Discussion

Methodological considerations

One of the major challenges of this project has been to correlate all of the different data – first-person phenomenological data, third-person neuro- and physio-logical data, and data generated by the Experiment Specific Survey of Experience (ESSE) and the various questionnaires. One common scale that is helpful for correlation is the simulation timeline. To the extent that data can be lined up on the simulation timeline in each experiment, significant correlation is made easier.

PhysioSync, and in-house computer program, was designed to correlate all neuro- and physiological data with the simulation timeline. Phenomenological interviewers were able to organize reports around specific simulation landmarks even when the interviews followed a different narrative timeline. Accordingly we were able to reorder the interview descriptions of experience to fit onto the simulation timelines with some degree of precision. ESSE data also included some reference to the simulation timeline. All other data were tied to individual participants.

Implicit in the kind of approach we are taking to the study of AWCH (and this generalizes to many types of consciousness) is the idea that a *full* account will not be had simply by looking in the brain – although obviously the neuroscience is an important component. We're attempting to understand precisely what elements in the environment are involved, what aspects of embodiment are involved, what aspects of culture and background practices are involved. The task was to find an experimental paradigm that can take all of these factors into account. We think the neurophenomenological approach goes some distance in this direction, and that it is easily supplemented using other instruments such as the ESSE and various questionnaires. Much of what we learned in this project concerns methodology (see Bockelman et al. 2013, and below).

What we learned about AWCH experiences

Astronauts' report experiences of awe, wonder, curiosity and humility (AWCH) during space travel. In some cases these experiences have a profound effect on their life perspective when they return to earth. However, the exact nature of these experiences is not fully understood, and have not been scientifically studied until now.

We conducted two experiments in our study. In the first, a simulated space environment was created in which participants in the first experiment passively observed either a Deep Space to Earth sequence or Earth to Deep Space sequence. In the Deep Space view, participants virtually traveled through space while observing stars in the distance, whereas in the Earth view participants saw Earth and slowly traveled away until it looked like a blue marble. Participants received the counter-balanced sequences in random order. The sequences were presented in a mixed virtual reality space that included simulated views through space shuttle portals. In the second experiment we used a Virtual Immersive Portable Environment (VIPE) to immerse subjects in visual simulations of space. To determine if participants experienced feelings of AWCH, a phenomenological interview was conducted after the simulation and the interviews were coded according to

categories derived from a previous hermeneutical analysis of astronaut journals. Neuro- and physio-logical measures (EEG, fNIR, and ECG) were taken during the simulation. Correlational analyses were conducted relative to the simulation timeline and to individual participants.

Table 1. Experiment 1 overview.

Features	Outcome	Relevance
Participant number	19 (no-object)/43 (both)	Provides "proof of concept"
Experimental Design	• Mixed reality simulation • Two-vantage manipulation/Four-vantage manipulation	Generated experiences akin to those reported by astronauts
Significant findings	• Cortical theta responses differed between experiencers and non-experiencers of awe during the earth condition	Role of ENGAGEMENT in the experience of awe
	• Cortical beta responses differed between the earth and deep space conditions	Role of STIMULUS to maintain attention and engagement during experimental conditions
	• Earth condition elicited higher responses of awe, wonder, and religiousness compared to the deep space condition	Role of STIMULUS in eliciting feelings of awe
	• Non-experiencers of awe reported greater religious traits compared to experiencers of awe	Role of TRAITS in the experience of awe

Experiment 1

The objective of Experiment 1 was to determine (1) the physiological markers associated with AWCH, (2) which variables will differentiate between AWCH experiencers and AWCH non-experiencers identified from the interviews, and (3) the environmental factors that influence AWCH experiences. According to the results, several EEG metrics were able to differentiate between AWCH experiencers, and AWCH non-experiencers and showed significant differences in several traits as measured by the BMMRS (Masters et al., 2009). Additionally, subjective reports during the phenomenological interviews and EEG beta differences indicated that the Earth view was more influential in eliciting AWCH statements compared to the Deep Space view.

