Appendix: The Experiment-Specific Survey of Experience (ESSE)

Experiment-Specific Survey of Experience

Please answer each of the questions to your best ability.

STOP! The research assistant must verify that your PARTICIPANT IDENTIFICATION NUMBER is entered correctly.

Demographics Questionnaire for *Viewing Earth from Space: First-Person Experiences*
What is your sex?

- ◯ Male
- ◯ Female

What is your age?

What is the HIGHEST level of education you have COMPLETED?

- ◯ High School
- ◯ Associates Degree or 2 years of College/University
- ◯ Bachelors Degree
- ◯ Masters Degree
- ◯ Doctoral Degree

When did you use computers in your education? *Select all that apply.*

- ☐ Preschool
- ☐ Grade School
- ☐ Junior High/ Middle School
- ☐ High School
- ☐ Technical School
- ☐ College
- ☐ Did not use

What is your major?

What is your minor? Please enter "NA" if you don't have one.

Are you in your usual state of physical health?

- ◯ Yes
- ◯ No (please explain)

Where do you currently use a computer? *Select all that apply.*

- ☐ Home
- ☐ Work
- ☐ Library
- ☐ Other (specify)
- ☐ Do not use

Is English your native (first) language?

- ◯ Yes
- ◯ No

At what age did you begin speaking English?

Would you consider yourself a fluent speaker of English?

- ◯ Yes
- ◯ No

Would you consider yourself a fluent reader of English?

- ◯ Yes
- ◯ No

Do you typically understand spoken English without difficulty?

- ◯ Yes
- ◯ No

What was your first language?

How many hours per day do you spend WORKING on a computer?

- ◯ 0
- ◯ <1
- ◯ 1–2
- ◯ 3–4
- ◯ 4–5
- ◯ 5–6
- ◯ 7+

How many hours per day do you spend READING?

- ◯ 0
- ◯ <1
- ◯ 1–2
- ◯ 3–4
- ◯ 5–6
- ◯ 7+

How many hours per day do you spend WATCHING TV?

- ◯ 0
- ◯ <1
- ◯ 1–2
- ◯ 3–4
- ◯ 5–6
- ◯ 7+

Approximately how many hours of sleep did you get last night?

Which of the following best describes your expertise with computers?

- ○ Novice
- ○ Good with one type of software package (such as word processing or slide shows)
- ○ Good with several software packages
- ○ Can program in one language and use several software packages
- ○ Can program in several languages and use several software packages

How often do you ...	Never	Less than Once a Month	Once a Month	2–3 Times a Month	Once a Week	2–3 Times a Week	Daily
Use graphics or drawing features in software packages?	○	○	○	○	○	○	○
Go to movies?	○	○	○	○	○	○	○
Watch IMAX or surround-screen movies?	○	○	○	○	○	○	○
Go to theme parks/ amusement parks?	○	○	○	○	○	○	○
Play video/computer games?	○	○	○	○	○	○	○
Visit a museum?	○	○	○	○	○	○	○
Visit a planetarium?	○	○	○	○	○	○	○
Attend faith-based or religious activities?	○	○	○	○	○	○	○

Which types of computer/video games do you most often play? *Select all that apply.*

- ☐ Action (First person shooter, fighting, etc.)
- ☐ Adventure, Real-time 3D
- ☐ Role Playing (including MMOs)
- ☐ Simulation (Sims, Civilization, etc.)
- ☐ Strategy/Puzzle
- ☐ Party, dance, or music
- ☐ Sports
- ☐ Other

When you do PLAY VIDEO GAMES, how many hours per day do you spend?

- ○ 0
- ○ <1
- ○ 1–2
- ○ 3–4
- ○ 5–6
- ○ 7+

Which of the following amusement/entertainment sites have you visited?

- ☐ Disney parks (i.e. Disneyworld, Disneyland, Euro-Disney)
- ☐ Disney Quest
- ☐ Universal Studios/ Islands of Adventure
- ☐ Kennedy Space Center
- ☐ Busch Gardens
- ☐ Sea World
- ☐ Six Flags

Rank your own level of competency with graphics or drawing software.

	Minimal skill or experience	Moderate skill level	Advanced or professional level of skill in at least one graphic or drawing software
My level of experience/ competency with graphic software is ...	○	○	○

STOP!

You have completed the demographic portion of this questionnaire. Wait for the research assistant to give you further instructions. Research Assistant Code

The Research Assistant will read the following aloud. Wait until it is read before continuing:

The following questions will help us interpret the results from your interview and physical readings more accurately. We will be looking especially at indicators of emotional experiences. To help you describe your experience, we ask that you make the following distinctions:

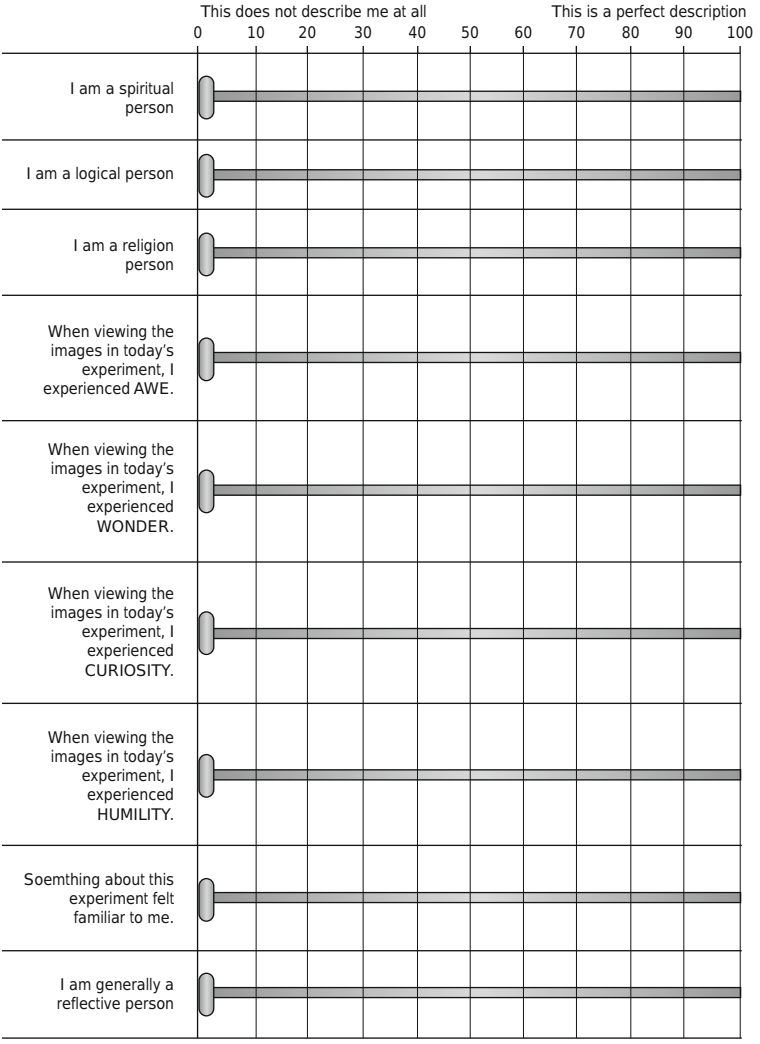
When we use the word AWE, we mean: *a direct and initial feeling when faced with something incomprehensible or sublime*.

