

## Psychometrics and cultural practices

This project expands on the neurophenomenological paradigm in several ways. It introduces simulation as an experimental testbed not previously used in neurophenomenological studies. It also supplements both the neurophysiological and the phenomenological dimensions with questionnaires designed to provide psychometric data and data on the cultural practices of the participants.

The following questionnaires were administered.

- Brief Multidimensional Measure of Religiousness/Spirituality (BMMRS) (Masters et al. 2009).
- Mini-IPIP Personality Scale (Cooper, Smillie & Corr 2010)
- Level of Self-Concept Scale (LSCS) (Selenta & Lord 2005)
- Need for Cognition (NCS) (Cacioppo & Petty 1982).
- Multiple Stimulus Types Ambiguity Tolerance (MSTAT) (McClain 1993).
- Trait Emotional Intelligence Questionnaire- Short Form (TEIQue-SF) (Petrides & Furnham 2006).
- Tellegen Absorption Scale (TAS) (Tellegen & Atkinson, 1974).

The questionnaires issued prior to the experimental conditions were selected to avoid priming and focus on personality traits pertinent to the present study. The Multiple Stimulus Types Ambiguity Tolerance scale (MSTAT; McClain, 2009) is a 22 item measure that determines an individual's tolerance for ambiguity. The Tellegen Absorption Scale (TAS; Tellegen & Atkinson, 1974) is a 34-item instrument that measures a participant's openness to absorbing self-altering experiences in seven scales: Responsiveness to Engaging Stimuli, Synesthesia, Enhanced Cognition, Oblivious/Dissociative Involvement, Vivid Reminiscence, and Enhanced Awareness. Finally, a simulator sickness questionnaire (SSQ; Kennedy, Lane, Berbaum, & Lilienthal, 1993) helped evaluate the participants' level of discomfort possibly induced by the simulation. The SSQ is a 16 item questionnaire that measures 3 different categories of simulator sickness: Nausea, Oculomotor, and Disorientation. The SSQ was administered to participants before and after both scenarios.

After all conditions were presented, and the phenomenological interview was conducted, participants completed the Experiment-Specific Survey of Experience (ESSE), which is a demographic and experiential survey designed to provide quantitative data of the first-person experience. Finally, participants completed the Brief Multidimensional Measure of Religiousness/Spirituality (BMMRS; Idler et al., 2003), a 34-item measure that evaluates religiousness/spirituality in seven areas: Experiential Comforting Faith, Negative Religious Interaction, Personal Spirituality, Punishing God, Religious Community Support, Private Religious Practices, and Forgiveness.

Religiosity and spiritual (RS) traits were measured according to the BMMRS (Masters et al., 2009). A one way between-subjects ANOVA was run to compare RS traits among

experiencers and non-experiencers of AWRS during the simulated space flight. Higher levels of *experiential comforting faith* as indicated on the BMMRS ( $F(1, 17) = 6.469, p = .021$ ) were found among non-experiencers of awe ( $M = 12.14, SD = 3.43$ ) compared to experiencers of awe ( $M = 22.75, SD = 10.60$ ) during the Earth condition. In addition, higher frequency of *private religious practices* as indicated on the BMMRS ( $F(1, 17) = 5.483, p = .027$ ) were found among non-experiencers of awe ( $M = 14.86, SD = 5.39$ ) compared to experiencers of awe ( $M = 20.58, SD = 4.73$ ) during the Earth condition.

Two subscales of the BMMRS, *Experiential Comforting Faith* (ECF) and *Private Religious Practices* (PRP) were able to differentiate RS traits between AWCH experiencers and non-experiencers during the Earth view. The ECF subscale is comprised of religious items that identify an individual's feeling of connection with a higher power such as "I Feel God's Presence" and "I believe in a God who watches over me" (Masters et al., 2009). In addition, the PRP subscale is comprised of items that tapped into an individual's prayer and meditation practices including "How often do you read sacred texts or other religious literature" and "Within your religious or spiritual tradition, how often do you meditate?" (Masters et al., 2009). Awe non-experiencers were found to have higher levels of RS compared to awe experiencers. Although awe experiences have been linked to RS factors (Emmons, 2005; Newberg & Newberg, 2005), the present results show that space-related awe experiences can occur with the absence of RS factors. This finding corresponds with Keltner and Haidt's (2003) model of awe and wonder experiences insofar as the two prerequisites of such experiences, perceived vastness and accommodation, do not depend on the presence of RS factors. In addition, this is consistent with a statement made by one astronaut in his journal who said: "People who had a religious background expressed (awe) in religious terms, and people who didn't, expressed (awe) in more humanitarian terms" (Lind, interviewed by White, 1987, p. 272ff).

#### **t-tests**

We conducted independent samples t-tests comparing AWCH experiencers and AWCH non-experiences (based on phenomenological interviews) with responses to the psychological surveys. We examined whether being an AWCH experiencer or not leads to a difference in reporting the experience within the scales of the ESSE, TAS, or BMMRS. This comparison helps to identify relationships between the phenomenological data and the psychometric data, thereby contributing to a better understanding of the constructs AWCH.