In order to identify physiological markers of AWCH, EEG, ECG, and fNIR metrics were compared among AWCH experiencers and non-experiencers. Greater left hemisphere theta and right hemisphere theta was found among non-experiencers of awe compared to experiencers of awe during the Earth condition. Traditionally, increases in theta have been interpreted in two contrasting ways (Paus & Zatorre, 1997); increases in frontal lobe theta have been interpreted as representing enhanced cognitive activity/working memory load (Smith et al. 2001; Gevins et al. 1997), whereas increases in wide-spread scalp theta have been interpreted as representing increased drowsiness and fatigue (Paus & Zatorre 1997). The differences found in the present study most likely reflect the latter interpretation due to differences being found in the left and right hemispheres as opposed to the frontal lobes. As a result, AWCH non-experiencers during the Earth condition experienced greater levels of drowsiness compared to experiencer of awe. According to Schacter (1977), participants who experience a drowsiness-related theta response also have a decreased awareness and ability to actively interact with the environment they are in. However, in order for an AWCH experience to occur, one's attention must be directed toward the stimuli (Shiota et al., 2007). As a result, the whole-scalp theta response can be used to differentiate AWCH non-experiencers whose attention is not directed toward the stimuli from neutral and AWCH experiencers whose attention is directed toward the stimuli.

This finding is also supported by the interviews of the AWCH experiencers compared to the non-experiencers, with the non-experiencers displaying boredom and inattention to the stimuli. The AWCH experiencers mention similar thoughts and feelings during the interviews, but, on average, not until much later in the simulation. The increased theta, however, does not appear to be continuous. These findings suggest that the AWCH non-experiencers are not attentionally engaged in viewing the virtual Earth very early in the simulation. Both non-experiencers exhibited an initial intense increase in theta from baseline for the first 3.5 minutes, with participant 29 exhibiting another large theta increase during the 8-minute mark. This later distraction or boredom reporting by the AWCH experiencers and non-experiencer is likely associated with the intense theta changes occurring in the physiological measures around the 8-10 min period for time spent viewing the Earth simulation. These theta changes from resting baseline during the later period resemble the physiological changes that occur during a vigilance task. Operators in vigilance tasks are most frequently highly motivated individuals who find it difficult to maintain attention to the task over time, increasing workload (Reinerman-Jones, Matthews, Langheim, & Warm 2010). For this reason we reduced the time on task in the second experiment to 7 minutes.

Two subscales of the BMMRS, Experiential Comforting Faith (ECF) and Private Religious Practices (PRP) were able to differentiate 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 religiousity/spirituality (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.

To further understand the environmental factors that influence AWCH, phenomenological statements and physiological metrics were compared among the Earth and DS conditions. According to the phenomenological interviews, the Earth condition elicited higher levels of AWCH compared to the DS condition. These results indicate that participants viewed the Earth scenario as more powerful and moving than DS scenario. In addition, the results indicate that participants had greater difficulty accommodating the Earth view into their current cognitive structures compared to the DS view, consistent with Keltner and Haidt's (2003) model of awe and wonder experience. These findings are further supported by the differences in EEG beta levels which revealed greater frontal lobe beta, parietal/occipital lobe beta, left hemisphere beta, and right hemisphere beta during the Earth condition compared to the Deep Space condition. Increases in beta have been linked to increases in arousal and attention (Prinzel, Freeman, Scerbo, Mikulka, & Pope 2000), which demonstrates that participants were more aroused and attentive during the Earth condition compared to the DS condition. Combined, these findings suggest that information rich and attention-grabbing environments are influential in AWCH experiences, consistent with findings from Shiota et al. (2007).

Experiment 2

The second experiment was more tightly controlled with an emphasis on the role that visual stimulus plays in AWHC experience. The visual simulations involved differences in context tied to a sense of location in the initial minute (FOC: Focused on a familiar environment versus GLO: without focus and unfamiliar environment). Despite these context differences, there was no statistically significant difference between groups on their ESSE experiential indications. Participants in both conditions reported experiencing awe, wonder, and humility at later points in the simulation. Curiosity showed the least context-dependence, being implicated in relatively proportionate degrees during the acclimation and experimental times.

