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Restoring to Cognition the Forgotten Primacy of Action, Intention and Emotion

Making sense of the mind is the human odyssey. Today, the cognitive sciences provide the vehicles and équipage. As do all culturally shaped activities, they manifest crystallized generalizations and ideological legacies, many of which go unquestioned for centuries. From time to time, these ideologies are successfully challenged, generating revisions and new forms of understanding. We believe that the cognitive sciences have reached a situation in which they have been frozen into one narrow form by the machine metaphor. There is a need to thaw that form and move from a reductionist, atemporal, disembodied, static, rationalist, emotion- and culture-free view, to fundamentally richer understandings that include the primacy of action, intention, emotion, culture, real-time constraints, real-world opportunities, and the peculiarities of living bodies. These essays constitute an array of moves in that direction.

Making Sense of our Minds: What Have We Inherited?

For millennia our ancestors, in trying to understand what it is to think and to know, have made sense of these processes in terms of spirit and soul (Durkheim, 1915; Barfield, 1965; Freeman, 1995; Núñez, 1995). Many of their questions are still with us. How do our senses convey the world to our inner spirits? How do we convert that input to knowledge, and ultimately to wisdom? How do we remember what we have done and become? What kinds of spirits exist in beings other than humans, such as animals, trees, rocks, mountains, stars, and other planets? How do we establish relations with them, so as to predict the future, invoke their help, placate their anger, or give thanks for their aid, with the help of images, icons, totems, invocations, songs, dances, instruments of observation? Where are the spirits located; in their world, or even in our own? Where do we go when we sleep? When we die? How do we protect our families from spirits who return from other worlds to take vengeance, or entice those who can guide us?

The questions have been revised in various ways throughout recorded history by new developments in the natural sciences. In the West, the questions and their answers were most strongly influenced by the emergence of material medicine in the age of Hippocrates (Clarke and O'Malley, 1968). Where in the body is the mind located, in the heart or in the head? How do the elements of which the world is made combine to form the four humours? How do these humours determine our personalities: sanguine, phlegmatic, melancholic, and choleric? How do imbalances in the humours lead to illness, and how can bleeding and purging restore the natural balance? In the East, a comparable system arose simultaneously and independently in China, leading to emergence of the medical systems of acupuncture and moxibustion (Mann, 1962), which were materialist, practical aspects of a deep and insightful mechanistic theory of mind, based in the concept of the flow of *qi* (energy), centred in the navel (this explains the shape they gave to Buddha's body; a big belly represented a man of substance). In western philosophy, the distinction between form and matter led the Greeks to the question: are there ideal forms for material objects made of atoms or the elemental substances (Lakoff and Johnson, 1998)? Can the forms exist independently in the material world, the spirit world, or in ourselves? Are they accessed by perception or by reason? Are gods spirits that inhabit animals, mountains, and other worlds?

Under the aegis of Augustine, the Platonic view held sway for nearly a thousand years, until the revolution wrought by Thomas Aquinas (1272). Whereas for Platonists the apprehension of forms was by the passive imprint of imperfect copies from the world on the senses, and the reconstruction of the ideal forms by reason, the Thomists followed Aristotle (Kenny, 1980) in proposing that perception occurs by action of the body into the world ('intendere'), followed by assimilation ('adequatio', to make equivalent, for example, to shape the hand in conformance with a cup so as to drink, not to incorporate the form of the cup into the mind by reason), but with a crucial difference (Freeman, 1999). Aristotelians proposed that the forms in the mind ('in-formation' as we would say) were derived through the senses from the forms of matter, whereas Thomists proposed that material objects were unique (we would say 'infinitely complex', ultimately not comprehensible, Kant's 'Ding-an-sich'), and that all knowledge of forms was created intentionally within minds by imagination through the processes of abstraction and generalization. Their view was in opposition to the Averroists' universal mind (Aquinas, 1272, part I, question 76, article 2, p. 389), in postulating that every mind is isolated from every other by this constraint (we would call it God's own 'firewall'), giving the gift of ultimate privacy. Recent studies in mesoscopic (Ingber, 1992; Imry, 1997) brain dynamics appear now to support this view (Freeman, 1991; 2000).

