-time (Schwarz et al., 1999). Furthermore, research on

smoking cessation demonstrated that individuals have poor abilities to recall their proper quit dates and they overestimate their quitting distress compared to what they report using realtime assessments (Shiffman et al., 1997). The same overestimation tendency of the remembering-self has been demonstrated in affective research, showing that people report more positive and negative emotions compared to ESM real-time assessments (Miron-Shatz et al., 2009). Thus, depending on which self is approached the acquired information and the approached construct may differ considerably.

Considering the strong emphasis of STE research (flow, awe, and mystical experiences) on the remembering-self, a paradigm shift towards the real-time assessment of the experiencing-self is of crucial importance (Csikszentmihalyi & Hunter, 2014). This shift may provide considerable different insights into the nature of STE's. However, little is known about the daily life prevalence of STE's in daily life. Regarding flow, only a few ESM studies on flow reported the actual percentage of flow incidences. They indicate that flow occurs considerably in daily life. A study on students showed that from 1846 valid observations, 24.1% of the observations were spent in flow (Haworth & Evans, 1995), while a study on nurses showed that from 497 prompts, 11.5% of the observations were spent in flow (Bringsén et al., 2011). Regarding awe, only one study investigated the incidence of awe in daily life within students (Koh et al., 2017). They showed that out of 569 total ESM observations awe was experienced 57.29% of the times. Regarding mystical experiences, a survey by the PEW Research Center (2009) showed that about half of the U.S. public had a mystical experience in their life defined as "moment of sudden religious insight or awakening." Moreover, a recent cross-sectional study by Gellings and colleagues (2022) showed that normal people reported on average 0.37 mystical experiences, 2.00 states of awe, and 2.46 flow states in daily life in the last four weeks. These are promising findings into mystical experiences in daily life, as they show that this phenomenon indeed occurs in daily life. However, the presented research was limited to the remembering-self. They did not take into consideration the experiencing-self investigated with the ESM. Taken together, there is preliminary evidence that people regularly have the experience of flow and awe in daily life, while research on mystical experiences in daily life is confined to the remembering-self.

Despite the potential novel insights gained by the ESM on the experiencing-self, research in this field is often not validated. Most studies develop new measurements that do not make any use of prior validation or solely adapt preexisting RSR's. However, it is of crucial importance to apply the same rigor on the development of validated ESM measures than it has been done on classical RSR's. This validation becomes even more important when considering the necessity for time efficiency, reduced participant burden, and compliance within ESM research (Myin-Germeys & Kuppens, 2021). Until now, only a few studies reported psychometric validation of ESM measures limited to the field of clinical psychology on constructs such as anxiety, anger, PTSD, and dissociation (e.g., Borah et al., 2018; Carlson et al., 2015; Edmondson et al., 2013). In these studies, convergent validity was investigated by correlating the ESM items with their corresponding RSR. These correlations vary considerable between the investigated constructs, ranging from no to medium strength associations. This implies that despite the same construct is approached, ESM measures often assess a different construct than classical RSR's. Internal consistency reliability was investigated by either making use of multilevel modeling in the case where several items were used for one construct, or by calculating the relationship between different observations in time, such as odd and even timepoints (Csikszentmihalyi & Larson, 2014). Another important indicator of validity and reliability is compliance, which is the ratio of completed ESM prompts divided by the maximum amount of ESM prompts (Vachon et al., 2019). This percentages relates inversely to the occasions a participant missed a prompt and varies on average between 70% and 80% (Myin-Germeys & Kuppens, 2021). If this missingness is high, it can undermine the validity, because the data might not accurately represent the phenomenon of interest anymore. A last psychometric consideration that is more frequently done in ESM research is the disentanglement of between-subject and within-subject variance. This is due to the reason that a large proportion of variance should be attributed to withinperson variance instead of between-person variance to make ESM research on the construct of interest meaningful. This is because the within-subject variance is based on the daily life fluctuations within individuals, while the between-subject variance is based on stable individual differences (Myin-Germeys & Kuppens, 2021). The intraclass correlation coefficient (ICC) indicates the proportion of these two variances (Bolger & Laurenceau, 2013). It reflects the between-person variance divided by the total variance (between-subject variance + within-subject variance). According to Bolger and Laurenceau (2013), ideally ESM measurements should have an ICC between .2 and .4, which would mean that 80% to 60% can be explained by within-subject variances. Thus, validated ESM research is scarce but several psychometric methodologies have been formulated.

Despite some promising psychometric studies on ESM, no ESM research on the psychometric quality of STE's (flow, awe, and mystical experiences) has been published, to the best of our knowledge. First, ESM studies on flow in daily life make use of ESM items, which are adapted trait measurements of flow without any validation and reliability considerations (e.g., Fullagar & Kelloway, 2009; Sumaya & Darling, 2018). These studies missed out on the general psychometric scrutiny that is employed within classical RSR's research. They did not investigate the convergent validity, internal consistency reliability, and compliance. Second, only one study investigated awe making use of ESM (Koh et al., 2017). Again, no psychometric considerations were employed and the compliance was not reported. The researchers operationalized the awe item solely by asking participants to what degree they experienced awe, without any description of what awe might entail. Hence, they did not make use of an adapted trait or state measurements of awe. Lastly, no study investigated mystical experiences making use of ESM. Taken together, there is a clear lack of validated STE ESM measures.

Therefore, the present research has the goal to develop and pilot validated ESM measures to assess flow, awe, and mystical experiences in daily life. More insight into STE's in daily life is of high societal relevance, as STE's have been shown to be transformative in cognition, emotion, and behavior (Garcia-Romeu & Richards, 2018; Luoma et al., 2020). Validated ESM measures could be used in various ways. First, validated ESM measures could be applied to measure STE's after laboratory interventions, to receive a better grasp of changes in daily life. Second, discovering the daily life patterns of STE's outside the laboratory confines might provide information on the personal and environmental context that elicits certain STE's. A reason for this is the higher ecological validity that ESM offers, since it considers the natural everyday environment of participants (Myin-Germeys & Kuppens, 2021). Third, insights on STE preconditions could be collected and used to develop new interventions that could increase the prevalence of STE's in daily life. Examples could be the integration of insights into just-in-time adaptive interventions (JITAI's) or neurofeedback trainings to elicit STE's. The former are interventions evoked at the right moment to provide an individual with the proper support (Wang & Miller, 2019). The latter enables individuals to practice the activation of certain brain areas via sensory feedback channels (Sitaram et al., 2016). Lastly, the insights collected via ESM on STE's could be used to improve the effectivity of psychedelic therapy (Garcia-Romeu & Richards, 2018; Luoma et al., 2020). Thus, validated STE measures may contribute to the development of promising insights, interventions, and therapies.

