

**Zoltan Torey**

*The Crucible of Consciousness: An Integrated Theory of Mind and Brain.*

Forward by Daniel Dennett.

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This book, first published by Oxford University Press (Australia) in 1999, is a very ambitious project undertaken by a clinical psychologist who attempts to combine views in evolutionary biology, neuroscience, psychology, and philosophy into a coherent picture of mind and brain, with the hope of solving old metaphysical riddles. The 2009 MIT edition of this book includes a foreword by Daniel Dennett, who gives it an enthusiastic, albeit slightly qualified endorsement. Although one can sympathize with the its general thrust, the book, which appears to be a selective quilt of various views, is plagued by numerous problems that put in doubt its success as a satisfactory and coherent philosophical and neuroscientific account.

To jump-start the project, Torey relies on the notion of basic animal awareness, referencing at one point Dennett's idea of qualia as neural language, or universal biophysical idiom for transcribing raw data into user-friendly form. Arguing that self-reflective awareness characteristic of the human mind evolved as a result of human language, the author explains the rise of this capacity within an evolutionary context. The switch to bipedalism and new habitat necessitated the banding of hominids into cooperative groups and increased selective pressure on learning and imitation, leading to changes in the hormonal balance of the sympathoadrenal system, increased period of post-natal development, and growing hemispheric specialization. The development of the neocortex and the neuroplasticity, made possible by neotenus regression, allowed the human child to reach the minimum brain volume (750 cc) necessary for language wiring by the age of one, five years earlier than *Homo erectus* whose 'neuroplasticity' window of opportunity by then was closed.

As a result of the increased neural arbarization, the frontal lobes developed downstream connections to the brain stem, gaining an auto-excitatory facility that allowed them to use the arousal system to fire-up the neocortex and sustain excitations in the 'off-line' mode. This advance in the brain's functional autonomy was further increased by the development of language, resulting from the asymmetrical development of the left hemisphere. Taking over the left motor area, which used to handle modal percepts, the brain used it to handle words, or neutral phonemic strings that it came to associate systematically with the modal percepts handled by the corresponding motor areas of the right hemisphere. Eliminating redundancy, this asymmetrical neural development usefully combined with the auto-excitatory facility to provide an 'off-line' cortical loop, which

allowed the brain to represent the external states of affairs and handle them internally, independently of external causal impingements. This breakthrough of fundamental proportions established a rich and autonomous system of internal representation, permitting the rise of self-reflective mind and the human leap over and far beyond the rest of the animal kingdom, whose members lack mechanisms for blocking automatic motor response to external stimuli.

The right hemisphere's primary percepts, the result of the brain's integration of modal experiences into objects and events, were further reinforced and stabilized through 'naming', or the attachment to them of neutral phonetic strings—the left hemisphere's secondary percepts or words. This process, which led to the development of protolanguage consisting of nouns and verbs, was followed by the backward, analytic process within frontal lobes that extracted individual qualities from complex perceptual assemblages and enabled the rise of adjectives, adverbs, and prepositions. The manipulation and arrangement of these components and subcomponents allowed the generation of grammar and syntax, permitting effective communication of primary percepts and experiences from one human being to another. In Torey's view, the newly autonomous brain can use the hijacked left motor areas to manipulate verbal tokens, which, due to their coupling with the corresponding modal percepts, now have representational content. In communication, the uttering of properly arranged phonetic strings allows the other individual to get the message through the reverse process of decoding, leading to the triggering of primary concepts and the recreation of the modality experience. Meaning is fixed in the mind through a rapid attentional oscillation, via the corpus callosum, between right-side-based primary (modal) and left-side-based secondary (verbal) percepts.

