Visual Experience and Guidance of Action: A Tribute to Bruce Bridgeman



Bruce Bridgeman (1944 - 2016) Editor-in-Chief of *Consciousness and Cognition* (2011 - 2016)

Foreword: Remembering Bruce Bridgeman

Readers of *Consciousness and Cognition* will remember Bruce Bridgeman as the Editor-in-Chief, a post he held from 2011 to 2016. Bruce came to *Consciousness and Cognition* with an exemplary background in research and theories of perception, action, and consciousness, employing diverse methodologies that ranged from psychophysics and single-cell recording in the visual cortex to deep study of classic works in the history of science, philosophy, and evolutionary biology. This Special Issue of *Consciousness and Cognition* was assembled as a tribute to Bruce's scholarly contributions and his enthusiastic and unselfish attitude toward the scientific enterprise. The Special Issue began on a very sad note as its original conception came on the heels of tragedy. In July 2016, Bruce was killed in a traffic accident while on a speaking tour in Asia.

Bruce's tenure as Editor-in-Chief of *Consciousness and Cognition* was well grounded. His studies of perception began as a young student at Cornell where he learned about James and Eleanor Gibson's ecological approach to understanding perception. Unlike the traditional account, the ecological perspective foregrounds *interactions* of an organism with its environment. James J. Gibson (1966, 1979) argued forcefully that inquiry should begin with the richly informative structure of the surrounding "optic array" rather than the impoverished two-dimensional retinal image. Over his career of nearly 50 years, Bruce did not adhere closely to Gibson's ecological theory, but he did build upon the insight that perception evolved along with behavior as a fundamentally interactive process. Much of his research was devoted to investigating the interdependence of sensory and motor systems.

After completing his studies at Cornell, Bruce earned his Ph.D. at Stanford University under the direction of the eminent brain scientist, Karl Pribram. Thereafter, Bruce took two post-doctoral research fellowships: one with Otto J. Grüsser at the Free University of Berlin, where he studied interactions of the visual and vestibular systems, and a second with Lawrence W. Stark at the University of California, Berkeley, which focused on eye movements that are essential for visual exploration of one's environment. In 1973, Bruce joined the faculty of University of California, Santa Cruz, where he taught courses in Perception, Evolutionary theory, Neuroscience, and Psychobiology. He was named Edward A. Dickson Professor of Psychology in 2012.

Bruce's many students and close colleagues found him to be an unusually enthusiastic and innovative experimentalist. In fond remembrance of Bruce's mentorship, Philip Tseng recounts Bruce's delight with the endless opportunities for new experiments: "As soon as you answer one question, it shatters into a million pieces... so you never run out of questions to ask." (Tseng, this issue) Other colleagues recall that Bruce was extraordinary open to diverse viewpoints, especially when they challenged his own work. It seems that Bruce considered such challenges as welcome guidance toward new questions for experimental inquiry (cf: Bridgeman, Dassonville, & Lester, this issue).

This Special Issue offers 24 original papers that present a bountiful, though incomplete, sample of Bruce's wide-ranging interests and their importance to expanding our understanding of Consciousness and Cognition. The editors organized these diverse papers into nine sections, understanding well that many of the papers could have been included in two or more of the sections. The first section includes three papers that focus on Bruce Bridgeman himself (Tseng; Bridgeman, Dassonille, & Lester; and Bachmann). The second section includes two papers presenting current research on visual masking and saccadic suppression, phenomena that Bruce recognized as critically important to our perception of a stable world despite the fact that more than a thousand jerks, twitches, and smears of the retinal image that occur every hour (Rolfs, Balsdon, Schweitzer, & Watson; and Ohl & Rolfs). The third section includes two papers that address questions about visual attention, the process by which we select components of our surroundings for close scrutiny (Di Lollo; and McManus & Thomas). The fourth section includes five studies of two visual systems, one that serves our conscious awareness and another phylogenetically older system that guides action, like locomotion, reaching, and grasping, largely without conscious awareness (Owens, Gu, & McNally; Göhringer, Löhr-Limpens, & Schenk; Rothkirch & Hesselmann; Witt; and Erlikhman, Caplovitz, Gurariy, Medina, & Snow). The fifth section includes four papers that focus more closely on the control of actions such as response selection, reaching and, grasping