To accomplish the goal of developing validated ESM measures for STE's in daily life, the present pilot-study proposed the following exploratory research questions: (RQ1) What are the incidences and intensities of flow, awe, and mystical experiences in daily life? (RQ2) What are the between and within subject variances of flow, awe, and mystical experiences? (RQ3) What is the internal consistency reliability of the flow, awe, and mystical experience ESM observations? (RQ4) What is the convergent validity of flow, awe, and mystical experience ESM items?

## Methodology

## **Ethics statement**

The present study was executed with the understanding and written consent of each participant. Moreover, it was approved by the BMS Ethics Committee.

## **Participants**

Participants were recruited by distributing the survey through social media using the smartphone application called WhatsApp. Through the application, several groups were contacted (psychology, business, and philosophy student groups). In total, 38 participants took part in the present study. In consideration of some complications during data collection (e.g., application malfunctioning, operator error, machine damage, etc.) which led to none of the participants reaching the maximum number of observations within the dataset (max = 69) we decided to be more lenient with the data exclusions. These technical issues might occur when collecting intensive longitudinal data with many data observations (e.g., Emery & Simons, 2020). Initially, we aimed at removing participants with less than a third of valid observations (23 observations). However, that would have been 11 participants, which would have been close to the cut-off point of 23 valid observations (e.g., 22, 21). Hence, we decided to adapt the rule to one fifth of valid observations in order to not remove meaningful participant data, as the rule has been argued to be rather arbitrary, since mixed models employed for most ESM research will account for missing data (Myin-Germeys & Kuppens, 2021). Hence, 5 participants with less than one fifth valid observation (15) were excluded. The final sample consisted out of 31 participants (n = 13 Men, n = 16 Women, n = 1 non-Binary, n = 1 unknown) with an average mean of 25 years (SD = 6.22). Their levels of education were High School (n = 14), Bachelor (n = 14), other (n = 2), and unknown (n = 1). The nationality of the participants was as follows: 76.7% German, 16.7% Dutch, and 6.7% other. As an additional incentive to combat attrition, participants were given the opportunity to enter a lottery and win 50 $\in$  when they answered more than 50% of the prompts.

In ESM studies power analysis is a complex and yet unsolved problem (Myin-Germeys & Kuppens, 2021). Hence, we aimed to have more than 30 participants in order to be considerably above the medium number (19) of other ESM studies (Van Berkel et al., 2017).

## Materials

For the classical RSR's (time-invariant), the following three instruments were chosen. First, an individual's disposition to experience flow was assessed with the Swedish Flow Proneness Questionnaire (Ullén et al., 2012). The SFPQ has three sub-scales (work, leisure, household) with 7 items. It examines an individual's proneness for flow in daily activities such as work or leisure activities. An example item would be: "When you do something at work, how often does it happen that you feel completely concentrated?". Items are answered on a five-point Likert scale ranging from never (1) to every day (5). The mean score was derived for the overall scale, with a higher score indicating a higher level of an individual's flow proneness. Cronbach's  $\alpha$  has been observed to be .83 (Ullén et al., 2012). Within the present study, Cronbach's  $\alpha$  was .82.

Second, an individual's disposition to experience awe was measured by the Dispositional Awe Scale (Shiota et al., 2006). The DAS is a 5-item survey designed to measure an individual's disposition to feel awe in daily life. An example item would be: "I see beauty all around me". All items are rated on a 7-point Likert scale ranging from "does not describe me at all" (1) to "describes me very well" (7), with higher scores indicating a higher level of dispositional awe. Cronbach's  $\alpha$  has been demonstrated to be .80 (Shiota et al., 2006). Within the present study, Cronbach's  $\alpha$  was .49, which is very low. It will be elaborated on this in the discussion section.

Third, an individual's disposition to have a mystical experience was measured with the Nondual Awareness Dimensional Assessment-Trait (Hanley et al., 2018). The NADA-T has 12 items with two dimensions: Self-Transcendence and Bliss. An example item would be "I have experienced the insight that *'all is One*". Items are answered on a five-point Likert scale ranging from never (1) to very often (5). Cronbach's  $\alpha$  has been demonstrated to be .94 for self-transcendence and .81 for bliss (Hanley et al., 2018). Within the present study, Cronbach's  $\alpha$  was .93 for self-transcendence and .83 for bliss.

To investigate flow, awe, and mystical experience with the ESM method, we developed new items suited to experience sampling. Specifically, we aimed at developing items which are related to their respective RSR's, but also have explanatory power for new insights. Next to a high convergent validity and internal consistency reliability, we aimed at a low participant burden by creating items that are as short as possible to answer. Kimhy and colleagues (2012) to showed that three minutes was good timeframe. However, the objective of the present study was to be was to be considerably below this time, taking approximately 30 seconds after an individual knows the survey. Such a short duration does not only enhance the compliance (Vachon et al., 2019), but also provides future researchers the space and time to add exploratory questions to the questionnaire. The last objective was to create similarly structured and consistent STE items to avoid possible confusion on the participant side. The items were based on the items used in the investigation done by Gellings and colleagues (2022). Within this investigation, the authors developed a questionnaire describing the phenomenological experience of flow, awe, and mystical experiences based on various collected definitions and questionnaires. In addition, they added features of the respective STE to support participants understanding of the state. This approach was chosen, since solely adapting already established RSR's does not necessarily work for investigating the experiencing-self (Borah et al., 2018). Moreover, Myin-Germeys and Kuppens (2021) argued that meaningful ESM items should contain state-like features related to the present moment of the individual being assessed. Therefore, participants were presented with a definition and a list of features for flow, awe, and mystical experiences one at a time. While Gellings and colleagues asked participants about STE's in the last four weeks, we adapted the question to "Have you had this experience since the last two hours?". When they indicate yes, they are asked "How intense was this experience", ranging from "not at all intense (1) to "extremely intense" (5). The definitions used for the present study can be found in Appendix A.

## Procedure

After participants provided informed consent and read the instructions of the study, they were asked to download the Ethica app (https://ethicadata.com) and enter the study ID to start with data collection. Within the app, they were first asked to fill in the time invariant questionnaires, as well as basic demographic questions. The next day, data collection of the ESM items started. Participants received a semi-random interval schema for two weeks, starting at a random time between 9-10, 12-13, 15-16, 18-19, 21-22. This interval schema was chosen as it shows a higher ecological validity than a fixed schema, and lower participant burden than a complete random schema (Myin-Germeys & Kuppens, 2021). Considering a low participant burden, a medium density of 5 prompts per day was chosen to increase the compliance, as suggested by Eisele and colleagues (2020). After a semi-random prompt was activated, participants had a up to 30 minutes to answer the prompt, as it has been executed in most other ESM studies (Scollon et al., 2009). After the study, a post-hoc qualitative analysis

on the experience of the study with several participants was conducted. In the end, participants acquired via WhatsApp who answered more than 50% of the prompts were invited for the lottery to win 50 euros.