When we use the word WONDER, we mean: *a more reflective feeling one has when unable to put things back into a familiar conceptual framework*.

When we use the word CURIOSITY, we mean: *wanting to know*, see, experience, understand more. When we use the word HUMILITY, we mean: a sensation about *one's relation to the universe or one's significance*.

While there may be other ways to use these terms, these are the definitions we are using in the following questions.

Use the sliding scale to show the degree to which each statement describes you.



Which best describes your experience? I experienced AWE the MOST when viewing...

- ◯ close images of the Earth (toward the beginning of the video).
- ◯ distant images of the Earth (toward the end of the video).
- ◯ the images of the geometric shape.

Which best describes your experience? I experienced WONDER the MOST when viewing...

- ◯ close images of the Earth (toward the beginning of the video).
- ◯ distant images of the Earth (toward the end of the video).
- ◯ the images of the geometric shape.

Which best describes your experience? I experienced CURIOSITY the MOST when viewing...

- ◯ close images of the Earth (toward the beginning of the video).
- ◯ distant images of the Earth (toward the end of the video).
- ◯ the images of the geometric shape.

Which best describes your experience? I experienced HUMILITY the MOST when viewing...

- ◯ close images of the Earth (toward the beginning of the video).
- ◯ distant images of the Earth (toward the end of the video).
- ◯ the images of the geometric shape.

References

Baigrie, B. S. (ed.) 1996. *Picturing Knowledge. Historical and Philosophical Problems Concerning the Use of Art in Science*. Toronto: University of Toronto Press.

Barber, S. 2012. *Muybridge: The Eye in Motion*. Washington, DC: Solar.

Bauermeister, M. 1964. The effect of body tilt on apparent verticality, apparent body position and their relation. *Journal of Experimental Psychology* 67, 142–147.

Bayne, T. 2004. Closing the gap? Some questions for neurophenomenology. *Phenomenology and the Cognitive Sciences* 3(4), 349–364.

Bechara, A., Damasio, H., Tranel, D. and Damasio, A. R. 1997. Deciding advantageously before knowing the advantageous strategy. *Science* 275 (5304), 1293–1295.

Bickle, J. 2003. *Philosophy and Neuroscience: A Ruthlessly Reductive Account*. Boston: Kluwer Academic.

Biddle, W. 2009. *Dark Side of the Moon: Wernher von Braun, the Third Reich, and the Space Race*. New York: WW Norton & Company.

Bockelman, P. S. 2013. *Neurophenomenological Methods: Experiences of Earth and Space in Simulation* (Unpublished doctoral dissertation). University of Central Florida, Orlando, Florida.

Bockelman, P., Reinerman-Jones, L. and Gallagher, S. 2013. Methodological lessons in neurophenomenology: review of a baseline study and recommendations for research approaches. *Frontiers in Human Neuroscience*, 7, 608. doi:10.3389/fnhum.2013.00608

Bonnefond, M. and Jensen, O. 2012. Alpha oscillations serve to protect working memory maintenance against anticipated distracters. *Current Biology* 22(20), 1969–1974. doi:10.1016/j.cub.2012.08.029

Bonner, E. T. and Friedman, H. L. 2011. A conceptual clarification of the experience of awe: an interpretative phenomenological analysis. *Humanistic Psychologist*, 39(3), 222–235.

Bono, M. 2011. *Thomas Ruff: Stellar Landscapes*. Heidelberg: Kehrer.

Brand, S. 2009. Photography changes our relationship to our planet. Smithsonian Photography Initiative. Cited at http://en.wikipedia.org/wiki/Stewart_Brand.

Bredekamp, H. 2011. Blue marble: der blaue Planet. In C. Markschies, I. Reichle, J. Brüning and P. Deuflhard (eds) *Atlas der Weltbilder* (366–375). Berlin: Akademie-Verlag .

Bulkeley, K. 2002. The evolution of wonder: religious and neuroscientific perspectives. Paper presented at the annual meeting of the American Academy of Religion, Toronto, Canada (November 2002).

Byers, B. K. 1977. *Destination Moon: A History of the Lunar Orbiter Program*. NASA Technical Memorandum X-3487. Washington, DC: NASA History Office.

Cacioppo, J. T. and Petty, R. E. 1982. The need for cognition. *Journal of Personality and Social Psychology* 42(1), 116–131.

Cahn, B. and Polich, J. 2006. Meditation states and traits: EEG, ERP, and neuroimaging studies. *Psychological Bulletin* 132(2), 180–211.

Cannon-Bowers J. A., Salas E. and Converse S. 1993. Shared mental models in expert team decision making. In N. J. Castellan Jr. (ed.) *Individual and Group Decision Making: Current Issues* (221–246). Hillsdale, NJ: Lawrence Erlbaum Associates.

Carnap, R. 1934. *The Unity of Science*, London: Kegan Paul, Trench, Trubner, and Co.

Carpenter, S. 1962. *We Seven: By the Astronauts Themselves*. New York: Simon and Schuster.

Chalmers D. J. 1995. Facing up to the problem of consciousness. *Journal of Consciousness Studies* 2(3), 200–219.

Chemero, A. 2009. *Radical Embodied Cognitive Science*. Cambridge, MA: MIT Press.

Cheron, G., Leroy, A., Palmero-Soler, E., De Saedeleer, C., Bengoetxea, A., Cebolla, A. M., Vidal, M., Dan, B., Berthoz, A. and McIntyre, J. 2014. Gravity influences top-down signals in visual processing. *PloS One* 9(1), e82371.

Chiel, H. and Beer, R. 1997. The brain has a body: adaptive behavior emerges from interactions of nervous system, body and environment. *Trends in Neuroscience* 20, 553–557.

Chudleigh, M. 1703. *Poems on Several Occasions. Together with the Song of the Three Children Paraphras'd*. London: Bernard Lintott at the Middle Temple Gate in Fleetstreet. pp. 161–162.

Churchland, P. S. 2011. *Braintrust: What Neuroscience Tells Us about Morality*. Princeton: Princeton University Press.