With the emergence of modern science, Descartes, Leibniz and Kant (1781) enacted a counter-revolution, the essence of which was the mathematization of the human mind (Lakoff and Núñez, 1997; Núñez and Lakoff, 1998), and the replacement of Thomist intentionality by representationalism. Putnam (1990) identified the two concepts ('representation — that is to say, intentionality — ' p.107) and wrote:

> Kant's purpose, unlike Berkeley's, was not to deny the reality of matter, but rather to deny that things in themselves are possible objects of knowledge. What we can know — and this is the idea that Kant himself regarded as a kind of Copernican Revolution in philosophy — is never the thing in itself, but always the thing as represented. And the representation is never a mere copy; it always is a joint product of our interaction with the external world and the active powers of the mind. The world as we know it bears the stamp of our own conceptual activity (p. 261).

This re-formulation led to various modern questions. What occurs in the senses upon the impact of matter and energy, causing the transfer of forms (information) into the brain? How is the information transmogrified to representations in perception? What are the mechanisms for learning, storing, and retrieving representations from memory? How are they selected by attention? How do brains assemble them into knowledge bases, and how do data bases lead to wisdom? What is consciousness, and what is it for? The act of perception in this view is the construction of representations as symbols of objects and events in the world, whether real or imaginary, for presentation to consciousness, and the operation of the mind is the manipulation of these symbols in accordance with the laws of logic, induction, statistical inference, and mathematical deduction. Imagination is replaced by the manipulation of representations, and intention is reduced to the 'aboutness' of the representations (Searle, 1983), i.e., how those in brains that can be related to the world outside minds, as distinct (according to Brentano, 1889) from those in extant machines that cannot.

Descriptions of mental phenomena from the scientific point of view have been continuously influenced by the world views and methodologies required for studies in the so-called 'hard sciences'. A particularly strong influence has been that of Isaac Newton's physics, which gave mathematical form to the Cartesian conception of reflection as the basis for understanding the hierarchy of reflexes in the nascent sciences of physiology and psychology (Prochaska, 1784). The flip side was the practice of astrology, which was the logical cognitive science of its day. Astrologers were more respected, better paid, and in some respects more successful than contemporary physicians at treating indispositions of the mind. Many astronomers made their living by casting horoscopes and teaching medical students to do so. When, in 1609, the Grand Duke Ferdinando lay ill, Galileo on call predicted from the stars that he would live many years more. Three weeks later he died (Sobel, 1999), and Galileo went on to social troubles of his own. Newton found alternative employment; perhaps he was concerned that the action-at-a-distance required by his gravitational theory might be confused with astrological influences of the stars. Today, many intractable problems stem from this platform: the mind–body split, linear causality, the subject–object and nature–nurture dichotomies, to mention a few (Núñez, 1997).

The Cartesian method reached an apogee of a sort when Whitehead and Russell (1910) published 'Principia Mathematica', in which they attempted to reduce all of symbolic logic and the quintessence of human reasoning to formal mathematics (Lakoff and Núñez, 2000). Even upon this culmination there was a series of death-blows through the works of Gödel (1930) and Wittgenstein (1922), whose work according to Kenny (1984) was presaged by Aquinas, as though the very clarity of the foundations of reason that Whitehead and Russell had brought to the enterprise had exposed the essential contradiction on which it was based: the impossibility of the mind understanding itself through purely logical analysis. But the irony is that the positivist and reductionist study of the mind gained an extraordinary popularity through a relatively recent doctrine called *Cognitivism*, a view that shaped the creation of a new field — *Cognitive Science* — and of its most hard core offspring: Artificial Intelligence. Some practitioners called this endeavour 'The Cognitive Revolution', though the real revolution was already over 300 years old.