## **Data Analysis**

First, the raw data was downloaded from Ethica. Then, the data was structured using Microsoft Excel 2019 (<u>https://office.microsoft.com/excel</u>). The statistical program that was used to conduct all further steps was SPSS Statistics 27 (IBM Corp., 2019). First, the demographics, answered prompts, and compliance were analyzed.

Following this, Shapiro-Wilk tests for the intensity of flow W(72) = .87, p < .001, awe W(72) = .88, p < .001, and mystical experience W(72) = .89, p < .001 revealed not-normally distributed data. Similarly, the incidences of flow, awe, and mystical experiences were not normally distributed, due to being binary data (yes or no). Hence, further analyses on the data needed to consider non-normality.

To answer RQ1 and RQ2, within subject outliers were detected on the intensity of flow (=7), awe (=10), and mystical experiences (=2) outside a 95% confidence interval from the mean. These outliers had the tendency to be too low as opposed to too high. This indicated that were the outliers to be excluded, the intensities would have slightly increased. No between subject outliers for the intensities were identified. In regards to the incidences, no within subject outliers were detected, due to being count data and only having two answer options. The between subject outliers for the incidences were zero for flow, two for awe (39 and 43; while the cutoff point was 31), and two for mystical experiences (33 and 22; while the cutoff point was 15). Despite several outliers, we decided to include all data for the analyses, since the degree of incidences or intensities might be part of the varying subjective nature of such states (Gellings et al., 2022). Moreover, this varying nature fulfills the nature of ES (Myin-Germeys & Kuppens, 2021). A similar approach has been employed by Gellings and colleagues (2022) for their cross-sectional study on STE, in which they purposefully included all outliers based on the varying subjective nature of STE's. Certain individuals might have a higher propensity for these states as others. Furthermore, since the incidences were binary in nature, they were transformed into a continuous variable to ease further analyses. Thus, the chance to experience the respective STE was calculated by dividing the number of yes by the total amount of answered observations. After this, descriptive statistics were derived. Moreover, to calculate the ICC for RQ2 the within-subject and between subject variance needed to be determined. The within-subject variance was determined by taking the average

variance for each participants STE incidence and intensity. The between-subject variance was determined by taking the variance for each participants average STE incidence and intensity. Lastly, data was visualized using boxplots and line graphs

To answer RQ3 and calculate the individual response consistency, each participants mean and standard deviation for odd and even observations was derived. Since we needed to conduct 24 Shapiro-Wilk tests to check for normality of this data, we decided to apply a Bonferroni correction to reduce the possibility of false positives (Napierala, 2012). This meant that the p-value must be below .002 in order to reject the null hypothesis. No test indicated a significant value and thus the means and standard deviations were normally distributed. Consequently, Pearson correlations between the even and odd means and standard deviations were conducted.

To answer RQ4 and calculate the convergent validity, we checked the reliability of the cross-sectional questionnaires using Cronbach's  $\alpha$ . For several measures Cronbach's  $\alpha$  was not acceptable or minimally acceptable (Cortina, 1993). Hence, we decided to remove items in the attempt to increase overall Cronbach's  $\alpha$ . The flow proneness scale (SFPQ) yielded a Cronbach's  $\alpha$  of .69. Four items required deletion to achieve a reliability of .82. The dispositional awe scale (DAS-5) yielded Cronbach's  $\alpha$  of .46. One item had to be deleted to yield the highest reliability of .49. The nondualism trait scale (NADA-T) yielded on the self-transcendence dimension a Cronbach's  $\alpha$  of .93 and on the bliss dimension a Cronbach's  $\alpha$  of .69. No item required deletion to yield the highest reliability of scale the highest reliability of .83. Following this, the means of the questionnaires were calculated. The relationship of these means with the incidences and intensities of STE' were then examined using Pearson correlations, because the data was normally-distributed.

### Results

## *RQ1: What are the incidences and intensities of flow, awe, and mystical experiences in daily life?*

Based on the 31 participants, a total amount of 2058 experience sampling prompts have been collected during a period of two-weeks. This yielded a mean of 38.19 (SD = 12) answered prompts per participant. Moreover, the average compliance for each participant was .57 (SD = 17.3), calculated by dividing the number of valid prompts by the total amount of prompts. The average duration to answer a prompt was 14.64 seconds (SD = 17.42).

Out of 1188 answered flow prompts, n = 508 (42.76 %) indicated the experience of flow in the last two hours, and n = 680 (57.24%) indicated to not experience flow in the last two hours. Out of 1189 answered awe prompts, n = 305 (25.65%) indicated the experience of awe in the last two hours, and n = 884 (74.35%) indicated to not experience awe in the last two hours. Out of 1188 answered mystical experience prompts, n = 123 (10.35%) indicated a mystical experience in the last two hours, and n = 1065 (89.65%) indicated to not experience a mystical experience in the last two hours.

Descriptive statistics revealed that during the two-weeks study period 31 participants experienced on average 16.39 flow (SD = 12.86) with an average intensity of 3.06 (SD = .67), 28 participants experienced on average 10.89 awe (SD = 11.92) with an average intensity of 2.89 (SD = .76), and 20 participants had on average 6.15 mystical experiences (SD = 8.51) with an average intensity of 2.65 (SD = .97).

## *RQ2:* What are the between and within subject variances of flow, awe, and mystical experiences?

The between and within subject variances of STE incidence and intensity are presented in Table 1.

## Table 1

Dependent Variable	BS-Variance	WS-Variance	ICC
Flow Incidence	.08	.17	.32
Flow Intensity	.45	.58	.44
Awe Incidence	.06	.12	.33
Awe Intensity	.58	.79	.42
Mystical Experience	.03	.06	.33
Incidence			
Mystical Experience			
Intensity	.93	.59	.61

Summary of between and within subject variances

*Note.* BS=Between Subject; WS= Within Subject; ICC=Intraclass Correlation Coefficient.

The ICC for flow incidence was .32, indicating that 68% of the variance can be attributed to within-subject variation, while the ICC for flow intensity was .44, indicating that 56% of the variance can be attributed to within-subject variation. The ICC for awe incidence was .33, indicating that 67% of the variance can be attributed to within-subject variation, while the ICC for awe intensity was .42, indicating that 58% of the variance can be attributed to within-subject variation. The ICC for mystical experience incidence was .33, indicating that 67% of the variance can be attributed to within-subject variation. The ICC for mystical experience incidence was .33, indicating that 67% of the variance can be attributed to within-subject variation, while the ICC for mystical experience incidence was .33, indicating that 67% of the variance can be attributed to within-subject variation. The ICC for mystical experience incidence was .33, indicating that 67% of the variance can be attributed to within-subject variation. These results suggest that 39% of the variance can be attributed to within-subject variation. These results suggest that the STE incidences and intensities vary considerable between observations. Further evidence for the consistency of STE intensities can be derived from the boxplots in Figure 1. They depict the within and between subject variance.