Churchland, P. S. 2013. *Touching a Nerve: Our Brains, Our Selves*. New York: WW Norton & Company.

Churchland, P. S. Ramachandran, V. S. and Sejnowski, T. J. 1994. A critique of pure vision. In C. Koch and J. L. Davis (eds) *Large-scale Neuronal Theories of the Brain*. Cambridge, MA: MIT Press.

Clark, A. 1997. *Being There*. Cambridge, MA: MIT Press

Clark, A. 1999. An embodied cognitive science? *Trends in Cognitive Sciences* 3(9), 345–351.

Clark, A. 2008a. *Supersizing the Mind: Reflections on Embodiment, Action, and Cognitive Extension*. Oxford: Oxford University Press.

Clark, A. 2008b. Pressing the flesh: a tension on the study of the embodied, embedded mind. *Philosophy and Phenomenological Research* 76, 37–59.

Clark, A. and Chalmers, D. 1998. The extended mind. *Analysis* 56(1), 7–19.

Clarke, A. C. 1973. *Profiles of the Future: An Enquiry into the Limits of the Possible*. 2nd Ed. London: Phoenix.

Clément, G. 1998. Alteration of eye movements and motion perception in microgravity. *Brain Research Reviews* 28(1), 161–172.

Clément, G., Lathan, C., and Lockerd, A. 2008. Perception of depth in microgravity during parabolic flight. *Acta Astronautica* 63(7), 828–832.

Clément, G. and Reschke, M. F. 2008. *Neuroscience in Space*. New York: Springer.

Coltheart, M. 1981. The MRC psycholinguistic database quarterly. *Journal of Experimental Psychology* 33A, 497–505.

Crick, F. 1995. *The Astonishing Hypothesis: The Scientific Search for the Soul*. New York: Simon and Schuster.

Damasio, A. 1994. *Descartes Error: Emotion, Reason, and the Human Brain*. New York: G. P. Putnam.

Danziger, S., Levav, J. and Avnaim-Pesso, L. 2011. Extraneous factors in judicial decisions. *Proceedings of the National Academy of Sciences* 108(17), 6889–6892.

Daston, L. and Galison, P. 2007. *Objectivity*. New York: Zone Books.

De Jaegher, H. and Di Paolo, E. 2007. Participatory sense-making: an enactive approach to social cognition. *Phenomenology and the Cognitive Sciences* 6, 485–507.

De Jaegher, H., Di Paulo, E. and Gallagher, S. 2010. Can social interaction constitute social cognition? *Trends in Cognitive Sciences* 14(10), 441–447

Dennett, D. C. 1989. *The Intentional Stance*. Cambridge, MA: MIT press.

Dennett, D. C. 1991. *Consciousness Explained*. Boston: Little, Brown, and Co.

De Toffol, B., Autret, A., Degiovanni, E. and Roux, S. 1990. Spectral analysis of the EEG (alpha rhythm) and activity in the left hemisphere: the effects of lateral gaze. *Neuropsychologia*, 28(8), 879–882.

Dewey, J. 1916. *Democracy and Education*. Carbondale: Southern Illinois University Press, 1985.

Didonna, F. (ed.) 2009. *Clinical Handbook of Mindfulness*. Berlin: Springer.

Dirican, A. C., and Göktürk, M. 2011. Psychophysiological measures of human cognitive states applied in human computer interaction. *Procedia Computer Science* 3, 1361–1367.

Dominey, P. F., Prescott, T., Bohg, J., Engel, A. K., Gallagher, S. Heed, T., Hoffmann, M., Knoblich, G., Prinz, W. and Schwartz, A. (in press). Implications of action-oriented paradigm shifts in cognitive science. In A. K. Engel, K. Friston, and D. Kragic (eds), *Where's the Action? The Pragmatic Turn in Cognitive Science*. Cambridge, MA: MIT Press.

Douy, M. and Douy, J. 1993. *Décors de Cinéma: Les Studios Français de Méliès À Nos Jours*. Paris: Éd. du Collectionneur.

Dukes, S. 1984. Phenomenological methodology in the human sciences. *Journal of Religion and Health* 23(3), 197–203.

Eisler, C. 2002. La 'Tempesta' di Giorgione: Il primo 'Capriccio' della pittura Veneziana. *Arte Veneta: Rivista Di Storia Dell'arte* 59, 84–97.

Ekman, P. 1992. An argument for basic emotions. *Cognition and Emotion* 6, 169–200.

Elias, J. and Fiore, S. M. 2012. Commenary on the coordinates of coordination and collaboration. In Salas, Eduardo, Stephen M. Fiore and Michael P. Letsky (eds) *Theories of Team Cognition: Cross-disciplinary Perspectives* (571–596). London: Routledge.

Emmons, R. A. 2005. Emotion and religion. In R. F. Paloutzian and C. L. Park (eds) *Handbook of the Psychology of Religion and Spirituality* (235–252). New York: Guilford Press.

Fellbaum, C. (ed.) 1998. *WordNet: An Electronic Lexical Database*. Cambridge, MA: MIT Press.

Flanagan, O. J. 1992. *Consciousness Reconsidered*. Cambridge, MA: MIT Press.

Flew, A. G. N. 1966. *God and Philosophy*. London: Hutchinson

Fuller, R. C. 2009. *Wonder: From Emotion to Spirituality*. The University of North Carolina Press.

Gadamer, H.-G. 1989. *Truth and Method*. 2nd ed. London: Sheed and Ward.

Galileo G. 1632. *Dialogue Concerning the Two Chief World Systems*: *Ptolemaic & Copernican*. Berkeley: University of California Press, 1953.