'Cognitivism': The Legacy of What Was to be the One True Science of Cognition

The new field of Cognitive Science, which we here call Cognitivism, was meant to be interdisciplinary, receiving contributions from psychology, neuroscience, linguistics, analytic philosophy, and computer science. But because of historical accidents of technology and of the nature of the enterprise, the contributions of the latter played the dominant role (Varela, 1989). The cognitivist-oriented study of the mind emerged in a specific place and time in history (the eastern seaboard of North America in the 1940s) as a concrete proposal for overcoming many of the analytic problems left unsolved by the approaches of the preceding era, such as introspection, psychoanalysis, and behaviourism. The aim was to provide a precise, pervasive, and uniform paradigm and methodology for operationalizing and emulating the essential aspects of the mind (not merely behaviour) in an objective, transparent, and controllable manner. The mind as a rational calculating device — an idea already posed by Leibniz and Descartes and expounded by Craik (1943) and Turing (1950) — served as a framework, and electronics provided the key tool for making the enterprise flourish: the digital computer (Berkeley, 1949), an artifact that could develop and operate an amazing variety of algorithms in software.

Technology, of course, was not the only factor. Cognitivism was built on a well-established doctrine — *substance dualism*, which postulates an essential separation between mind and body — and on a novel one — *functionalism*, which defines the mind as a set of mechanisms that can perform functions independently of the physical platform on which it is implemented (Block, 1980). The digital computer was the perfect platform on which these doctrines could be realized by positing 'a level of analysis wholly separate from the biological or neurological, on the one hand, and the sociological or cultural, on the other' (Gardner, 1985, p. 6). This reduced level of analysis focussed on the individual mind as a passive input–output device that processed information, and it characterized reasoning as the logical manipulation of arbitrary symbols. Thus technology and the philosophic *Zeitgeist* gave rise to a powerful and inviting metaphor, the legacy of which deeply influences us still today: the metaphor of the mind as a computer. Ironically, this happened despite the caveat, published posthumously shortly after the dawn of Cognitivism by John von Neumann (1958), chief architect of games theory, self-reproducing machines, and the programmable digital computer:

> Thus the outward forms of *our* mathematics are not absolutely relevant from the point of view of evaluating what the mathematical or logical language *truly* used by the central nervous system is. . . . It is characterized by less logical and arithmetical depth than what we are normally used to. . . . Whatever the system is, it cannot fail to differ considerably from what we *consciously* and *explicitly* consider as mathematics (pp. 81–2).

But von Neumann's conclusion was ignored. The Cognitive Revolution was already in full sway, so that all aspects of the mind were seen as software that happened in humans to be implemented in wetware having unreliable neurons, and that might be vastly improved if implemented instead in hardware with reliable transistors. As Gardner said, ' . . . not only are computers indispensable for carrying out studies of various sorts, but, more crucially, the computer also serves as the most viable model of how the human mind functions' (Gardner, 1985, p. 6). As a consequence, the entire domain of the science of cognition became narrowly defined as 'the study of intelligence and intelligent systems, with particular reference to intelligent behaviour as computation' (Simon and Kaplan, 1989, p. 1). This reductionist characterization became synonymous with 'Cognitive Science'. Cognitivism had not only *defined* Cognitive Science, but also it had *prescribed* how to conceive and carry out any true science of cognition.

The Cognitive Revolution was launched with great optimism amid predictions of devices for general problem solving, speech recognition, language translation, reading cursive script and photographs, and making free-roving household robots. (For details about these and other predictions and how they failed, see Dreyfus, 1992, and Winograd and Flores, 1986). This seductive way of looking at the mind engendered new journals, departments, and academic societies to exploit the new concepts and their related technology. As a result, the mind as computer metaphor provided not only a redefinition of fundamental concepts such as reasoning, thought, perception, knowledge, and learning, but also what later became an entire conceptual apparatus for how to understand people, neurons, languages, brains, and experiences in classrooms, in terms of information-processing: algorithms, subroutines, formal logic modules, content-addressable memories for storage, pattern completion by retrieval, and so on. The computer-oriented vision has enthralled (in the sense of 'enslaved') in various ways the minds of two generations of scientists. New approaches were parallel distributed processing, artificial neural networks and other forms of connectionism, hybrid systems, and more recently, neurocomputation. Although Cognitivism in the form of 'strong AI' is not as widely endorsed as it once was (Searle, 1992), its legacy is pervasive. What we observe today are approaches to understanding cognition and the mind that retain a substantial dose of residual Cognitivism hidden behind the attractive possibilities of the ever-developing computer technology. Together they constitute what we here call *Neo-Cognitivism*, comprising more subtle and updated forms of the doctrine which carry the heavy and reductionist legacy of the Cognitive Revolution and its seventeenth-century forebears.