Torey argues that language is responsible for transforming the mechanistic animal awareness into human reflective self-awareness. The 'off-line' cortical linguistic loop allows accessing and manipulating elements of the endogram—the brain's representation of what we are aware of at a time—highlighting some elements, reentering them into the endogram, and influencing the inhibition of others. Trains of thought, grounded in the manipulation of percepts with words, generate proprioception, or the experience of doing the deed. Reflective awareness arises due to the brain's attentional beam shifting to and fro between experience, its proprioception, and alternating representations. Although psychic experience is the result of the speech-generated thought process, the brain misidentifies it as the source, ascribing it agency. Furthermore, the operation of the linguistic loop reveals the mechanism of censorship—inputs from the representational cortices are processed in the frontal evaluative cortex and are sent down to the reticular formation where the relevant inputs are given facilitation through the arousal mechanism, reaching awareness at 400-500 ms of processing, while threatening or irrelevant inputs are inhibited. Since this filtering process is largely unconscious, human beings universally, albeit mistakenly, perceive themselves as free agents. Although the aware mind cannot force decisions onto the unreflective brain, which filters or commits to actions based on

‘intuitively sensed values or valences’ congruent with the biological priorities, it can affect decision-making either by vetoing a selected action sequence within 150-200 ms of becoming aware of it or by providing elaborate alternative ‘motor schemata’ for solving problems.

After dealing with these core issues, the author proceeds to argue that computationalism and, specifically, strong AI positions are untenable because formal systems cannot explain semantic content or transcend their own programs and become mind-like. He illustrates the former with Chomsky’s ‘colorless green ideas sleep furiously’ and the latter by arguing that formal systems would not recognize the nonsense of the ‘truthful liar’ conundrum or Russell’s paradox. Torey finishes the book with more general reflections on the questions of probability, evolution, cosmos, and the place of human consciousness therein, arguing that the conscious mind is the highest form of expression of the evolutionary process and drawing normative implications for rational societal coexistence.

Although the discussions of neoteny and brain censorship are rather interesting, this book has a number of significant problems from the philosophical, neuroscientific, and scholarly perspectives. From the philosophical perspective, the book is marked by a somewhat shallow understanding of the issues within philosophy of mind and language, with the result that the account of the development of language appears to be modeled on a 200 years old naïve empiricist tradition. Not only is the emergence of categories left unexplained, but thought is viewed as a recreation of modal experiences, while the semantic content of linguistic terms is explained by the triggering of the corresponding modal percepts, which mysteriously become concepts by the middle of the book.

The treatment of other authors, such as Chomsky, Chalmers, or Dennett, is brief, superficial, and not particularly useful. The neuroscientific account appears to be both selective and out of date: for example, recent studies show that the general inhibition of speech and action originates in the right rather than left hemisphere lateral frontal areas, while speech processing draws on semantic memory and involves the amodal semantic representations within the anterior temporal lobe and activation within the medial temporal lobe. Furthermore, the fixation of meaning as the corpus-callosum-supported attentional oscillation between left hemisphere’s verbal tokens and right hemisphere’s modal percepts is not only unsubstantiated but raises obvious questions in the context of split brain cases. Finally, the book, which has a six-page reference section and an eleven-page bibliography, lacks adequate in-text citations that could help to distinguish reliably the author’s speculation from the results of empirical studies or the theorizing of other authors. While the handful of the most recent references are from 1997, the vast majority of references are over twenty years old, which, regrettably, ensures that this integrated theory of mind and brain fails to take into account the neuro-imaging results accumulated over the last ten years.

Yet, this is not to say that Torey is not making a worthwhile philosophical contribution—he makes a valiant attempt to connect the dots spread out across increasingly more specialized fields of evolutionary biology, neuroscience, cognitive science, and philosophy. To make sense of just the neuro-imaging results is hard; to combine these with the results from biological, behavioral, cognitive, and psychological investigations is a project of Herculean proportions. Yet, it seems that, increasingly, philosophical endeavors should be about high level synthesis of results brought from disparate domains. In that sense, this book should be applauded, bearing in mind that its second edition could have been improved.

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