Gallagher, S. 1992. *Hermeneutics and Education*. Albany: State University of New York Press.
Gallagher, S. 2003. Phenomenology and experimental design. *Journal of Consciousness Studies* 10 (9–10), 85–99.
Gallagher, S. 2004. Hermeneutics and the cognitive sciences. *Journal of Consciousness Studies* 11 (10–11), 162–174.
Gallagher, S. 2005. *How the Body Shapes the Mind*. Oxford: Oxford University Press.
Gallagher, S. 2007. Neurophilosophy and neurophenomenology. In L. Embree and T. Nenon (eds) *Phenomenology 2005* Vol. 5. (293–316). Bucharest: Zeta Press.
Gallagher, S. 2008. Direct perception in the intersubjective context. *Consciousness and Cognition* 17(2), 535–543.
Gallagher, S. 2009. Two problems of intersubjectivity. *Journal of Consciousness Studies* 16, 298–308.
Gallagher, S. 2013. The socially extended mind. *Cognitive Systems Research* 25–26, 4–12.
Gallagher, S. (in press). Do we (or our brains) actively represent *or* enactively engage with the world? In A. K. Engel, K. Friston, and D. Kragic (eds.), *Where's the Action? The Pragmatic Turn in Cognitive Science*. Cambridge, MA: MIT Press.
Gallagher, S. and Aguda, B. 2015. The embodied phenomenology of phenomenology. *Journal of Consciousness Studies* 22(3–4): 93–107.
Gallagher, S. and Bower, M. 2014. Making enactivism even more embodied? *AVANT/Trends in Interdisciplinary Studies* (Poland) 5(2), 232–247.
Gallagher, S. and Brøsted Sørensen, J. 2006. Experimenting with phenomenology. *Consciousness and Cognition* 15(1), 119–134.
Gallagher, S., Reinerman, L., Sollins, B. and Janz, B. 2014. Using a simulated environment to investigate experiences reported during space travel. *Theoretical Issues in Ergonomic Sciences* 15(4), 376–394.
Gallagher, S. and Varela, F. J. 2003. Redrawing the map and resetting the time: phenomenology and the cognitive sciences. *Canadian Journal of Philosophy. Supplementary Volume* 29, 93–132.
Gallagher, S. and Varga, S. 2014. Social constraints on the direct perception of emotions and intentions. *Topoi* 33, 185–199.
Gallagher, S. and Zahavi, D. 2012. *The Phenomenological Mind*. London: Routledge.
Gallese, V. 2014. Bodily selves in relation: embodied simulation as second-person perspective on intersubjectivity. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 369(1644), DOI: 10.1098/rstb.2013.0177.
Galsion, P. and Jones, C. A. (eds) 1998. *Picturing Science, Producing Art*. New York/London: Routledge.
Geppert, A. C. T. (ed.) 2012. *Imagining Outer Space*. Basingstoke: Palgrave Macmillan.
Gevins, A., Smith, M. E., McEvoy, L. and Yu, D. 1997. High-resolution EEG mapping of cortical activation related to working memory: effects of task difficulty, type of processing, and practice. *Cerebral Cortex* 7(4), 374–385.
Gevins, A. S., Yeager, C. L., Diamond, S. L., Spire, J., Zeitlin, G. M., and Gevins, A. H. 1975. Automated analysis of the electrical activity of the human brain (EEG): a progress report. *Proceedings of the IEEE* 63(10), 1382–1399.

Gibson, J. J. 1977. The theory of affordances. In J.J. Gieseking, W. Mangold, C. Katz, S. Low, S. Saegert (eds) *The People, Place, and Space Reader* (56–60). Hilldale, NJ: Lawrence Erlbaum.

Gibson, J. J. 2013. *The Ecological Approach to Visual Perception*. New York: Psychology Press.

Goldman, A. I. 2012. A moderate approach to embodied cognitive science. *Review of Philosophy and Psychology* 3(1), 71–88.

Graesser, A. C., McNamara, D. S., Louwerse, M. M. and Cai, Z. 2004. Coh-Metrix: analysis of text on cohesion and language. *Behavior Research Methods, Instruments, and Computers* 36, 193–202.

Harris, C. S. 1965. Perceptual adaptation to inverted, reversed, and displaced vision. *Psychological Review* 72, 419–444.

Harris, L. R., Jenkin, M., Jenkin, H., Dyde, R., Zacher, J. and Allison, R. S. 2010. The unassisted visual system on earth and in space. *J Vestibular Research* 20, 25–30.

Hartl, G. and Sicka, C. 2005 Komposition oder Abbild? Die Darstellung des Nachhimmels in Adam Elsheimers Flucht nach Ägypten – eine naturwissenschaftlich-kritische Betrachtung. In R. Baumstark, M. Dekiert and W. Augustyn (eds) *Von Neuen Sternen: Adam Elsheimers* Flucht Nach Ägypten (107–125). München [u.a.]: Pinakothek-DuMont.

Haugeland, J. 1985. *Artificial Intelligence: The Very Idea*. Cambridge, MA: MIT Press.

Heidegger, M. 1992. *Parmenides*. Trans. A. Schuwer and R. Rojcewicz. Bloomington: Indiana University Press.

Hügel, F. von. 1908. *The Mystical Element of Religion: As Studied in Saint Catherine of Genoa and Her Friends*. 2 vols. London: J. M. Dent & Co.

Hurley, S. 1998. *Consciousness in Action*. Cambridge, MA: Harvard University Press.

Husserl, E. 1970. *The Crisis of the European Sciences and Transcendental Phenomenology*. Evanston, IN: Northwestern University Press.

Husserl, E. 2012. *Ideas: General Introduction to Pure Phenomenology*. London: Routledge.

Idler, E. L., Musick, M. A., Ellison, C. G., George, L. K., Krause, N. and Williams, D. R. 2003. Measuring multiple dimensions of religion and spirituality for health research. *Research on Aging* 25, 327–365.

Ishihara, S. 2010. *Ishihara's Tests for Colour Deficiency*. 14 Plate Book Concise Edition (1st ed.) Graham-Field.

James, W. 1890. *The Principles of Psychology. 2 Vols*. New York: Dover 1950.

Keltner, D. and Haidt, J. 2003. Approaching awe, a moral, spiritual, and aesthetic emotion. *Cognition & Emotion* 17(2), 297.

Kennedy, R. S., Lane, N. E., Berbaum, K. S. and Lilienthal, M. G. 1993. Simulator sickness questionnaire: an enhanced method for quantifying simulator sickness. *International Journal of Aviation Psychology* 3(3), 203–220.

Kingwell, M. 2000. Husserl's sense of wonder. *The Philosophical Forum* 31(1), 85–107.

Kozin, A. V. 2007. Iconic wonder: Pavel Florensky's phenomenology of the face. *Studies in Eastern European Thought* (59), 293–308.

Kramer, L. A., Sargsyan, A. E., Hasan, K. M., Polk, J. D. and Hamilton, D. R. 2012. Orbital and intracranial effects of microgravity: findings at 3-T MR Imaging. *Radiology* 263(3), 819–827.

Le Van Quyen, M. and Petitmengin, C. 2002. Neuronal dynamics and conscious experience: an example of reciprocal causation before epileptic seizures. *Phenomenology and the Cognitive Sciences* 1(2), 169–180. doi:10.1023/A:1020364003336

López-Alegría, M. 2014. Looking down at the earth. In M. Najjar (ed.) *Outer Space* (68–90). Berlin Distanz Verlag.

Lovelock, J. 2000. *Gaia: A New Look at Life on Earth*. Oxford: Oxford University Press.

Lutz, A. 2002. Toward a neurophenomenology as an account of generative passages: a first empirical case study. *Phenomenology and the Cognitive Sciences* 1, 133–167.