Reclaiming What Is Primary

In this volume, we collect papers from a variety of disciplines with the goal of calling to attention the urgent need to reconsider the study of the mind. The aim is to bring to the fore some issues down-played under the legacy of Cognitivism, and which today are sustained by Neo-Cognitivism. The authors reinstate some inherent aspects of the mind: action in the world, intention, emotion, bodily grounded experiences, the human brain as an organ of social action, and so on. Because of the variety of the backgrounds of the contributors, the collection of papers included here is heterogeneous. The common thread is a determination to take full advantage of the social and biological contexts of the human animal, and to develop conceptual frameworks and methodologies freed from the assumptions of Cognitivism as outlined above.

Even under the dominance of Cognitivism a plurality of alternatives has continued to flourish, like mammals under the dinosaurs, and these provide the roots of many of the essays in this volume. Some authors have followed the route of Gestalt psychologists (for example, Koffka, 1935; Köhler, 1940) and their successor J.J. Gibson (1979) in proposing that internal representations are not static, localized entities, but are fluid, distributed structures in brains that are derived by 'in-forming'. That is, their contents are derived by actions of the body as the agent of the mind, which extract information from objects in the world through their relations to the agent in the form of affordances. These properties belonging to objects afford an agent the opportunities to use them to achieve its individual goals, through which the agent establishes relations with those facets of the world with which it can interact and from which it can learn. By virtue of these relations, the mind is not restricted to the brain or body but extends into the world (Clark, 1997), and the mind is a seamless fabric of inner and outer experience (Jarvilehto, 1998), perhaps having an ancestral affinity to the Averroist view. Others hold that the concept of internal representation is a misleading fiction, or perhaps even an outright category mistake (Ryle, 1949; Freeman, 1997; Núñez *et al*., 1999). They follow the lead of Pragmatists such as John Dewey (1914), who conceived of action 'into the stimulus', not reaction and representation, and phenomenologists such as Merleau-Ponty (1945), who conceived of 'the intentional arc' as the means for the mind to exert 'maximum grip' on the world without need for representation. Yet others follow the lead of Aquinas, who distinguished between the infinite complexity of the material world and the inner world of imagination, abstraction and generalization (Copleston, 1955; Freeman, 1999). He dismissed Plato and his concept of ideal forms, thereby avoiding what would become explicit as the Cartesian subject–object apposition, because he denied that minds could maintain images (representations) of material objects. The mind consisted of knowledge in action (Aquinas, 1272, part I, question 85, article 2, p. 454; Basti and Perrone, 1993) which it expressed into the world through its agent, the body, by shaping energy and matter for purposes of grasping the nature of the world, of other intentional beings, and of God, processes that we now call intention and social communication. These patterns of energy and material objects, which we call external representations, do not exist in brains, either as forms of neurons or patterns of neural activity. They exist only in the world outside mind. Aquinas' doctrine had contributed to the growth of the middle class, and became a parent of the Scientific Revolution in the Renaissance, and it, or rather its late and somewhat decadent residue, was the system from which Descartes took his departure: discarding intentionality and the phantasms of the imagination, re-introducing Platonic forms and the certitudes of mathematics, and treating the soul as the pilot of the corporeal boat, instead of the integrated function of the body engaged by intention with the world. When seeking the origins and resolutions of the nagging deficiencies in 'Cartesian Theater' (Dennett, 1991), there is no better place to find perspective for a fresh start than to read his 'Treatise on Man' (part I, questions 75–102) and digest the system of thought that had prevailed before Descartes (Barfield, 1965, pp. 85–91).