Participants who, during the phenomenological interview, articulated AWCH experiences were significantly less likely to describe themselves as "logical" in the ESSE;  $t(44.759) = 3.435, p = .001$ ; AWCH experiencers ( $n = 45, M = 72.13, SE = 3.292$ ) < non-experiencers ( $n = 16, M = 88.13, SE = 3.291$ ). There were no significant differences between the logical category and any of the other psychological metrics from the ESSE, TAS, or BMMRS.

Due to the rigorous categorical limitations, religious-experiencers occurred less frequently than spiritual-experiencers, but when they did, these participants were less

likely to self-report being a “reflective person” in the ESSE;  $t(27.161) = -2.773, p = .010$ ; religious-experiencers ( $n = 6, M = 84.67, SE = 2.472$ ), < non-experiencers ( $n = 55, M = 73.64, SE = 3.116$ ). These participants reported higher levels of curiosity in response to the stimuli;  $t(11.581) = -2.871, p = .015$ , religious-experiencers ( $M = 89.17, SE = 4.167$ ), > non-experiencers ( $M = 74.31, SE = 3.069$ ).

Participants who described their experiences in religious terms had higher rates of negative religious interactions in the BMMRS (Idler et al., 2003) than their counterparts who did not use religious language during the interviews;  $t(21.423) = -2.486, p = .021$ ; religious-experiencers ( $M = 7.83, SE = .167$ ), < non-experiencers ( $M = 7.22, SE = .183$ ).

Those who spoke of their experiences while viewing Earth in terms of the sublime, exteroceptive intensive experiences, and pleasure (“aesthetic experiencers”) scored significantly lower in the “sensory perceptual absorption” category of the TAS (Tellegen & Atkinson, 1974);  $t(59) = 2.292, p = .025$ ; aesthetic-experiencers ( $n = 37, M = 14.38, SE = .407$ ), < aesthetic non-experiencers ( $n = 24, M = 15.83, SE = .477$ ). There were no other significant results of the t-tests for aesthetic experience.

Following the phenomenological interview, participants who had expressed experiences of awe while viewing the experimental condition were categorized as “awe-experiencers” ( $n = 39$ ) or “awe non-experiencers” ( $n = 22$ ). The participants who expressed an experience of awe during the phenomenological interview were significantly more likely to have reported awe in their psychological surveys as well,  $t(34.018) = -2.374, p = .023$ ; Awe experiencers ( $M = 19.69, SE = 3.626$ ) < non-experiencers ( $M = 20.91, SE = 6.564$ ). While there was no significant relationship to wonder and curiosity, participants who expressed awe reported greater levels of humility in their psychological surveys;  $t(39.00) = -2.356, p = .024$ ; awe experiencers ( $M = 63.74, SE = 4.843$ ) < non-experiencers ( $M = 42.95, SE = 7.377$ ).

Participants who articulated awe during their interviews also had higher scores in “private religious practice” in the BMMRS (Idler et al., 2003);  $t(27.808) = -2.061, p = .049$ ; awe experiencers ( $M = 21.77, SE = .514$ ), > non-experiencers ( $M = 18.91, SE = 1.289$ ). No other area on the BMMRS showed significance with the interview expressions of awe.

Participants who expressed experiences of awe in the phenomenological interview also scored significantly lower in the “sensory perceptual absorption” category of the TAS (Tellegen & Atkinson, 1974);  $t(47.350) = 2.767, p = .008$ ; awe experiencers ( $M = 14.33, SE = .477$ ) < non-experiencers ( $M = 16.05, SE = .395$ ). The awe-experiencing participants were more likely to answer “false” to questions like, “Textures- such as wool, sand, and wood- sometimes remind me of colors and music,” and “The crackle and flames of wood fire stimulate my imagination.”

Participants who expressed wonder ( $n = 26$ ) to their interviewers reported higher levels of awe in the ESSE;  $t(58.910) = -2.022, p = .048$ ; wonder-experiencers ( $M = 67.88, SE = 4.382$ ), > non-experiencers ( $n = 35, M = 54.57, SE = .4913$ ). There was no significance

found when comparing the groups to reports of wonder, curiosity, and humility in the ESSE, nor any of the other psychometrics.

There was no significance found comparing the phenomenological articulations of curiosity and any of the psychometric results.

Like the experiencers of awe, humility-experiencers ( $n = 26$ ) scored lower in the TAS (Tellegen & Atkinson, 1974) category of “sensory perceptual absorption” than non-experiencers ( $n=35$ );  $t(59) = 2.562, p = .013$ ; humility-experiencers ( $M = 14.04, SE = .442$ ), < non-experiencers ( $M = 15.63, SE = .422$ ). There was no significance found across the other psychometric categories.