

to be moving in the opposite direction, and what this phenomenon indicates about the way the visual system parses time.

References

- 1 Kline, K. *et al.* (2004) Illusory motion reversal is caused by rivalry, not by perceptual snapshots of the visual field. *Vis. Res.* 44, 2653–2658
- 2 Purves, D. *et al.* (1996) The wagon wheel illusion in movies and reality. *Proc. Natl. Acad. Sci. U. S. A.* 93, 3693–3697
- 3 Reichardt, W. (1961) Autocorrelation, a principle for the evaluation of sensory information by the central nervous system. In *Sensory Communication* (Rosenblith, W.A., ed.), pp. 303–317, Wiley
- 4 Andrews, T. and Purves, D. (2005) The wagon-wheel illusion in continuous light. *Trends Cogn. Sci.* 9, 261–263
- 5 VanRullen, R. *et al.* (2005) Attention-driven discrete sampling of motion perception. *Proc. Natl. Acad. Sci. U. S. A.* 102, 5291–5296
- 6 Simpson, W.A. *et al.* (2005) Illusory percepts of moving patterns due to discrete temporal sampling. *Neurosci. Lett.* 375, 23–27
- 7 Holcombe, A.O. *et al.* (2005) Illusory motion reversal in tune with motion detectors. *Trends Cogn. Sci.* 9, doi:10.1016/j.tics.2005.10.009
- 8 Hutchinson, C.V. and Ledgeway, T. (2005) Sensitivity to spatial and temporal modulations of first-order and second-order motion. *Vision Res.* (in press)

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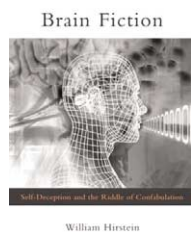
Book Review

The origin(s) of confabulation

Brain Fiction: Self-Deception and the Riddle of Confabulation by William Hirstein. MIT Press, 2005. \$35.00/£29.95 (289 pp.) ISBN 0 262 08338 8

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An amnesic patient with Korsakoff's syndrome is asked to chronicle events of the previous weekend; she describes to her doctor, with full conviction and in vivid detail, a plane ride she took while visiting long-lost friends, when in fact she had never left her hospital room. A stroke patient, suffering from

paralysis of the left side of his body, is asked to move his left arm and replies 'I don't feel like it' or 'I have never been ambidextrous'. He further denies having any problem with his arm, despite the clear evidence that he is unable to perform this simple task. A neurologically intact individual is asked to recite a list of recently presented words that are semantically associated (e.g. *bed, rest, awake*, etc.) and happens to recall a related word that was never actually presented (e.g. *sleep*), again with absolute conviction. What do these three seemingly unrelated anecdotes have in common? In each case the individual is not lying. They all claim that what they are reporting is true. But what exactly is happening? How do these individuals come to overlook the reality of their respective situations? This is the question that philosopher William Hirstein has attempted to answer in his new book *Brain Fiction: Self-Deception and the Riddle of Confabulation*.

Separate literatures have grown up around these and various other manifestations of confabulation (e.g. misidentification syndromes, split-brain patients, sociopathy), in many cases through the use of case studies. Here, the author takes on the lofty goal of bringing them all together. In so doing, he wants to focus on the commonalities among these various forms of confabulation, weaving together a story around the data coming from neuropsychology, neuroscience, and behavioral studies of memory.

'Understanding confabulation is in one respect similar to the attempt to properly classify a recently discovered animal species – it must be placed in a proper family' (p. 71).

The argument for this 'single entity' point of view is largely rooted in the argument that confabulation represents a breakdown in reality monitoring [1]. That is, these individuals are all unable to recognize their reports as ill-grounded. Just as reality monitoring breakdowns tell us something about how memory works, Hirstein argues that confabulation tells us something fundamental about people. 'The phenomenon contains important clues about how humans assess their thoughts and attach either doubt or certainty to them' (p. 4).

In focusing upon the commonalities among all these cases, the author further identifies the orbitofrontal cortex as the key player that likely underlies the deficits shared by such patients. Indeed, it is well known that damage to regions within orbitofrontal cortex can produce a form of disinhibition in a formerly healthy individual (as is the case with acquired sociopathy), and orbitofrontal cortex has long been thought to play an inhibitory role in the production of thoughts into actions [2].

However, just as it is unclear if all breakdowns in reality monitoring can be traced back to a single cause, it is unclear whether confabulation can be boiled down essentially into one phenomenon. Although many would agree that monitoring processes are involved and that the orbitofrontal cortex underlies some of these processes, many would also argue that there exist many monitoring processes and that there are many brain regions underlying these various processes. For instance, the orbitofrontal cortex itself is not a monolithic entity [3]; differing loci of damage likely lead to differing deficits.