## Figure 1







*Note.* Participants with a median bar without upper and lower quartiles only indicated a single value on the intensity of the respective STE. It can be seen that flow has the lowest amount (4) of individuals with only one single STE value, followed by awe (6) and mystical experience (10). Thus, these individuals show no within subject variance.

In order to make the ESM data on the incidences and intensities of STE's more palpable, we created example line graphs for an individual with a high flow incidence (38) and intensity (M = 3.69), and an individual with a lower flow incidence (17) and intensity (M = 1.48) across all observations of the study period (see Figure 2). These line graphs depict that there is a

considerable within and between subject difference on flow incidence and intensity between the two subjects.

## Figure 2

Line graphs on flow incidence and flow intensity over the course of the whole study period.



Note. For the flow incidence: 1 means flow occurrence and 2 means no flow occurrence.

## RQ3: What is the internal consistency reliability between the odd and even observations?

Pearson correlations revealed significant positive correlations between the odd and even observation means of flow incidence, r(31) = .87, p < .01, flow intensity, r(29) = .83, p < .01, awe incidence, r(31) = .88, p < .01, awe intensity, r(31) = .47, p = .03, mystical experience incidence, r(22) = .85, p < .01, and mystical experience intensity, r(11) = .82, p < .01. Moreover, Pearson correlations revealed significant positive correlations between the odd and even observation SD of flow incidence, r(31) = .61, p < .01, awe incidence, r(31) = .46, p = .01, mystical experience incidence, r(31) = .72, p < .01. The correlation between even and odd SD of flow intensity, r(26) = .22, p = .29, awe intensity, r(15) = .13, p = .65, and mystical experience intensity, r(7) = .2, p = .67, were non-significant.

## RQ4: What is the convergent validity of the flow, awe, and mystical experience item?

Pearson correlations were derived between STE incidences, intensities, and the classical trait RSR's. Their significance levels can be found in Table 2.

## Table 2

Variable	п	1	2	3	4	5	6	7	8	9	10
1. Flow	31										
Incidence											
2. Flow Intensity	31	.5**									
3. Awe Incidence	28	.75**	.37*								
4. Awe Intensity	28	.28	.76**	.31	_						
5. Mystical	20	.39*	25	.41*	.04						
Experience											
Incidence											
6. Mystical	20	.40	.62**	.4	.54*	.2					
Experience											
Intensity											
7. SFPQ	30	.31	.28	.2	.21	.06	.07				
8. DAS-5	30	.31	.29	.4*	.03	.4*	.04	.26			
9. NADA-T1	30	.33	.32	.3	.2	.21	.49*	.04	.61**	_	
10. NADA-T2	30	.05	.36	.04	.26	.14	.27	.06	.25	.5**	

Pearson Correlations for STE incidences, intensities and classical trait RSR's.

Note. \*\*p < .05. \*\*p < .01; T1=Self-Transcendence dimension, T2=Bliss dimension

The correlations showed that flow incidence was significantly correlated with flow intensity, awe incidence, and mystical experience incidence. Flow intensity was significantly related to awe incidence, awe intensity, and mystical experience intensity. Awe incidence was significantly related to mystical experience incidence and the DAS-5. Awe intensity was significantly related to mystical experience intensity. Mystical experience incidence was significantly related to the DAS-5. Mystical experience intensity was significantly related to the DAS-5. Mystical experience intensity was significantly related to the DAS-5. Mystical experience intensity was significantly related to the NADA-T self-transcendence dimension. The DAS-5 was significantly related to the NADA-T self-transcendence dimension. Lastly, the NADA-T self-transcendence was significantly related to the NADA-T bliss dimension. Taken together, the incidences significantly correlated with each other, the incidence of awe and mystical experience (indicating that a similar construct was measured), and the NADA-T self-transcendence dimension significantly correlated with the intensity of mystical experiences (indicating that a similar construct was measured).

## Discussion

In the present study we aimed at piloting and validating a new set of ESM items to capture STE's (flow, awe, mystical experiences) in daily life. The reason for this was that previous research on STE's did not have measures specifically psychometrically validated for the use of ESM. Hence, to our knowledge, this is the first psychometric ESM study on STE's. Our findings revealed that: (1) Flow, awe, and mystical experiences were reported frequently with varying degrees of intensity; (2) That there is a stronger within-subject variance compared to between-subject variance for the incidence and intensity of flow and awe. For mystical experiences the incidence also showed a stronger within-subject variance, but the intensity showed a stronger between-subject variance; (3) The internal consistency of even and odd observations means and SD on flow, awe, and mystical experience incidence was significant and strong. The internal consistency of even and odd observation means on flow, awe, and mystical experience was significant and mostly strong, while the internal consistency of even and odd SD was nonsignificant; (4) The convergent validity with the RSR questionnaires was low or non-existing. The DAS-5 showed a moderate level of convergent validity with awe and mystical experience incidence, while the self-transcendence dimension of the NADA-T showed a moderate level of convergent validity with the intensity of mystical experiences. The SFPQ was not at all related to the flow assessed with the present items. Furthermore, the incidences strongly correlated with each other, while the intensities

moderately correlated with each other. Taken together, the result of the present study was the development of a short 3-item ESM questionnaire, with one item for each STE, that proved to have a high internal consistency and a low convergent validity. Such a short questionnaire provides enough time within the ESM protocol to explore various other research questions. Moreover, the high levels of within-subject variances confirm that STE's are worthwhile to explore with the use of ESM.

## RQ1: Incidences and intensities of flow, awe, and mystical experiences

The first contribution to the literature was to show the incidence and intensities of flow, awe, and mystical experiences in daily life. In line with previous ESM research on flow, we showed that people report a substantial amount of flow experience during the ESM observation (Bringsén et al., 2011; Haworth & Evans, 1995). All reported reported lower levels of flow during ESM observations compared to the 42.76% reported in the present study. Nurses reported to be 11.5% in flow during an observation (Bringsén et al., 2011), while students reported to be 24.1% in flow (Haworth & Evans, 1995). Regarding awe, the present study showed considerably lower awe experiences compared to the student sample of Koh et al. (2017). While they reported to have awe 57.29% during ESM observations, the sample of the present study reported to be in awe 25.65% during the observations. The differences of the present research with previous research on flow and awe might stem from different methods and participant samples. For instance, the present sample consisted approximately out of one-half students and another half of people who worked (e.g., finished high school). This might lead to different STE incidences compared to the awe and flow student sample, or the flow student and nurses samples. Hence, future research could investigate the convergent validity of these ESM measures, or explore which sample occupation or characteristics report higher levels of STE's.