Lutz, A., Lachaux J. -P., Martinerie J. and Varela F. J. 2002. Guiding the study of brain dynamics by using first-person data: synchrony patterns correlate with ongoing conscious states during a simple visual task. Proceedings of the National Academy of Sciences 99, 1586–1591

Lutz, A. and Thompson, E. 2003. Neurophenomenology integrating subjective experience and brain dynamics in the neuroscience of consciousness. *Journal of Consciousness Studies* 10(9–10), 31–52.

Mader, T. H., Gibson, C. R., Pass, A. F., Kramer, L. A., Lee, A. G., Fogarty, J., Tarver, W. J. et al. 2011. Optic disc edema, globe flattening, choroidal folds, and hyperopic shifts observed in astronauts after long-duration space flight. *Ophthalmology* 118(10), 2058–2069.

Magnus, A. 1988. *Super Dionysii Mysticam Theologiam*. Translated in *Albert and Thomas: Selected Writings*, S. Tugwell (trans.). New York: Paulist Press.

Makarchouk, N. E., Maksimovich, K. Y., Kravchenko, V. I., and Kryzhanovskii, S. A. 2011. Modifications of EEG activity related to perception of emotionally colored, erotic, and neutral pictures in women during different phases of the ovulatory (menstrual) cycle. *Neurophysiology* 42(5), 362–370.

Mallis, M. M. and DeRoshia, C. W. 2005. Circadian rhythms, sleep, and performance in space. *Aviation, Space, and Environmental Medicine*, 76(Supplement 1), B94–B107.

Masters, K. S. 2013. Brief multidimensional measure of religiousness/spirituality (BMMRS). In *Encyclopedia of Behavioral Medicine* (267–269). New York: Springer.

Masters, K. S., Carey, K. B., Maisto, S. A., Caldweel, P. E., Wolfe, T. V., Hackney, H. L., France, C. R. and Himawan, L. 2009. Psychometric examination of the brief multidimensional measure of religiousness/spirituality among college students. *International Journal for the Psychology of Religion* 19, 106–120.

Mayer, H. 2011. A short chronology of spaceflight. In C. Brünner and A. Soucek (eds) *Outer Space in Society, Politics and Law* (20–29). Vienna and New York.

McClain, D. L. 2009. Evidence of the properties of an ambiguity tolerance measure: the Multiple Stimulus Types Ambiguity Tolerance Scale-II (MSTAT-II). *Psychological Reports* 105(3), 975–988.

McDonald, J. D. 2008. Measuring personality constructs: the advantages and disadvantages of self-reports, informant reports and behavioural assessments. *Enquire* 1, 1–18.

McGivern, P. 2008. Reductive levels and multi-scale structure. *Synthese* 165(1), 53–75.

McIndoo, J. M. 1914. Instinct as Related to Education. PhD Dissertation, Clark University. Worcester, MA.

Mclain, D. L. 1993. The Mstat-I: a new measure of an individual's tolerance for ambiguity. *Educational and Psychological Measurement* 53, 183–189.
Melzack, R. and Wall, P. D. 1967. Pain mechanisms: a new theory. *Survey Instinct as Rrelated to Educationof Anesthesiology* 11(2), 89–90.
Merleau-Ponty, M. 1964. *The Structure of Behavior*. Trans. A. L. Fisher. Boston: Beacon Press.
Merleau-Ponty, M. 1968. *The Visible and the Invisible*. Trans. A. Lingis. Evanston: Northwestern University Press.
Merleau-Ponty, M. 2012. *Phenomenology of Perception*. Trans. D. A. Landes. London: Routledge.
Metzinger, T. 2004. *Being No One: The Self-Model Theory of Subjectivity*. Cambridge, MA: MIT Press.
Miller, G. A, Beckwith, R., Fellbaum, C., Gross, D. and Miller, K. 1990. Five papers on WordNet. Report No. 43. Princeton, NJ: Cognitive Science Laboratory, Princeton University.
Mitchell, S. D. 2002. Integrative pluralism. *Biology and Philosophy* 17(1), 55–70.
Mühling, M. 2008. *The Space that Time Forgot: Angela Bulloch, Städtische Galerie Im Lenbachhaus Und Kunstbau, München*. Köln: König.
Nagel, T. 1974. What is it like to be a bat? *The Philosophical Review* 83(4), 435–450.
NASA *Science News*. 2001. Mixed up in space. At http://science.nasa.gov/science-news/science-at-nasa/2001/ast07aug_1/.
Nicogossian, A. E. and Parker Jr, J. F. 1982. *Space Physiology and Medicine* (No. N-8325349; NASA-SP-447). National Aeronautics and Space Administration, Washington, DC (USA).
Neger, T. and Soucek, A. 2011. Space faring: a short overview of the present situation (2.4.1 The space race after WWII). In C. Brünner and A. Soucek (eds) *Outer Space in Society, Politics and Law* (157–159). Vienna and New York.
Newberg, A. B. 1994. Changes in the central nervous system and their clinical correlates during long-term spaceflight. *Aviation, Space, and Environmental Medicine* 65(6), 562–572.
Newberg, A. B. and Newberg, S. K. 2005. The neuropsychology of religious and spiritual experience. In R. F. Paloutzian and C. L. Park (eds) *Handbook of the Psychology of Religion and Spirituality* (199–215). New York: Guilford Press.
Newell, C. L. 2013. The strange case of Dr. von Braun and Mr. Disney: Frontierland, Tomorrowland, and America's final frontier. *Journal of Religion and Popular Culture* 3, 416.
Noë, A. 2004. *Action in Perception*. Cambridge, MA: MIT Press.
Novak, J. D. and Cañas, A. J. 2006. The theory underlying concept maps and how to construct them. *Florida Institute for Human and Machine Cognition, 1*. Technical Report IHMC CmapTools 2006–2001
Oppenheim, P. and Putnam, H. H. 1958. Unity of science as a working hypothesis. *Minnesota Studies in the Philosophy of Science* 2, 3–36.
O'Regan, K. and Noë, A. 2001. A sensorimotor account of vision and visual consciousness. *Behavioral and Brain Sciences* 23, 939–973.
Osborne, L. 1997. *The New Vision of the Earth*. Cocoa, FL: Theater 360, Brevard Community College.
Paulhus, D. L. and Vazire, S. 2009. The self-report method. In R.W. Robins, R. C. Fraley and R. F. Krueger (eds) *Handbook of Research Methods in Personality Psychology* (224–239). New York: Guilford Press.

Paus, T. and Zatorre, R. J. 1997. Time-related changes in neural systems underlying attention and arousal during the performance of an auditory vigilance task. *Journal of Cognitive Neuroscience* 9(3), 392.