Further difficulties arise in consideration of the disparate neuroanatomical etiologies of confabulatory

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behavior. Consider the patient with Korsakoff's syndrome, who has sustained considerable damage to brain regions known to be involved in memory function (e.g. mamillary bodies, dorsomedial nuclei of the thalamus) following an extended period of alcohol abuse [4]. Consider also the anosognosic stroke patient who has incurred marked damage to the right parietal cortex (which represents the left side of the body [5]). As another example, take the Alzheimer patient, exhibiting signs of Capgras' syndrome, who insists that a visiting relative is actually an imposter that happens to share many of the same physical attributes as his 'real' nephew. This syndrome is thought to involve both frontal and temporal cortex impairment [6]. Consider further what these patients confabulate about. The Korsakoff's patient fills in gaps in her memory. The anosognosic patient confabulates about his ability to control his body. The Alzheimer patient maintains that his relatives are not who they say they are. Do these deficits represent a common phenomenon or do these patients simply share a common characteristic, namely a lack of awareness for their respective deficits? What should we make of the striking differences that exist between these and other confabulators?

In the end, Hirstein has put together a book attempting to take a look at the big picture of confabulation, creating a fascinating thesis. He unites a wealth of neuroanatomical evidence related to the notion of confabulation into a coherent theory based on the common deficits possessed

by all such patients, relating his ideas to such diverse topics as theory of mind, the concept of self, and notions of free will. A clear concern arises, though, in that (as the very topic of the book reminds us) just because we can weave a tale does not make it true. That being said, the author is to be commended for pulling together an assorted set of literatures and offering a thorough investigation of a very interesting topic that will surely spark future conversation, debate, and research both within and between the fields of neuroscience, neuropsychology and philosophy.

References

- 1 Johnson, M.K. and Raye, C.L. (1981) Reality monitoring. *Psychol. Rev.* 88, 67–85
- 2 Harlow, J.M. (1869) Recovery from the passage of an iron rod through the head. *David Clapp and Sons Medical and Surgical Office*. Reprinted (1993) in *History of Psychiatry* 4, 271–281
- 3 Fuster, J.M. (1987) *The Prefrontal Cortex: Anatomy, Physiology, and Neuropsychology of the Frontal Lobe*, Lippincott–Raven
- 4 Parkin, A.J. and Leng, N.R.C. (1993) *Neuropsychology of the Amnesic Syndrome*, Erlbaum
- 5 Rizzolati, G., Berti, A. and Gallese, V. (2000) Spatial neglect: Neuropsychological bases, cortical circuits and theories. In *Handbook of Neuropsychology* (Boller, T. et al., eds), pp. 503–537, Elsevier
- 6 Signer, S.F. (1994) Localization and lateralization in the delusion of substitution. *Psychopathology* 27, 168–176

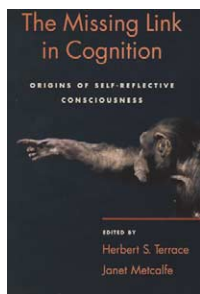
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Animal consciousness: how can we know?

The Missing Link in Cognition: Origins of Self-Reflective Consciousness edited by Herb S. Terrace and Janet Metcalfe. Oxford University Press, 2005. £46.00 (364 pp.) ISBN 0 19 516156 4

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After a century in the wilderness of questions considered unanswerable by science, the study of animal consciousness has undergone a revival in the last few decades. Research on consciousness in nonhumans has spawned several experimental paradigms, all of which are represented in this edited volume. *The Missing Link in Cognition* (the missing link being,

as its subtitle suggests, the origin of self-reflective consciousness) stands as an excellent resource for advanced students and researchers interested in the state of the art in this rapidly growing field.

The study of animal consciousness was made cogent by Darwin's profound insight of continuity between humans and nonhumans in all their properties – psychological as

much as physical [1]. After thirty years of empathetic observation of conscious awareness in animals however, the rise of experimental animal behavior studies led to a demotion of the question of animal consciousness to a category of phenomena that were not available to intersubjective observation and thus not to be studied. This taboo on animal consciousness studies was challenged by Donald Griffin in 1976 with *The Question of Animal Awareness* [2] and since then curiosity about animal consciousness has grown apace.

In the 13 chapters of the book I counted six major lines of attack on animal consciousness. In approximate order of representation these are Memory (especially autobiographical, episodic memory); Metacognition; Self-consciousness; Theory of Mind; Deception, and Language. Two chapters (Nelson Chapter 4 and Higgins Chapter 6) offer perspectives on animal consciousness from human developmental studies.

The volume starts with a chapter by Tulving on autoegetic episodic memory. This is 'the ability to mentally

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