The EEG results, however, indicated a difference between FOC and GLO participants. There was a drop in alpha in both groups, but with a greater drop in FOC. Viewing negative stimuli can cause a depression in alpha (Makarchouk et al. 2011), possibly linked to limbic response. This potentially indicates an unpleasant affective response to the grounding of the experiential context at the local campus starting point. The cause may be attributed to the sense of dizziness that some participants reported when the simulation moved quickly over land. However, the discrepancy also appeared at the end of the simulation, when the visual stimuli were quite similar. This suggests another interpretation: alpha differences at the beginning and end of the simulation may be related to changes in lateral gaze as the simulation moved from a full screen image to focus in the center of the visual field (de Toffol, Autret, Degiovanni, & Roux, 1990). At the beginning of the FOC condition, the aerial view of the circular campus defined a

central focus. A third interpretation of these findings would be that the changes in alpha indicate shifts of task attention (Bonnefond & Jensen, 2012). In consideration of the role of context, the view of the campus may have helped the FOC group generate and maintain attention. This interpretation has important implications for research in vigilance work, as introducing contextual grounding into vigilance tasks may increase neurological attentive behaviors.

Table 2. Experiment 2 overview.

Features	Outcome	Relevance
Participant number	73	Supports significance
Experimental Design	• Visual immersion simulation • Context manipulation	Generated experiences akin to those reported by astronauts
Significant findings	• Cortical responses to context manipulation are evident in simulation time and create significant differences when viewing similar stimuli.	Role of MEMORY, particularly engaged in context
	• Differences in self-identification as a logical or spiritual person are evident in visual processing of simulation to opposing degrees of significance.	Role of PERCEPTION as an individually unique process
	• Some participants with greater alpha suppression differences from baseline articulated more spiritual and aesthetic experiences, likely due to more cortical interaction, than those with differences closer to their baseline values. • Further, results from the analysis of individual differences suggest different biological mechanisms may be responsible for the complex manifestations of experience.	Role of CONSCIOUSNESS, and the interaction of brain areas involved in complex processes seems to be linked to individualized
	• Working memory and attention while viewing Earth are suggested from frontal lobe behaviors during simulation time.	Role of EXECUTIVE FUNCTION, connecting experience to cognitively engaged, non-passive, neural activity

GLO participants had a significantly higher beta than FOC participants at both the beginning and the end of the simulation experience. Global beta changes have been implicated in suppression of motor activity (Pogosyan, Gaynor, Eusebio, & Brown 2009). GLO participants may have experienced a reduction of motor affordance while viewing the condition, perhaps due to fewer physical affordances within the stimulus compared to the near-earth vantage of the FOC condition. The significant differences during the final minutes of the simulation are important. By the end of the simulation, the participants in both conditions are viewing similar images with similar affordances (or the lack thereof). If the beta changes are indicators of motor suppression, this would suggest that prior context has some influence on subsequent motor action.

Theta poses interesting interpretive challenges for studies involving quiet contemplation, like the present study, as it is associated with both meditation and sleep. The findings from the first experiment showed significant findings in theta activity, but we could not conclusively say whether these were the results of relaxed and thoughtful states or transitions to sleep. We are not alone in struggling with the interpretation of theta. In some cases, left hemisphere theta reduction has been recorded during hypnosis (Taddei-Ferretti & Musio 1999) and suggests an increase in cognitive effort. Theta changes have been associated with meditative states, though studies conflict on the directionality of the changes for certain types of meditation (Cahn & Polich 2006). The present study reduced the length of simulation time compared to the first experiment, hoping to reduce the likelihood of drowsiness. Even in the second experiment, however, drowsiness may explain the similar theta findings between groups as the simulation progressed, keeping in mind that for both conditions, the last few minutes were of a quiet, tranquil view of a slowly turning planet. The phenomenological interviews confirm that many participants felt relaxed, and even sleepy, by the end of the experiment. The conditions of the experiment were relaxing, with no audio stimulation, low lighting, and, according to most participants, pleasurable visuals. Future work should disentangle the phases between thoughtful relaxation and drowsiness as it pertains to the first-person articulation of experience.

FNIR measurements in the right frontal lobe also showed significant differences between FOC and GLO groups. Again, the key is the timing. In the first minute, the significant differences are to be expected. The images are different, with the FOC containing various familiar images that, during the interviews, participants said they recognized. Many participants who received the focal condition also reported looking for places, (e.g. trying to locate a girlfriend's apartment building or the route they take home). This type of engagement, or *gamification* could account for the differences in the frontal lobe behaviors, which are typically associated with executive function. Interviews from the GLO participants indicated a different sort of cognitive task, as they experienced a less familiar starting point. They started in darkness and the first landscape images were not familiar. The vantage was over a red-toned landscape of Africa, and some participants reported thinking they were on Mars. The lack of familiarity at this stage may have made it more difficult to engage cognitively (Tulving et al. 1996). A similar issue of novelty versus familiarity may explain the differences during the fourth minute as well. However, this trend appeared throughout the experiment, even though the significance was only

found during minutes one and four, suggesting an enduring effect of the initial contextual grounding on the subsequent frontal lobe behaviors.