(Weast & Proffitt; Rossetti; Prinz; and Reed, Garza, & Vyas). Section six includes two theoretical papers on space constancy and embodied cognition (Spivey & Batz; and Proctor & Xiong). The seventh section, on spatial reference frames, includes three papers that address the roles of geographic slant, visual-vestibular orientation, and the geometry of consciousness (Hecht & Daum; Davidenko, Cheong, Smith, & Harmon; and McBeath, Tang, & Shaffer). Section eight includes two papers that address basic characteristics of consciousness *per se*, including the geometry on consciousness, phantom limbs and the neural architecture of consciousness, which together help to extend Bruce's argument that memory and planning are the primary functions that underpin and employ consciousness (Anderson; and Velichkovsky). The Special Issue concludes with section nine, a personal correspondence that reflects on Bruce's evolutionary approach to cognition and consciousness and to teaching (Klein).

These contributions reflect Bruce Bridgeman's lasting influence on our investigations of *Consciousness and Cognition*, and they present many opportunities to play Bridgeman's insights forward in time. The present authors and future readers will find grist here for new questions that, when answered, will "shatter into a million pieces" leading to yet more questions and insights into the fundamental nature of mind.

D. Alfred Owens and Guido Hesselmann, Guest Editors Talis Bachmann, Editor-in-Chief *August 2018*

References

- Gibson, J.J. (1966). *The senses considered as perceptual systems*. Boston: Houghton Mifflin Company.
- Gibson, J. J. (1979). *The ecological approach to visual perception*. Boston: Houghton Mifflin Company.
- Tseng. P. (2018). The 72-year-old grad student. *Consciousness and Cognition,* this issue.

Table of Contents

Foreword: Remembering Bruce Bridgeman

Section 1 – Focusing on Bruce Bridgeman

Philip Tseng

The 72-year-old grad student <u>Key words</u>: Visual stability; two visual systems; perception and action; consciousness; eye movement; saccadic suppression

Bruce Bridgeman, Paul Dassonville, & Benjamin D. Lester

The Roelofs and Induced Roelofs Effects <u>Key words</u>: Roelofs effect; illusion; perception; action; reference frame; apparent midline

Talis Bachmann

Visual masking: contributions from and comments on Bruce Bridgeman <u>Key words</u>: masking; metacontrast; visual processing; consciousness; psychophysiology; models

Section 2 – Masking, Saccadic suppression

Martin Rolfs, Tarryn Balsdon, Richard Schweitzer, Tamara Watson

All is not lost: Post-saccadic contributions to the perceptual omission of intrasaccadic streaks

Key words: Eye movement, Saccadic omission, intra-saccadic perception, backward masking

Sven Ohl, Martin Rolfs

Saccadic selection of stabilized items in visual memory Key words: eye movements; saccades; visual memory

Section 3 – Attention

Vincent Di Lollo

Attention is a sterile concept; iterative reentry is a fertile substitute <u>Key words</u>: visual attention; feed-forward processing; iterative reentrant processing; preattentive; attentive; circularity.

Robert McManus & Laura Thomas

Immobilization does not disrupt near-hand attentional biases <u>Key words</u>: action; visual attention; affordance; grasping; peripersonal space; proximity

Section 4 – Two Visual Systems

D. Alfred Owens, Jingi Gu, Rebecca McNally

Perception of the Speed of Self-motion vs. Object-motion: Another example of two modes of vision?