Regarding mystical experiences, the present study is the first to show that 10.35% of the ESM observations were a mystical experience. This finding was to our surprise, since classical RSR research indicates that this event is rather rare. Only half of the U.S. public reported to have such an experience in their life, and Gellings et al. (2022) showed that people reported to have on average 0.37 mystical experiences in the last four weeks. A reason for this high percentage might be that we decided to include two 95% outliers for the analyses. These individuals substantially affect the 10.35%. Future research should reflect on how to handle these high incidence individuals. Moreover, it might be worthwhile to explore what they report when having mystical experiences, to see whether they indeed have them or confuse it with another construct, such as awe. In line with this, Gellings et al. (2022) argued that awe

and mystical experiences might be on a similar continuum. The present ESM items could be expanded by adding exploratory questions on the context and on the experience itself when individuals report to have such STE's. This could also be done by employing qualitive research (Bishop, 2014). Furthermore, future research could make use of the present items after STE interventions, such as psychedelics (Johnson et al., 2019), the use of the placebo gods helmet (Maij & van Elk, 2018), and meditation (Russ & Elliott, 2017). This could provide insights into STE changes in daily life before and after the intervention. Moreover, ESM might also be interesting to disentangle the between and within subject associations of these interventions. While for some individuals the intervention might be effective, this might not be the case for others. A confirmation for this can be found in an ESM study by Kraiss et al. (2022), in which they showed that there is a considerable variability in individual slopes. This shows the importance of examining possible differences on the within-level.

Regarding the intensities of flow, awe, and mystical experiences, the present study is the first to our knowledge to report these. So far, no ESM and RSR's research reported them. Future ESM research could explore what characteristics or contexts might be associated with the strength of the intensity, such as performed activity or cognitions during that moment. Next to this, it might be worthwhile to explore how important the intensity is to elicit quantum changes in cognition, behavior, and affect (Miller & Baca, 2001). This could provide important insights to improve psychedelic treatment (Garcia-Romeu & Richards, 2018; Luoma et al., 2020).

Another finding was that the incidences significantly correlated with each other, as well as the intensities. This means that the investigated constructs show some similarity. To investigate the underlying connections of STE's, it might be interesting to place them in a larger network. This can be done with a combination of multilevel vector autoregression and multilevel modeling (Bringmann et al., 2013). As such, this network method enables a closer examination of the underlying between-subject and within-subject connections on the corresponding STE's.

### **RQ2:** Between and within subject variance of flow, awe, and mystical experiences

The second contribution to the literature was to show the between and within subject variance of flow, awe, and mystical experiences. The ICC's indicated that the STE incidence and intensity showed stronger within-subject variance than between-subject variance. This meant that the contextual and situational variation had a much larger influence on STE's than between people differences. This is in line with the findings of Fullagar and Kelloway (2009) on flow, in which they showed that for flow, 74% of the total variance was accounted for by

within-subject variance, while 36% was accounted for by between-subject variance. Their values are close to the variance we received for each STE (67% to 68%). In our study, only the mystical experience intensity showed more between-subject variation. A reason for this is most likely the fact that it is a rather rare event and 10 participants only reported a single value over the course of the study. This did not generate any within-person variance. It might be that when the study duration would be higher, more different values would be reported. Thus, the within-person variance for mystical experience intensity may come closer to the 56% to 58% of awe and flow. Lastly, the low ICC's of the present study indicate that ESM is greatly suited to investigate STE's in daily life (Bolger & Laurenceau, 2013). The reason for this is that a high within-subject variance shows that a construct is dynamic and state-like. This enables the real-time assessment of ESM to provide various insights on situational and contextual factors (Myin-Germeys & Kuppens, 2021). Thus, as the reliability and low convergent validity has been demonstrated with our items, future research can employ them to disentangle other contextual factors such as day, time of the day, job tasks, certain activities, that explain more of the large within-subject variance.

## **RQ3 and RQ4: Psychometric properties**

The third contribution to the literature was the testing of internal-consistency reliability and convergent validity of ESM items on flow, awe, and mystical experiences. The internal consistency was strong and similar to other ESM validation studies (Borah et al., 2018; Edmondson et al., 2013). This shows that the items reliably assess the construct of interest over time. Only the SD's of flow, awe and mystical experience intensity were nonsignificant. A reason for this might be the high within-subject variance in intensity in combination with limited observations. This may lead to random deviations between odd and even observations, which might approximate each other the more observations are added. This approximation is suggested by the high consistency of the means. Next to this, only participants with varying intensities can be used to calculate the average SD of odd and even observations. This led to a very low number of participants included for the Pearson correlations, as several participants indicated only a single value. This reduced the significance even more.

Unexpectedly, the convergent validity was low to non-existing. Awe incidence was weakly associated with its respective RSR, the DAS-5. Next to this, the DAS-5 was weakly associated with the incidence of mystical experience. The associations of the DAS-5 need to be interpreted with caution, due to the low Cronbach's  $\alpha$  of .49, which might be due to the low sample size. Nevertheless, DAS-5 associations with the incidence of awe and mystical

experiences might confirm the idea mentioned above, that awe and mystical experience might be on a similar continuum. Mystical experience intensity was weakly associated with its respective RSR, the NADA-T. Flow incidence and intensity were not related to any RSR. However, a low association of trait RSR's and ESM data is common (e.g., Schwartz et al., 1999; Solhan et al., 2009). An explanation for this low convergent validity might be that STE's vary from situation to situation which limits the ability of a trait RSR to be associated with these states (Edmondson et al., 2013). Another explanation might be that individuals had a different construct in mind when filling in the RSR compared to what they actually experienced in real life (Schwartz et al., 1999). For instance, participants thought about a deep experience when filling out the RSR's while they based their answers during ESM on more regular experiences. This relates well to the overestimation and underestimation bias that has been demonstrated when comparing RSR with ESM reports (Shiffman et al., 1997; Miron-Shatz et al., 2009). The last explanation might be that a single ESM item of the present study might not capture the broader content and constructs of classical STE RSR's. However, research suggests that single-item measures correlate good with multi-item measures investigating the same construct (Yarkoni, 2010). To receive more insight into the convergent validity of the present study, it might be promising to explore how our flow item relates to flow items of other ESM studies. This would show whether a convergent validity is present when assessing flow in daily life.