Neurological responses to context differences between the FOC and GLO conditions indicate previously unexplored features of experience as it applies to the observation of Earth in a simulation environment. These findings suggest that the grounded context, the notion of coming from "home" and moving into space, increases the neurological behaviors associated with both attention and relaxation. As the astronaut reports indicated experiences of peace and beauty, it is possible that the types of neural processes observed during the experiment involve transitioning from the anxiety of launch into a state that allows for more positive spiritual and affective experiences while in space. Astronauts maintain a contextual awareness that they are leaving a specific location on earth and that they will return to a location. Results of the experiment suggest that contextual grounding is associated with differences in brain areas involved in attention, memory, and relaxation. However, while these findings begin to paint a picture of the neurological conditions associated with the experience of looking at Earth from space, they alone are not sufficient for describing the astronaut *experiences* of AWCH. To explore the nature of the spiritual and aesthetic experiences, these findings must be considered in their relationship to self-reports of the experiencers while viewing the simulation.

Complexities in perception and communication

To flesh out the fuller figure of AWCH, it is helpful to integrate information collected from the participants in the form of their survey results. The ESSE explicitly asked participants to report aspects of spirituality and AWCH; these reports were then correlated with both the results of the phenomenological interviews and the neurophysiological analysis. Among the more intriguing findings are the opposing correlative directions for visual processing-associated beta and theta behaviors in those who self-identified as "logical" rather than "spiritual" or "religious". Note that the participants were free to identify with every, or no, category; that is, for example, participants were not forced to choose between "spiritual" or "logical" – they could choose to self-identify as both logical and spiritual, or as neither. Consequently, the self-identifications correlated to neural processes are all the more intriguing. It seems that the spiritually inclined person not only sees the world differently in a figurative sense, but quite literally. A person who considers herself "spiritual" or "religious" will process the visual world differently on the neurophysiological level than a person who more strongly identifies as "logical".

This raises numerous questions for further study: Do other sensory modalities demonstrate such discrepancies (e.g. Does auditory processing vary in a similar pattern?). It also raises philosophical questions. If people who self-identify as more or less spiritual literally see things differently, do these differences scale up to have sociological and political implications? It will be valuable to replicate these findings. It is one thing to acknowledge that different cultures "see the world differently", but it is an entirely new realm for investigation to consider evidence implying that our diverse views of ourselves may be so closely bound to our different sensory experiences. Future work should examine questions of causality in this regard: Do I see the world differently because I am

a spiritual person? Alternatively, am I a spiritual person, because of the way I process visual information? Perhaps, in such matters, traditional notions of causality are not so relevant, and exploring such issues opens non-linear explanations for these relationships.

We can also ask what such self-perceptions say about the astronauts' experiences? One's self-identification as spiritual, religious, and/or logical is bound to one's historical circumstance and personal experience, inseparable from episodic memories, influenced by learned schemas and constructs, and by cultural practices. The neurological processes associated with experience are only *partially* the result of the immediate stimulus. A large portion of the experience has to do with those things beyond the experimenter's control, the things unique to each individual. However, being beyond the experimenter's control does not mean that they are beyond the experimenter's grasp. That is where the phenomenological interview rounds out the toolkit for exploring experience. The tools of psychology and neuroscience tell us much, but they fall short of describing the experiences in the depth and fullness required. The phenomenological interviews support a broader understanding, a dynamic image of experience, taking into account the complexities of individual differences.

In this case, the physiological and psychological findings are supported by the phenomenological examination, in that participants who self-identified as "logical" were significantly less likely to express themselves in spiritual terms. Consequently, the issue extends into the nature of the interview itself. If a speaker gives a personal account from his or her personal perspective, in a way, the listener is exposed to a worldview that is more or less "spiritual" in experiential terms and a worldview connected to the speaker's self-view. Self-identification may act as a type of perceptual filter or frame, not always recognized by others or even by ourselves. In the interview process, as in our interactions with others generally, differences in such frames may put up roadblocks to understanding, just as recognizing such differences may facilitate communication.