<u>Key words</u>: Perceived speed; self-motion; object-motion; contrast; two visual systems; ambient vs. focal

Frederic Göhringer, Miriam Löhr-Limpens, Thomas Schenk

The visual guidance of action is not insulated from cognitive interference: a multitasking

<u>Key words</u>: Multitasking; Obstacle-Avoidance; Bisection; Perception-Action Model; Two Visual Streams Hypothesis

Marcus Rothkirch & Guido Hesselmann

No evidence for dorsal-stream-based priming under continuous flash suppression <u>Key words</u>: continuous flash suppression; interocular suppression; masked priming; consciousness; two visual systems hypothesis; perception-action model

Jessica Witt

In Absence of an Explicit Judgment, Action-specific Effects Still Influence an Action Measure of Perceived Speed

Key words: Action-perception relationships; action-specific perception; two visual stream

Gennady Erlikhman, Gideon Caplovitz, Gennadiy Gurariy, Jared Medina, & Jacqueline Snow

Towards a unifying perspective of object shape and motion processing in human dorsal cortex

<u>Key words</u>: dorsal stream, action, reaching, grasping, 3-D shape, object perception, shape perception, spatiotemporal integration

Section 5 – Action

Rebecca Weast & Dennis Proffitt

Can I reach that? Blind Reaching as an accurate measure of estimated reachable distance

<u>Key words</u>: Perception; Action; Reaching; Reachability; Open-loop response; Action boundary

Yves Rossetti

Paradoxical adaptation of successful movements: the crucial role of dynamic errors signals

Key words: visuo-motor adaptation, prism, error signals, grasping, reward, dynamic error, consciousness, automatic pilot

Wolfgang Prinz

Contingency and similarity in response selection <u>Key words</u>: choice reaction time tasks; task representation; event codes; task sets; similarity; contingency

Catherine Reed, John Garza, & Daivik Vyas

Feeling but not Seeing the Hand: Occluded Hand Position Reduces the Hand Proximity Effect in Event Related Potentials <u>Key words</u>: hand proximity effect, multisensory integration, vision, proprioception, event related potentials, electrophysiology

Section 6 -- Space Constancy, Embodied Cognition

Michael Spivey & Brandon Batzloff

Bridgemanian Space Constancy as a Precursor to Extended Cognition Key words: space constancy; visual perception; embodied cognition; extended mind

Robert Proctor & Aiping Xiong

Taking into Consideration Explanations of Perception-Action Interactions that may be "Less Dramatic, but More Reflective of What Happens in the Real World" <u>Key words</u>: embodied cognition; flanker effect; reference frames; Simon effect; stimulus- response correspondence; two visual systems

Section 7 – Reference Frames

Heiko Hecht, Oliver Daum

Effects of symmetry, texture, and monocular viewing on geographical slant estimation

Key words: geographical slant; slope perception; symmetry; Bridgeman

Nicolas Davidenko, Yeram Cheong, Jacob Smith, Sarah Harmon

The influence of visual and vestibular orientation cues in a clock reading task <u>Key words</u>: visual perception; orientation; reference frames; environmental; egocentric; virtual reality; clock reading; analog clocks

Michael McBeath, Ty Tang, & Dennis Shaffer

The Geometry of Consciousness

<u>Key words</u>: Analytic geometry, algebra, reference frame, egocentric, exocentric, allocentric, coordinate system, Cartesian, Euclidean, catching, intercepting, collision avoidance, baseball, outfielder, fly ball, consciousness.

Section 8 – Consciousness

Michael Anderson

What phantom limbs are

Key words: phantom limbs; body image; body schema; self awareness

Boris Velichkovsky

Consciousness in a multilevel architecture: Evidence from the right side of the brain

<u>Key words</u>: Consciousness; dynamic causal modeling (DCM); resting state; lateralization; frontopolar cortex; hippocampal formation; ventrolateral prefrontalamygdala emotional pathway; egocentric spatial representation; self-referential cognition; levels of cognitive organization

Section 9 – Personal Correspondence

Stanley Klein

Reflections on Bruce Bridgeman's insights into Evolution of Consciousness and Cognition

Key words: Bruce Bridgeman; consciousness; language; cognition