## **Strengths & limitations**

This study showed various strengths in employing the experience sampling method for STE's. First, ESM enabled us to directly investigate within-subject and between-subject processes across time. This is crucial for STE's, as the present study and ESM research on flow showed that there is considerably more within-subject variance compared to between-subject variance. This makes classical RSR's very limited in assessing the fluctuating nature of STE's in daily life. Second, ESM enables researchers to take several assessments within a day. This daily assessment is much superior to classical longitudinal studies, as the temporal distance between measurements has a strong influence on observed effects (Collins, 2006). Third, ESM considers the natural everyday environment of participants, compared to unnatural elicited laboratory settings, leading to a higher ecological validity (Myin-Germeys & Kuppens, 2021). Fourth, ESM strongly reduces the effect of recall biases (Schwarz et al., 2009). Fifth, this research is, to our knowledge, the first to report the incidences and intensities of STE's in daily life, showing that these are worthwhile constructs to explore with ESM in the future. Sixth, the present study demonstrated the psychometric qualities of STE

items. Next to this, the 1-item survey for each STE is short to enable space for other items, effective in capturing the STE 's (Yarkoni, 2010), and similarly structured to avoid possible confusion on the participant side.

Several limitations need to be noted. First, participating in a study could interfere with the subject's behavior because the investigated phenomena might become more salient to the individual (Telford et al., 2012). Similarly, ESM items do not provide a guarantee for a completely accurate report on daily life experiences. Participants may still be susceptible for recall biases and social desirability. These biases could possibly increase the reported incidences and intensities. Second, the sample consisted out of western, educated, industrialized, rich and democratic (WEIRD) participants, and thus might lead to some biased results (Henrich et al., 2010). Third, a post-hoc qualitative analysis revealed that several participants were dissatisfied with only having 30 minutes to answer the prompt. They described that when working or studying, it often occurred, that they missed the prompt. Hence, future studies employing our items could consider to increase the duration to answer the prompt. This might increase the compliance of the ESM protocol. Lastly, the compliance of 57% was rather low compared to the 70% and 80% average compliance of other ESM studies (Myin-Germeys & Kuppens, 2021). Partly, this lower compliance could be explained by the technical issues described in the method section. Furthermore, other ESM studies reported even lower compliances of 56.9% (Kuepper et al., 2013 and 47% (Ramsey et al., 2016). Considering this, the compliance of the present study was still acceptable. An explanation for the missed prompts might be that participants did not used their phone because they engaged in other activities. This was also indicated in the post-hoc qualitative analysis. To improve the current ESM protocol, it might be worthwhile to add a question on why participants missed the last prompt. Through this, insight as to why the compliance was lower may be gained.

## Conclusion

To conclude, we developed and piloted a newly developed short 3-item ESM questionnaire for STE's in daily life. To our knowledge, this is the first psychometric ESM Study on STE's. The present research showed that a considerable amount of STE incidences occurs in daily life, with a substantial within-person variance. This revealed that the investigation of STE's with ESM is a worthwhile endeavor to provide new insights on flow, awe, and mystical experiences. Next to this, the developed items have a good internal consistency, but a low convergent validity with classical retrospective trait questionnaires. The current research engaged in the first validation of the items, but future studies will be needed to improve the presented psychometric properties. Lastly, we showed that further knowledge on STE's is of high societal relevance, as they demonstrate strong therapeutic potential.

#### References

- Bolger, N., & Laurenceau, J. P. (2013). Intensive Longitudinal Methods: An Introduction to Diary and Experience Sampling Research (Methodology in the Social Sciences). New York, NY: Guilford Press.
- Borah, T. J., Murray, A. L., Eisner, M., & Jugl, I. (2018). Developing and validating an experience sampling measure of aggression: The aggression-es scale. *Journal of Interpersonal Violence*, 36(11-12). <u>https://doi.org/10.1177/0886260518812068</u>
- Bringsén, S., Ejlertsson, G. & Andersson, I. H. (2011). Flow situations during everyday practice in a medical hospital ward. Results from a study based on experience sampling method. *BMC Nursing*, 10(1). <u>https://doi.org/10.1186/1472-6955-10-3</u>
- Büssing, A., Recchia, D., & Baumann, K. (2018). Validation of the gratitude/AWE questionnaire and its association with disposition of gratefulness. *Religions*, 9(4), 117. <u>https://doi.org/10.3390/rel9040117</u>
- Carlson, E. B., Field, N. P., Ruzek, J. I., Bryant, R. A., Dalenberg, C. J., Keane, T. M., & Spain, D. A. (2015). Advantages and psychometric validation of proximal intensive assessments of patient-reported outcomes collected in daily life. *Quality of Life Research*, 25(3), 507–516. <u>https://doi.org/10.1007/s11136-015-1170-9</u>
- Chirico, A., & Yaden, D. B. (2018). AWE: A self-transcendent and sometimes transformative emotion. *The Function of Emotions*, 221–233. <u>https://doi.org/10.1007/978-3-319-</u> <u>77619-4\_11</u>
- Chirico, A., Cipresso, P., Yaden, D. B., Biassoni, F., Riva, G., & Gaggioli, A. (2017).
   Effectiveness of immersive videos in inducing awe: An experimental study. *Scientific Reports*, 7(1). <u>https://doi.org/10.1038/s41598-017-01242-0</u>
- Collins, L. M. (2006). Analysis of Longitudinal Data: The integration of theoretical model, temporal design, and statistical model. *Annual Review of Psychology*, 57(1), 505–528. <u>https://doi.org/10.1146/annurev.psych.57.102904.190146</u>
- Conner, T. S., & Barrett, L. F. (2012). Trends in ambulatory self-report. *Psychosomatic Medicine*, 74(4), 327–337. <u>https://doi.org/10.1097/psy.0b013e3182546f18</u>

Cortina, J. M. (1993). What is coefficient alpha? an examination of theory and applications. *Journal of Applied Psychology*, 78(1), 98–104. <u>https://doi.org/10.1037/0021-9010.78.1.98</u>

Csikszentmihalyi, M. (1991). Flow: The psychology of optimal experience. Harper and Row.