The self-described "logical" person may not only see something different, but also in conversation, invites the listener into a world that is shaped by that experience. The structure of the perceptual filter can shape the second-person interaction within the interview process and influence reception of the experience. In this regard, by way of further analysis, the ESSE and other questionnaires can help to understand the particular dynamics of the interview process. Neurophenomenology, supplemented with these additional measures, contributes to a ground-level mapping of these difficult and entangled aspects of experience and communication in an interactive world.

Methodological complexities

In the present study, the contributions toward the neurophenomenological project of understanding the structure of experience involve complexities in categorical components, relational factors, and the various disciplinary lenses that are used for such a study.

Categorical components

The hermeneutical-phenomenological analysis of the astronauts' reports and the phenomenological interviews clarified the experiential details and the language used to

represent and discuss the phenomena at hand – the AWCH experiences. The findings regarding awe showed a predictable connection between the ESSE's indications of awe and those interpreted in the transcript analyses. However, these relationships did not hold so tightly for the other constructs, such as wonder, curiosity. This should be regarded as a productive discrepancy that helps to point phenomenology in a certain direction by holding a light up to specific categories that can be refined further in the attempt to capture experience.

There are two possibilities for why the discrepancies between the psychological and phenomenological first-person accounts might occur. First, the psychological tool may be considered a blunt instrument, and a straight-forward question about AWCH may not provide the nuances involved in the hermeneutical categories; consequently, the constructs would not be as highly correlated. A second possibility is that there is ambiguity involved in the method of transcript analysis. Although the hermeneutic analyses were developed using inter-rater reliability methods, the interview transcripts were analyzed by single-rater experts. The use of expert evaluation has been validated across multiple fields, with highly successful results (Bevan 1995; Hardesty & Bearden 2004; Stufflebeam & Webster 1983), so the concern is not necessarily with the single-rater, but with the discrete scoring that the single rater method created in this circumstance. With multiple raters, the scores and values can be presented in ranges or averages, which could allow for more flexible statistical comparisons with the Likert-scale values used in the ESSE.

Further, the variances in experiential scale, as reported in the ESSE, suggest intensity is a factor in the ultimate experience. In future application, the interview analysis should include perceived intensity so that the categorical findings might be scaled. This would yield thresholds, so that experiential ranges may be more accurately identified. Intensity appears to be relevant to each category and subcategory of experience, even though it had been omitted from the hermeneutic models used. The present study contributes to the phenomenological project by highlighting the value of intensity in considerations of the structural aspects of experience.

The present study also contributes categorical guidance by highlighting nuanced differences between components of experience. For instance, people who articulated an experience of awe were significantly more likely have indicated experiencing humility on their psychological survey. A finding like this can be important. The articulation of the markers of awe may not have correlated to an articulation of humility, but that sense of humility was still present and became something reportable through the ESSE. As there had been no significant relationship between experiencers of awe and experiencers of humility in the ESSE alone, it is through the analysis of the two data sources together that the connection in the articulation of some constructs and the underlying experiences emerges. These combinatorial analyses help to refine the hermeneutic categories, but more importantly, they direct researchers for future exploration to consider more closely the conditions under which these related phenomena co-occur.

Finally, in regard to using the consensus categories to analyze the interviews, we discovered that there was at least one important aspect that the categories missed. In each case the category (and category judgment) was based on relatively well-formulated expressions of experience. In many cases, however, subjects had difficulty formulating or finding the right words to express the experience, and in some of these cases this inability reflected was is often regarded as the *ineffability* of experiences of awe and wonder. In some cases such instances were categorized as "being overwhelmed" to the extent that one could not find the words. Further analysis is required to identify all of the instances where positive categories did not sufficiently capture the expression of (or trouble in trying to express) such experiences.

Relational factors

It is one thing to recognize pieces of a whole, but that is not enough for a full understanding of the whole dynamically integrated phenomenon. Shifting to a discussion of the relationships between categories and measures can help to move us toward this full understanding.