Penrose, R. 1999. *The Emperor's New Mind: Concerning Computers, Minds, and the Laws of Physics*. Oxford: Oxford University Press.

Pepper, K. 2014. Do sensorimotor dynamics extend the conscious mind? *Adaptive Behavior* 22(2), 99–108.

Petitmengin C. 2006. Describing one's subjective experience in the second person: an interview method for the science of consciousness. *Phenomenology and the Cognitive Sciences* 5, 229–269

Petitmengin, C. 2010. A neurophenomenological study of epileptic seizure anticipation. In S. Gallagher and D. Schmicking (eds) *Handbook of Phenomenology and Cognitive Science* (471–499). Springer Netherlands.

Petitot J., Varela, F., Roy, J-M. and Pachoud, B. 1999. *Naturalizing Phenomenology: Issues in Contemporary Phenomenology and Cognitive Science*. Stanford, CA: Stanford University Press

Pfurtscheller, G. and Lopes da Silva, F. H. 1999. Event-related EEG/MEG synchronization and desynchronization: basic principles. *Clinical Neurophysiology* 110(11), 1842–1857.

Pogosyan, A., Gaynor, L. D., Eusebio, A. and Brown, P. 2009. Boosting cortical activity at beta-band frequencies slows movement in humans. *Current Biology* 19(19), 1637–1641. doi:10.1016/j.cub.2009.07.074

Prinzel, L. J., Freeman, F. G., Scerbo, M. W., Mikulka, P. J. and Pope, A. T. 2000. A closed-loop system for examining psychophysiological measures for adaptive task allocation. *The International Journal of Aviation Psychology* 10(4), 393–410.

Reddy, V. 2008. *How Infants Know Minds*. Cambridge, MA: Harvard University Press.

Reinerman-Jones, L. E., Matthews, G., Langheim, L. K. and Warm, J. S. 2010. Selection for vigilance assignments: a review and proposed new directions. *Theoretical Issues in Ergonomics Science* 1–24.

Reinerman-Jones, L. E., Sollins, B., Gallagher, S. and Janz, B. 2013. Neurophenomenology: an integrated approach to exploring awe and wonder. *South African Journal of Philosophy* 32 (4), 295–309.

Rieth, A. 1953. *Der Blitz in der bildenden Kunst*, München: Heimeran

Rock, I. and Harris, C. S. 1967. Vision and touch. *Scientific American*, 216(5), 96–104.

Roll, J-P. and Roll, R. 1988. From eye to foot: a proprioceptive chain involved in postural control. In G. Amblard, A. Berthoz, and F. Clarac (eds) *Posture and Gait: Development, Adaptation, and Modulation* (155–164). Amsterdam: Excerpta Medica.

Rowlands, M. 2010. *The New Science of the Mind*. Cambridge, MA: MIT Press.

Schacter, D. L. 1977. EEG theta waves and psychological phenomena: a review and analysis. *Biological Psychology* 5(1), 47–82.

Shapiro, L. A. 2004. *The Mind Incarnate*. Cambridge, MA: MIT Press.

Sherman, W. R. and Craig, A. B. 2002. *Understanding Virtual Reality: Interface, Application, and Design*, 1st Edn. San Francisco, CA: Morgan Kaufmann.Sherman W. R., Craig A. B. (2002). *Understanding Virtual Reality: Interface, Application, and Design*, 1st Edn. San Francisco, CA: Morgan Kaufmann

Shiota, M. N., Keltner, D. and Mossman, A. 2007. The nature of awe: elicitors, appraisals, and effects on self-concept. *Cognition & Emotion* 21(5), 944–963

Smith, M. E., Gevins, A., Brown, H., Karnik, A. and Du, R. 2001. Monitoring task loading with multivariate EEG measures during complex forms of human-computer interaction. *Human Factors* 43(3), 366–380.

Spinoza, de B. 1970. *Ethics*. J. Gutmann (ed.) New York: Simon and Schuster.

Steinbock, A. 2007. *Phenomenology and Mysticism: The Verticality of Religious Experience*. Bloomington: Indiana University Press.

Straus, E. 1966. *Philosophical Psychology*. New York: Basic Books.

Strollo, F. 1999. Hormonal changes in humans during spaceflight. *Adv Space Biol Med* 7(2), 99–129.

Sutton, J., Harris, C. B., Keil, P. G. and Barnier, A. J. 2010. The psychology of memory, extended cognition, and socially distributed remembering. *Phenomenology and the Cognitive Sciences* 9(4), 521–560.

Taddei-Ferretti, C. and Musio, C. 1999. The neural net of Hydra and the modulation of its periodic activity. In J. Mira and J. V. Sánchez-Andrés (eds) *Foundations and Tools for Neural Modeling* 1606 (123–137). Berlin: Springer.

Task H. L. and Genco L. V. 1987. Effects of short-term space flight on several visual functions. In B. W. Bungo, T. M. Bagian, M. A. Bowman and B. M. Levitan (eds), Results of the bye sciences DSOs conducted aboard the space shuttle 1981–1986. NASA Technical Memorandum 58280, p. 173

Taylor, C. 1985. *Human Agency and Language*. Cambridge: Cambridge University Press.

Tellegen, A. and Atkinson, G. 1974. Openness to absorbing and self-altering experiences ('absorption'), a trait related to hypnotic susceptibility. *Journal of Abnormal Psychology* 83, 268–277. doi:10.1037/h0036681

Thompson, E. 2007. *Mind in Life: Biology, Phenomenology and the Sciences of Mind*, Cambridge, MA: Harvard University Press.

Thompson E., Lutz A. and Cosmelli D. 2005. Neurophenomenology: an introduction for neurophilosophers. In A. Brook and K. Akins (eds) *Cognition and the Brain: The Philosophy and Neuroscience Movement* (40–97). New York, NY: Cambridge University Press.

Thompson, E. and Stapleton, M. 2009. Making sense of sense-making: reflections on enactive and extended mind theories. *Topoi* 28(1), 23–30.

Thompson, E. and Varela, F. 2001. Radical embodiment: neural dynamics and consciousness. *Trends in Cognitive Sciences* 5(10), 418–425.

Tourangeau, R. 2000. Remembering what happened: memory errors and survey reports. In A. A. Stone et al. (eds) *The Science of Self-report: Implications for Research and Practice* (29–48). New Jersey: Lawrence Erlbaum.

Trevarthen, C. B. 1979. Communication and cooperation in early infancy: a description of primary intersubjectivity. In M. Bullowa (ed.) *Before Speech* (321–348). Cambridge: Cambridge University Press.