- Csikszentmihalyi, M., & Hunter, J. (2014). Happiness in everyday life: The uses of experience sampling. *Flow and the Foundations of Positive Psychology*, 89–101. https://doi.org/10.1007/978-94-017-9088-8\_6
- Edmondson, D., Shaffer, J. A., Chaplin, W. F., Burg, M. M., Stone, A. A., & Schwartz, J. E. (2013). Trait anxiety and trait anger measured by ecological momentary assessment and their correspondence with traditional trait questionnaires. *Journal of Research in Personality*, 47(6), 843–852. https://doi.org/10.1016/j.jrp.2013.08.005
- Eisele, G., Vachon, H., Lafit, G., Kuppens, P., Houben, M., Myin-Germeys, I., & amp;
  Viechtbauer, W. (2020). The effects of sampling frequency and questionnaire length on perceived burden, compliance, and careless responding in experience sampling data in a student population. *Assessment*, 29(2), 136–151.
  https://doi.org/10.1177/1073191120957102
- Emery, N. N., & Simons, J. S. (2020). The role of affect, emotion management, and attentional bias in young adult drinking: An experience sampling study.
  Psychopharmacology, 237(5), 1557–1575. <u>https://doi.org/10.1007/s00213-020-054805</u>
- Ethica Data. (2022). Ethica. Retrieved from https://ethicadata.com
- Fullagar, C. J., & Kelloway, E. K. (2009). Flow at work: An experience sampling approach. *Journal of Occupational and Organizational Psychology*, 82(3), 595–615. <u>https://doi.org/10.1348/096317908x357903</u>
- Garcia-Romeu, A., & Richards, W. A. (2018). Current perspectives on psychedelic therapy: Use of serotonergic hallucinogens in clinical interventions. *International Review of Psychiatry*, 30(4), 291–316. <u>https://doi.org/10.1080/09540261.2018.1486289</u>

- Gellings, T., Ossebaard, J., & Schie, H. T. (2022). The relationships between meditation and transcendental experiences. Work prepared for publication but not submitted. Faculty of Social Science, Radboud University.
- Hanley, A. W., Nakamura, Y. & Garland, E. L. (2018). The Nondual Awareness Dimensional Assessment (NADA): New tools to assess nondual traits and states of consciousness occurring within and beyond the context of meditation. *Psychological Assessment*, 30(12), 1625–1639. <u>https://doi.org/10.1037/pas0000615</u>
- Haworth, J. & Evans, S. (1995). Challenge, skill and positive subjective states in the! daily life of a sample of YTS students. *Journal of Occupational and Organizational Psychology*, 68(2), 109–121. <u>https://doi.org/10.1111/j.2044-8325.1995.tb00576.x</u>
- Henrich, J., Heine, S. J., & Norenzayan, A. (2010). Beyond WEIRD: Towards a broad-based behavioral science. *Behavioral and Brain Sciences*, 33(2–3), 111–135. <u>https://doi.org/10.1017/s0140525x10000725</u>
- IBM Corp. (2019). IBM SPSS Statistics for Windows, Version 27.0. IBM Corp
- Johnson, M. W., Hendricks, P. S., Barrett, F. S., & Griffiths, R. R. (2019). Classic psychedelics: An Integrative Review of Epidemiology, therapeutics, mystical experience, and Brain Network function. *Pharmacology & Therapeutics*, 197, 83–102. https://doi.org/10.1016/j.pharmthera.2018.11.010
- Kahneman, D., & Riis, J. (2005). Living, and thinking about it: Two perspectives on life. The science of well-being, 1, 285-304. Oxford University Press, USA.
- Kimhy, D., Myin-Germeys, I., Palmier-Claus, J., & Swendsen, J. (2012). Mobile assessment guide for research in schizophrenia and severe mental disorders. *Schizophr Bull*, 38(3), 386-395. <u>https://doi.org/10.1093/schbul/sbr186</u>
- Koh, A. H., Tong, E. M., & Yuen, A. Y. (2017). The buffering effect of awe on negative affect towards lost possessions. *The Journal of Positive Psychology*, 14(2), 156–165. <u>https://doi.org/10.1080/17439760.2017.1388431</u>
- Kraiss, J. T., Kohlhoff, M. & ten Klooster, P. M. (2022). Disentangling between- and withinperson associations of psychological distress and mental well-being: An experience sampling study examining the dual continua model of mental health among university students. *Current Psychology*. <u>https://doi.org/10.1007/s12144-022-02942-1</u>

- Kuepper, R., Oorschot, M., Myin-Germeys, I., Smits, M., van Os, J., & Henquet, C. (2013). Is psychotic disorder associated with increased levels of craving for cannabis? an experience sampling study. *Acta Psychiatrica Scandinavica*, *128*(6), 448–456. <u>https://doi.org/10.1111/acps.12078</u>
- Kurtz, E. (1991). *Not-god: A history of alcoholics anonymous*. Hazelden Educational Services.
- Luoma, J. B., Chwyl, C., Bathje, G. J., Davis, A. K., & Lancelotta, R. (2020). A meta-analysis of placebo-controlled trials of psychedelic-assisted therapy. *Journal of Psychoactive Drugs*, 52(4), 289–299. <u>https://doi.org/10.1080/02791072.2020.1769878</u>
- Maij, D. L. R., & van Elk, M. (2018). Getting absorbed in experimentally induced extraordinary experiences: Effects of placebo brain stimulation on agency detection. *Consciousness and Cognition*, 66, 1–16. https://doi.org/10.1016/j.concog.2018.09.010
- Many Americans mix multiple faiths. Pew Research Center's Religion & Public Life Project. (2009, December 9). Retrieved February 20, 2022, from <u>https://www.pewforum.org/2009/12/09/many-americans-mix-multiple-faiths/</u>
- Marsh, H. W., & Jackson, S. A. (1999). Flow experience in sport: Construct validation of multidimensional, hierarchical state and trait responses. *Structural Equation Modeling:* A Multidisciplinary Journal, 6(4), 343–371.
   <a href="https://doi.org/10.1080/10705519909540140">https://doi.org/10.1080/10705519909540140</a>
- Microsoft Corporation. (2019). *Microsoft Excel*. Retrieved from <u>https://office.microsoft.com/excel</u>
- Miller, W. R., & Baca, J. C. (2001). *Quantum Change: When epiphanies and sudden insights transform ordinary lives.* Guilford Press.
- Miron-Shatz, T., Stone, A., & Kahneman, D. (2009). Memories of Yesterday's emotions:
  Does the valence of experience affect the memory-experience gap? *Emotion*, 9(6), 885–891. <u>https://doi.org/10.1037/a0017823</u>