Developmental psychologists, drawing on work such as that of Myrtle McGraw and John Dewey (Dalton, 1999) in North America and Jean Piaget (1930) in Europe, and in opposition to Cognitivism, particularly Chomskian linguistics (see Piattelli-Palmarini, 1980), have continued to incorporate the biological bases of human and animal cognition and the ways in which they emerged through phylogenetic evolution (Herrick, 1926; Maturana and Varela, 1987). Writers here follow the lead of non-linear dynamicists (Haken, 1983) in describing how brains largely direct and control their own ontogenetic evolution (Ashby, 1960; Walter, 1963; Clark, 1997; Hendriks-Jansen, 1996). These processes invoke circular causality by which bodily actions under brain control modify the brain through sensation, perception and learning, thereby incorporating the world through experience, not through information in the form of external symbols and internal representations. The somatomotor dialectic unfolds throughout infancy and childhood (Piaget 1930; 1967; Thelen and Smith, 1994), as subjects learn to control their bodies and direct them to the achievement of goals that emerge through internal creative dynamics (Freeman, 2000), and are not imposed by observers as ideal targets, that are to be approached by reduction of mean squared errors of the differences between sets of *a priori* and *a posteriori* numbers. Other than the acquisition of skills in music, language and abstract reasoning, similar ontogenetic processes occur in other mammals and possibly all animals. More generally, the array of species in the animal kingdom offers an incredibly rich reservoir of examples of cognition that is almost entirely inaccessible to Cognitivists and Neo-Cognitivists. Moreover, even after language emerges in humans, the study of colourful constructions that seem to defy logic, yet have compelling utility in social communication, exposes to view the rich alternatives to traditional logic that are characteristic of human mentation (Piattelli-Palmarini, 1980; Rosch, 1978; Lakoff, 1987; Johnson, 1987; McNeill, 1992). Some of these impressive mechanisms of everyday human cognition are analysed in this volume through the study of spontaneous gestures, conceptual systems, unconscious and effortless inference-making, metaphorical thinking, speech–gesture coordination, and natural language understanding. The arguments propose new forms of understanding human semantics and the nature of concepts, revealing the primary role played by bodily grounded experiences in making meaning and abstraction possible. These studies also show that meaning and concepts are socially and historically mediated, but unlike what many post-modern philosophers suggest, they are not the result of arbitrary social conventions. They are indeed realized through non-arbitrary, species-specific, bodily grounded experiences that are at the basis of consensual spaces and inter-subjectivity (Núñez, 1997). These results show the fundamental and intimate co-definition of minds and bodies, providing thus fruitful alternatives to the restrictions imposed by linear causality, the subject–object dichotomy, and the mind–body split.

Cognitivists have been known to deride researchers who investigate the carbon-based platform that evolution used for the creation of intelligence as ‘hydrocarbon chauvinists’ and their position as ‘neuromachismo’, for example using the phrase, ‘you don’t need feathers in order to fly’. They speculate about zombies — bodies without minds — and disembodied minds — brain-in-a-vat, brain transplants, humanoids, and cyberspace intellects, all of which for neurobiologists are science fiction of a rather low class — on the dualist and functionalist premise that minds are independent of the matter in which they are deployed. Considering that these views are anti-biological, the manner in which neurobiologists have been subverted by Cognitivists is most extraordinary. Fifty years ago, the excitabilities of cortical neurons were described in terms of their receptor fields. After the take-over of neurobiology by neuroengineers, the same neurons became ‘feature detectors’ (Lettvin *et al.*, 1959), whose activities were summed as a proposed solution to the ‘binding problem’ that this move created *de novo*. This change in terminology based in a recurring category error (Freeman, 1997) that has had the far-reaching effect of treating neurons as vectors of information that represent to other parts of brains the objects whose reflected or emitted energies are statistically linked to their firing rates (for example, Barlow, 1972; Abeles, 1991). Contrary to widespread beliefs among computer scientists and Cognitivists, action potentials are not binary digits, and neurons do not perform Boolean algebra. Their impulses are electrochemical waves serving as carriers for pulse frequency modulation, by which analogue quantities are transmitted across immense distances without the attenuation and delay imposed by diffusion (Bloom and Lazerson, 1988; Freeman, 1992; Kandel *et al*., 1993).