Trevarthen, C. and Hubley, P. 1978. Secondary intersubjectivity: confidence, confiding and acts of meaning in the first year. In A. Lock (ed.) *Action, Gesture and Symbol: The Emergence of Language* (183–229). London: Academic Press.

Tulving, E., Markowitsch, H. J., Craik, F. I., Habib, R. and Houle, S. 1996. Novelty and familiarity activations in PET studies of memory encoding and retrieval. *Cerebral Cortex* 6(1), 71–79. doi:10.1093/cercor/6.1.71

Turing, A. M. 1950. Computing machinery and intelligence. *Mind* 59(236), 433–460.
Underhill, E. 1912. *Mysticism: A Study in the Nature and Development of Man's Spiritual Consciousness*. 4th Ed. London: Methuen & Co. Ltd.
van Riel, R. and Van Gulick, R. 2014. Scientific reduction. In E. N. Zalta (ed.) *The Stanford Encyclopedia of Philosophy*. At: http://plato.stanford.edu/archives/sum2014/ entries/scientific-reduction/.
Varela F. J. 1996. Neurophenomenology: a methodological remedy for the hard problem. *Journal of Consciousness Studies* 3, 330–349
Varela, F. J., Thompson, E. and Rosch, E. 1991. *The Embodied Mind: Cognitive Science and Human Experience*. Cambridge: MIT Press.
Villard, E., Garcia-Moreno, F. T., Peter, N. and Clément, G. 2005. Geometric visual illusions in microgravity during parabolic flight. *Neuroreport* 16(12), 1395–1398.
Wallace, B. A. 2007. *Where Buddhism and Neuroscience Converge*. New York: Columbia University Press.
Wapner, S. and Werner, H. 1965. An experimental approach to body perception from the organismic developmental point of view. In S. Wapner and H. Werner (eds) *The Body Percept*. New York: Random House.
Ward, B. 1968. *Spaceship Earth*. New York: Columbia University Press.
Weems, S. A., Zaidel, E., Berman, S. and Mandelkern, M. A. 2004. Asymmetry in alpha power predicts accuracy of hemispheric lexical decision. *Clinical neurophysiology* 115(7), 1575–1582. doi:10.1016/j.clinph.2004.02.020
Weinstein, D. 2002. Captain video: television's first fantastic voyage. *Journal of Popular Film and Television* 3, 148.
White, F. 1987. *The Overview Effect: Space Exploration and Human Evolution*. Reston, VA: The American Institute of Aeronautics and Astronautics.
Wilkinson, M. J., Lulla, K., Bowersox, K. D., Rominger, K., Thornton, K., Coleman, C., Lopez-Alegria, M., Leslie, F. and Sacco, A. 1998. Space shuttle Columbia's earth observations photography (October 20–November 5, 1995): A mission report. *Geocarto International* 13(1), 83–97.
Wubbels, P., Nishimura, E., Rapoport, E., Darling, B., Proffitt, D., Downs, T. and Downs III, J. H. 2007. Exploring calibration techniques for functional near-infrared imaging (fNIR) controlled brain-computer interfaces. In D. Schmorrow (ed.), *Foundations of Augmented Cognition* (23–29). Berlin: Springer.
Zahavi, D. 2010. Naturalized phenomenology. In S. Gallagher and D. Schmicking (eds) *Handbook of Phenomenology and Cognitive Science* (2–19). Dordrecht: Springer.
Zajac, F. E. 1993. Muscle coordination of movement: a perspective. *Journal of Biomechanics* 26(suppl. 1), 109–124.
Zwart, S. R., Gibson, C. R., Mader, T. H., Ericson, K., Ploutz-Snyder, R., Heer, M. and Smith, S. M. 2012. Vision changes after spaceflight are related to alterations in folate–and vitamin B-12–dependent one-carbon metabolism. *The Journal of Nutrition* 142(3), 427–431.

Index

4Es (cognitive science), 158, 164–8

aesthetic, 47–9, 51, 53, 59, 66, 87, 101
  appreciation, 97, 120, 128
  experiencers, 102, 110
affordances, 161–2
aliens, 137, 149
Apollo program, 33, 139, 141, 142
Apollo 13 (film), 144–6
Armageddon (film), 144
artificial intelligence, 8, 73–4
Astronauts, 5, 25, 26, 30–4
attention, 10–11, 56–7, 64, 105, 107, 169–70
Avatar (film), 146
awe, 1–4, 6, 22–3, 26–7, 29
  awful, 27
  definition, 22, 29

beauty, 28, 30–1, 49, 98, 107, 142, 145
Bildakt, 13, 36
Blue Marble, 36–8, 40, 137, 141–3
brain, 67
  activity, 62
  surgery, 65
Brand, Steward, 141
Bredekamp, Horst, 13, 143
Brief Multidimensional Measure of Religiousness/Spirituality (BMMRS), 47, 50, 52, 54, 58, 101–3, 125, 169, 171
Bulloch, Angela, 152

Captain Video (television), 137
Carnap, Rudolph, 154
Chalmers, David, 67, 162
Chamitoff, Greg, 31, 32
Christianity, 98, 129
Churchland, Patricia, 9
Clark, Andy, 159, 162, 163, 165
Clarke, Arthur, 126
cognitive psychology, 62, 77, 83–5
cognitive science, 8, 15–16, 60, 71, 75–6
Coh-metrix, 20, 21
Cole, Jonathan, 161
computers
  administered test, 90
  assisted image, 134, 143, 150
  human computer interaction, 80
consciousness, 9, 66–9, 165ff
context, 87, 107, 111
  see experience
curiosity, 23, 30, 70, 91, 95, 102, 103, 118

Dennett, Daniel, 9
Destination Moon (film), 135–6, 139
Dewey, John, 162
Disney attractions, 149, 178
  film, 136–7, 146–7
drugs, 65, 160

ecological perception, 160ff
  see embedded cogntion
electroencephalography (EEG), 45–6, 56, 62, 64–5, 69–70, 90–6, 98–101
Elsheimer, Adam, 134
embedded cognition, 160–2
embodied cognition, 67
enactive cognition, 77–9, 163–4
  enactivism, 66–9
experiences
  contextual, 103–5
  correlates, 10, 50–8
  cultural influences, 144–50
  Erfahrung, 25–6
  Erlebnis, 26
  inner space, 3
  mystical, 54, 122, 125, 127
  scale effects, 6
Experiment-Specific Survey of Experience, 90–1, 94–6, 101–3, 108, 110
  interpretation, 171, 172
explanatory gap, 66–9, 83, 165

extended mind, 162–3
  socially, 163

faith, 50, 52, 126, 132, 143
fidelity, 37, 80
first-person science, 172
floating, 14, 29, 31, 51, 57, 97, 145
fNIR, 45
Frisius, Gemma, 61