- Myin-Germeys, I., & Kuppens, P. (2021). The open handbook of experience sampling methodology: A step-by-step guide to designing, conducting, and analyzing Esm Studies. The Center for Research on Experience Sampling and Ambulatory Methods Leuven (REAL).
- Myin-Germeys, I., Oorschot, M., Collip, D., Lataster, J., Delespaul, P. & van Os, J. (2009).
   Experience sampling research in psychopathology: opening the black box of daily life.
   *Psychological Medicine*, 39(9), 1533–1547.
   https://doi.org/10.1017/s0033291708004947
- Nakamura, J., & Csikszentmihalyi, M. (2014). The concept of flow. Flow and the Foundations of Positive Psychology, 239–263. <u>https://doi.org/10.1007/978-94-017-9088-8\_16</u>
- Napierala, M. A. (2012). What is the Bonferroni correction? *AAOS Now*, 40. <u>https://link.gale.com/apps/doc/A288979427/HRCA?u=anon~1100ae8c&sid=googleScholar&xid=0811591e</u>
- Ramsey, A. T., Wetherell, J. L., Depp, C., Dixon, D., & Lenze, E. (2016). Feasibility and acceptability of smartphone assessment in older adults with cognitive and emotional difficulties. *Journal of Technology in Human Services*, 34(2), 209-223. <u>https://doi.org/10.1080/15228835.2016.1170649</u>
- Russ, S. L., & Elliott, M. S. (2017). Antecedents of mystical experience and dread in intensive meditation. *Psychology of Consciousness: Theory, Research, and Practice*, 4(1), 38–53. <u>https://doi.org/10.1037/cns0000119</u>
- Schwartz, J. E., Neale, J., Marco, C., Shiffman, S. S., & Stone, A. A. (1999). Does trait coping exist? A momentary assessment approach to the evaluation of traits. Journal of Personality and Social Psychology, 77(2), 360–369. <u>https://doi.org/10.1037/0022-3514.77.2.360</u>
- Schwarz, N. (2012). Retrospective and concurrent self-Reports: The rationale for real-time data capture. *The science of real-time data capture: Self-reports in health research*, 11-26. <u>https://doi.org/10.1201/9781584888901.ch2</u>

- Schwarz, N., Kahneman, D. & Xu, J. (2009). Global and Episodic Reports of Hedonic Experience. *Calendar and Time Diary*, 156–174. https://doi.org/10.4135/9781412990295.d15
- Scollon, N. C., Prieto, C. K., & Diener, E. (2009). Experience Sampling: Promises and pitfalls, strengths and weaknesses. In E. Diener (Ed.), Assessing Well-Being: The Collected Works of Ed Diener (pp. 157-180): Springer Netherlands.
- Shiffman, S., Hufford, M., Hickcox, M., Paty, J. A., Gnys, M., & Kassel, J. D. (1997). Remember that? A comparison of real-time versus retrospective recall of smoking lapses. *Journal of Consulting and Clinical Psychology*, 65(2), 292–300. <u>https://doi.org/10.1037/0022-006x.65.2.292.a</u>
- Shiota, M. N., Keltner, D., and John, O. P. (2006). Positive emotion dispositions differentially associated with big five personality and attachment style. J. Posit. Psychol. 1, 61–71. <u>https://doi.org/10.1080/17439760500510833</u>
- Sitaram, R., Ros, T., Stoeckel, L., Haller, S., Scharnowski, F., Lewis-Peacock, J., Weiskopf, N., Blefari, M. L., Rana, M., Oblak, E., Birbaumer, N., & Sulzer, J. (2016). Closed-loop brain training: the science of neurofeedback. *Nature Reviews Neuroscience*, 18(2), 86– 100. <u>https://doi.org/10.1038/nrn.2016.164</u>
- Solhan, M. B., Trull, T. J., Jahng, S., & Wood, P. K. (2009). Clinical assessment of affective instability: Comparing EMA indices, questionnaire reports, and retrospective recall. *Psychological Assessment*, 21(3), 425–436. <u>https://doi.org/10.1037/a0016869</u>
- Sumaya, I. C., & amp; Darling, E. (2018). Procrastination, flow, and academic performance in real time using the experience sampling method. *The Journal of Genetic Psychology*, 179(3), 123–131. <u>https://doi.org/10.1080/00221325.2018.1449097</u>
- Sun, J., Rhemtulla, M. & Vazire, S. (2020). Eavesdropping on Missing Data: What Are University Students Doing When They Miss Experience Sampling Reports? *Personality and Social Psychology Bulletin*, 47(11), 1535–1549. <u>https://doi.org/10.1177/0146167220964639</u>
- Telford, C., McCarthy-Jones, S., Corcoran, R., & Rowse, G. (2011). Experience Sampling Methodology studies of depression: the state of the art. *Psychological Medicine*, 42(6), 1119–1129. <u>https://doi.org/10.1017/s0033291711002200</u>

- Vachon, H., Viechtbauer, W., Rintala, A., & Myin-Germeys, I. (2019). Compliance and Retention With the Experience Sampling Method Over the Continuum of Severe Mental Disorders: Meta-Analysis and Recommendations. *J Med Internet Res, 21*(12), e14475. <u>https://doi.org/10.2196/14475</u>
- Van Berkel, N., Ferreira, D., & Kostakos, V. (2017). The experience sampling method on mobile devices. ACM Computing Surveys, 50(6), 1–40. <u>https://doi.org/10.1145/3123988</u>
- Wang, L., & Miller, L. C. (2019). Just-in-the-moment adaptive interventions (JITAI): A Meta-Analytical Review. *Health Communication*, 35(12), 1531–1544. <u>https://doi.org/10.1080/10410236.2019.1652388</u>
- Yaden, D., Haidt, J., Hood, R., Vago, D., & Newberg, A. (2017). The varieties of selftranscendent experience. *Review of General Psychology*. 2017;21(2):143-160. <u>https://doi.org/10.1037/gpr0000102</u>
- Yarkoni, T. (2010). The abbreviation of personality, or how to measure 200 personality scales with 200 items. *Journal of Research in Personality*, 44(2), 180–198. <u>https://doi.org/10.1016/j.jrp.2010.01.002</u>

## **Appendix A**

## **ESM Questionnaires**

The description of flow: Flow is described as an intrinsically rewarding experience in which an individual is fully taken up by the activity that she/he/they are engaging in, in which the sense of self is diminished. The phenomenon of flow may be associated with the following features: 1) a clear focus or concentration 2) absorption in the ongoing activity 3) an optimal balance between skill and challenge 4) clear and immediate feedback in performance 5) the feeling that goals may be easily attained 6) a strong sense of control 7) a feeling of intrinsic reward 8) a loss of self-consciousness or a merging of action and awareness 9) a change in the perception of time.

The description of awe: Awe is a strong emotional response that overwhelms a person with a feeling of deep respect, admiration or fear that leaves a lasting impression. People often report awe in response to beautiful nature, beautiful music, meeting a powerful person or having a deep insight. Consequently, individuals may report 1) a feeling of connection 2) a feeling of oppression 3) chills 4) a diminished self 5) a need for understanding 6) a change in the perception of time.

The description of mystical experience: In a mystic state an individual becomes one with the absolute and becomes aware of their oneness. They perceive an ultimate reality which can also be experienced as divine. The mystical experience is typically accompanied by a realization that nothing in the universe is truly separate and that all is connected. Such an experience is immensely meaningful and profound, and provides one with renewed meaning and strength in life. Consequently, individuals may report 1) a sense of unity or totality 2) a sense of timelessness 3) a sense of having encountered the ultimate reality 4) a sense of sacredness 5) a sense that one cannot adequately describe the richness of the experience.