The distinction here lies between using mathematics to describe brain function and postulating that brain function is computational. As some of our contributors argue, mathematics (and its formal systems) is part of human conceptual systems, so that numbers (and mathematical formulae) exist in the minds of observers, and not as representations in the brains being observed (Longo, 1998; Lakoff and Núñez, 2000). The functions of a brain are recorded by measurements either of its electrochemical activities or of the bodily behaviours that by intention represent its internal states. Our essayists show that the numbers and other symbols resulting from the measurements can be modelled by mathematics to provide compelling insights into brain dynamics, as well as by natural languages and the use of metaphor. But this doesn't mean that the language of the brain is mathematics or logic, or that the theories are prescriptions for algorithms by which to construct autonomous robots or even less complex devices that can simulate or emulate the observed behaviours. For example, one may describe the operation of the lens of the eye by using the Fourier transform without proposing that the lens computes it. Newer forms of NeuroCognitivism have stepwise moved the computational assumptions from an overt CPU in one or another thalamocortical circuit (Baars, 1997; Wright and Liley, 1996; Taylor, 1997) towards finer structural levels such as neurons equivalent to DSPs and chips, sub-neuronal components (Alkon, 1992) like microsomes and RNA (Hydén, 1973) as the repository of memories, and microtubules and subsynaptic webs (Hameroff, 1987) conceived as quantum computing devices, for which neurons serve as amplifiers (Penrose, 1994). As our essayists show, these speculations are far from reality.

The contributions to this volume include the recognition and exploitation of the obvious phylogenetic fact that human brains have evolved primarily as organs of social organization (Freeman, 1995; Núñez, 1997). They include descriptions of the higher levels of brain function that are enabled by the tools of non-linear dynamics and theories of chaos and complexity. They invite reconsideration of the primacy of everyday unconscious cognition. They invoke a resurrection of the forgotten foundation of the science, industry, medicine and law of the latter half of the Middle Ages in the philosophy of Thomas Aquinas. These plural approaches simply bypass the old traps of the mind–body split, the artificial subject–object dichotomy, and the reductionist, static, algorithmic, and emotion-free views of cognition. They avoid the Platonic view that in order to study cognition and objective knowledge, one has to isolate reason from the other mental faculties, and, as does Damasio (1994), they treat emotional and intentional aspects of cognitive psychology as central rather than irrelevant and disruptive or at best secondary to rational discourse. They incorporate the cultural and social dimensions of minds (Vygotsky, 1986). Even a simple act of observation with its consequences is a prototype for all intentional behaviour. Here we have a fresh insight into the story of observation in quantum physics as a circumscribed yet highly instructive microcosm of the relation of the observer to the world. And this is not only in relation to the material systems being acted upon but equally to other observers and the social interactions that are required for validation, interpretation, and acceptance or rejection of the meanings that emerge, constituting the traffic of minds. Our authors transform familiar scenes into gardens of delight, emphasizing the social dimensions of mind, for example, those relating to gender and psychosocial development, thereby again dispelling the notions that cognition is a purely rational, abstract activity, and that mind is an ahistorical, culture-free, and disembodied logical system (Varela *et al*., 1991). The various contributions show that one need not be a monist, dualist or functionalist to practice the science of the mind.

Our aim with this collection of essays is not to answer questions about the nature of mind and cognition, but to reopen for consideration some avenues of exploration that have been shouldered aside by classic and Neo-Cognitivism, and, rather than abandon the name of cognitive science as if it were a bone to a dog, to reassert its pertinence in a wide range of behavioural sciences. We humanists and scientists should not allow ourselves to be bullied and dispossessed by analysts and technocrats, who create intractable problems that may often be claimed to be fundamental, if no solutions can be found. Perhaps we can rescue them from the morass of their own making, but perhaps we have other more interesting things to do.

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