Gadamer, Hans-Georg, 22
Gaia Project, The, 143
Géricault, Théodore, 131
Gibson, James, 160
Giorgione (Giorgio Barbarelli da Castelfranco), 133–4
God, 30, 61, 98, 118, 127–8, 129
gravity, 14, 38–9, 150
  microgravity, 14, 37–9, 161

Haidt, J., 23, 123, 170
Hanks, Tom, 145
hard problem (of consciousness), 67–9, 165–6
hermeneutical analyses, 6, 19–34
  consensus categories, 28–30
  experimentation, 47–50
  syntactical analysis, 19–21
  textual interpretation, 24–5
Hesiod, 143
holism, 77–9, 166–7
humility, 23, 28, 30
Husserl, Edmund, 7, 10, 116, 129, 157

immersion, 69, 80, 144
ineffability, 34, 122, 126
intentionality, 9, 53, 64, 85
International Space Station (ISS), 40, 42, 54, 55, 147–8
intersubjectivity, 65, 72, 73, 164
introspection, 8

James, William, 2, 9, 122, 123

Keltner, D., 23, 123, 170

language, 103–4, 154
  syntactical structure, 4

La Tempesta, 133–4
La Voyage dans la Lune, 135
lightning, 130, 133–4
Lovelock, James, 143
lunar, *see* moon

McIndoo, John Milton, 23
Magnus, Albert, 23
Magnus, Sandra, 25, 26
Man and the Moon (television), 137
measurements, 70, 90
Méliès, George, 135
Merleau-Ponty, Maurice, 7, 125, 158
mind-body dualism, 67
Mitchell, Edgar, 127–8
Mitchell, Sandra, 156
mixed reality, 35
moon, 135–40
  photograph, 143
  see Apollo program
motion sickness, 150
Multiple Stimulus Types Ambiguity Tolerance, 44
Muybridge, Eadweard, 131–2
mysticism, 6, 123

Nagel, Thomas, 7
NASA images, 13, 36, 37, 38, 140
  texts, 19, 25, 128
natural attitude, 129
Nelson, Bill, 5, 49–50
neurophenomenology, 10–12, 157
  experimentation, 11, 44ff, 62ff
  methods, 43, 69–85
neuroscience, 9
Night Sky (2007–2008), *see* Bulloch, Angela
non-reductionism, 15–16, 78, 92, 129, 153
  experimental design, 110–11

overwhelmed, feeling of, 26–8, 31

peace, 29, 49, 50, 51, 107
perception, 160–2, *see* embedded cognition; enactive cognition
  vision, 38–9, 160–1

perspectival shift, 33, 47, 53, 133
Petitmengin, Claire, 11, 46, 65
phenomenology, 7–11, *see* neurophenomenology
  front-loaded, 157
  methods for, 10–11, 43, 62ff, 122, 157
  phenomenological interviews, 46–7, 65–6, 80–4, 91
  phenomenological map, 7
physiological measures
  methods, 43, 45
Plato, 116, 127, 129
proprioception, 14, 159
psychometrics, 15, 81, 92, 103, 110

reductionism, 8, 82, 153–8
  eliminativism, 154
religion, 2–3, 98, 123, 125
religious experience, 30, 47, 49–50, 91, 108, 119, 122
  Brief Multidimensional Measure of Religiousness/Spirituality, 47, 50, 52, 91, 95, 102, 169
  correlates, 96, 101–2, 171–2
  religiosity, 126
Ricoeur, Paul, 22
rockets, 40, 138, 150
Ruff, Thomas, 151

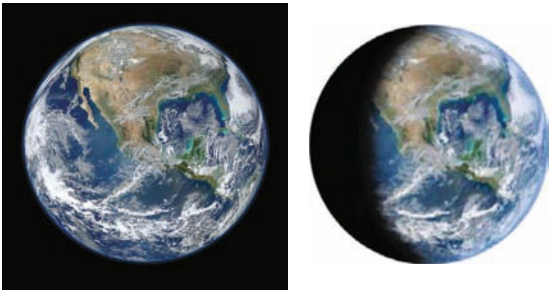
scale effects, 6, 27–8, 47ff, 97, 120, 145
sensation, 7, 84, 86, 97, 102, 120
  astronaut, 111
shared mental models, 73–6
simulation, 4, 12, 14, 35–6, 40, 46, 53, 57, 75–7, 80, 85, 87ff, 95, 106, 107, 120, 144, 149ff, 159
simulation sickness, 45
Spaceship Earth, 139
Spinoza, Baruch, 117
spirituality, 15, 30
  measurement, 47, 53–4, 91, 94–6, 108–10, 169–72
Startreck (television), 144, 147–8
Star Wars (film), 144
Steinbock, Anthony, 124–5
stimulus, 39, 43, 63–4, 81, 90, 111
sublime, 6, 24, 28, 30

Taylor, Charles, 22
team science, 74
television, 137, 144, 150
Tellegen Absorption Scale (TAS), 54, 90, 92, 101, 102, 110, 154–5, 171
Thaumazein, 117–18, 122, 128–9
theoria, 129
Thor (film), 146
triangulation, 60–3
Turing, Alan, 8

Varela, Francisco, 10–12, 46, 60, 62, 68, 72, 163
verticality, 124–5
video games, 148–50, 177, 178
vigilance, 57, 105, 169–70
Virtual Space Lab, 8–9, 35
  design, 35–41
  simulation features, 37, 144
Von Braun, Wernher, 137

Ward, Barbara, 139
weightlessness, 13–14, 29
  see gravity
Whitson, Peggy, 33, 34, 128
Whole Earth Catalog, 139
Willams, Jeffrey, 30, 80
wonder, 1–4, 6, 115ff, 118ff, 125
  ontological vs cognitive, 116, 126

Plate 1 Interior of the VSL



A B

Plate 2 (A) Blue Marble 2012 – NASA image; (B) Blue Marble modified

Plate 3 The FOC-condition began near the earth, over a view of the participant's university

Plate 4 The FOC-condition pulled away from the earth, while revolving

Plate 5 Final vantage in the FOC-condition

Plate 6 The final vantage in GLO-condition

Plate 7 Giorgione's *La Tempesta*

Plate 8 *Destination Moon* (1950)

Plate 9 The 'Blue Marble' photograph, taken on December 7, 1972, by the crew of the Apollo 17 spacecraft at a distance of about 29,000 kilometres. It shows Africa, Antarctica, and the Arabian Peninsula. Public domain image. http://www.nasa.gov/images/content/115334main_image_feature_329_ys_full.jpg

Plate 10 The Earth-Moon System (http://solarsystem.nasa.gov/multimedia/gallery/Earth_Moon_br.jpg)