The relationships between categories of experience and other measured factors indicate that experience is highly dynamic and expressed in different ways. An example comes from the integration of the TAS results regarding sensory absorption and the phenomenological groupings. Researchers use the TAS to capture the types of conditions that might elicit absorption, and the category of "sensory perceptual absorption" identifies sensory/perception conditions. Contrary to what one might assume, subjects who experienced aesthetic appreciation, awe, and/or humility scored significantly lower in sensory perceptual absorption. Methodologically, this may be a simple difference between what the metrics aim to measure and what they actually measure. This explanation could be explored by refining the metric, perhaps through isolating exclusively visual absorption (as opposed to multi-modal absorption) for visually-exclusive stimuli. However, the fact that none of the other absorption categories were flagged for significance should elicit caution before dismissing the use of the metric. One might also assume that a tendency toward "imaginative involvement" would play a role in the experience of viewing a simulation. The relationships between these constructs should be more closely examined to parse out the structural commonalities for AWCH.

A similar relational issue is raised by those AWCH experiencers (as identified in the phenomenological interviews) who self-identified as less "reflective" persons on the ESSE. For example, P4, demonstrated alpha-suppression, did not articulate AWCH experiences, and also identified as "reflective". What is the relationship between considering oneself reflective and a decreased likelihood of AWCH experiences? First, one must take seriously methodological points that should be addressed to validate these findings (e.g. replication, larger data samples). The data presented here can direct further phenomenological analysis into the role of metacognitive factors (like reflection) in real-time experience. Metacognition as a broad category was not part of the hermeneutic analysis from the original astronaut texts, but the current findings implicate contributions from neural correlates generally associated with working and episodic memory. Pieced together, meta-cognitive features from the psychological, physiological, and

phenomenological data sources can be used to create a clearer picture AWCH experiences.

These relational issues also suggest that the structure of experience may be, in part, a function of narrative capacity and implicit social norms. A "reflective" person may be more inclined to take time before articulating an experience, particularly to a stranger and especially in regard to experiences may be considered intimate or culturally charged, such as AWCH. Reflection, in and of itself, may interfere with immediate articulation, but might render a richer account over time.

Integrating lenses

The interviews did successfully indicate experiential data for analysis and the correlations with neurophysiological data indicate underlying mechanisms involved in the specific experiences. The AWCH experiencers identified by the interview analyses would not necessarily have been identified by the ESSE (a traditional type of psychological survey). The trends visible in the *individual differences* analyses of brain processes in correlation with the phenomenological reports of AWCH constructs revealed a compelling case for the role of alpha brain activity differences. Recent research links alpha processes to a gating or inhibition of areas not related to a task (Jensen & Mazaheri 2010; Klimesch, Sauseng & Hanslmayr 2007). The results indicate that the categories of AWCH can be used to cluster the participants into groups that coincide with distinct neural behaviors. In this case, the greater alpha-suppression rates in the AWCH experiencers may indicate the broader cortical activation required to synthesize consciousness, perception, and working memory. While the results of this form of analysis are not considered generalizable to the entire population, they suggest that some individuals may exploit the neural interactions facilitated by alpha suppression. The higher degree of neural interaction may be linked to the subsequent articulation of experience in terms of AWCH.

It cannot go unmentioned that some participants with high alpha suppression did not discuss their experiences in terms of AWCH. This is not surprising, as the picture of experience that has taken shape from this study is far more complex that a one-to-one physiological-phenomenological corollary. P4, who demonstrated alpha-suppression, but did not articulate AWCH experience during interview, indicated in the ESSE that he did experience wonder, curiosity, and humility. He also indicated on the ESSE that the simulation felt familiar, and self-identified as a "reflective" and "logical" person. Granted that experience is a multi-dimensional phenomenon, the information on P4's experience collected from these three (neurological, phenomenological and psychological) lenses fits a complex model. In addition, alpha oscillations are implicated in active processing related to memory maintenance (Palva & Palva 2007). Knowing that P4 experienced familiarity (a demand on memory) may also help to explain the alpha findings. There is also a difference between *experiencing* and *articulating* experience. P4's self-identification as logical and reflective may actually decrease the likeliness for articulations of AWCH (see discussion of metacognition above). Accordingly, while the phenomenological interview can be a powerful tool, and it successfully led to clusters of data otherwise not available, like the other lenses, it is optimized through integration with other tools and measures.