A Stimulus to the Imagination:
A Review of *Questioning Consciousness: The Interplay of Imagery, Cognition and Emotion in the Human Brain* by Ralph D. Ellis

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Twentieth century philosophy and psychology have been peculiarly averse to mental images. Throughout nearly two and a half millennia of philosophical wrangling, from Aristotle to Hume to Bergson, images (perceptual and quasi-perceptual experiences), sometimes under the alias of "ideas", were almost universally considered to be both the prime contents of consciousness, and the vehicles of cognition. The founding fathers of experimental psychology saw no reason to dissent from this view, it was commonsensical, and true to the lived experience of conscious thinking. However, early in this century, just about when the behaviorist revolution in psychology was loudly declaring the scientific illegitimacy of any attempt to study consciousness, and the concomitant non-existence of imagery (Watson, 1913; see Thomas, 1989), philosophy was undergoing its "linguistic turn", a turn to seeing philosophy as essentially about language rather than the world, even the 'inner' world. For decades, the very concept of the mental image was suspect, and it was certainly banished from playing any major role in theories of mind and of thinking. Ralph Ellis' *Questioning Consciousness*, together with the recent speculations of certain influential neuroscientists (Edelman, 1992; Damasio, 1994), may be signaling the end this unusual era.

Of course, as everybody knows, the world did change in the 1960s. It wasn't just that everyone was taking hallucinogens; for a whole host of very respectable practical and empirical reasons, psychologists found it imperative to take imagery seriously again (Bugelski, 1984; Paivio, 1971/1979; Holt, 1964). The discoveries of the striking 'mental rotation' (Shepard & Metzler, 1971; Shepard & Cooper, 1982) and 'mental scanning' (Kosslyn, 1973, 1980) effects only reinforced a burgeoning revival of imagery research that one of the leading pioneers of cognitivism saw as portending "a paradigm shift in psychology" (Neisser, 1972). Before long, psychologists were ready directly to broach the issue of consciousness in major journals once again (e.g., Natsoulas, 1974, 1978).

But it was not to be. The consciousness revolution fizzled out, and the real paradigm shift in psychology during the 60s and 70s turned out not to be about imagination, but computers. Both imagery and consciousness research were overwhelmed by the rising tide of computational cognitivism. Until very recently, consciousness has remained the concern of just a handful of mavericks (lately it seems to have become the concern of a *whole lot* of mavericks). Meanwhile, imagery researchers became embroiled in an impassioned, high-profile, but ultimately sterile dispute as to whether computational models could accommodate fundamentally picture-like representations, or whether imagery experiences (and the experimental evidence suggesting their functional significance) could and should be explained entirely in terms of the sorts of language-like encodings with which computer programmers were more familiar (Pylyshyn, 1973; 1981; Kosslyn & Shwartz, 1977; Kosslyn, Pinker, Smith, & Shwartz, 1979; Kosslyn, 1980; Anderson, 1978; Hinton, 1979; Block, 1981).

Whoever won this so called "analog/propositional" debate (for what it is worth, it seems to have been the 'analog' or picture theorists (Tye, 1991; Kosslyn, 1994)) the upshot was to be the marginalization of imagery within cognitive theory. The assumptions built into the question being asked inevitably led to the view that most, if not all, of the real work of cognition and mental representation goes on at a non-conscious, computational level. The widespread move from 'symbolic' to 'connectionist' computational theories only served, if anything, to consolidate this trend: as computational psychology has become more plausible as an account of brain mechanisms it has become all the less plausible as a picture of the conscious mind, and it is no accident that connectionist modelers and 'eliminativist' philosophers have been able to make so much common cause (e.g., Churchland & Sejnowski, 1992; Churchland, 1989). With only a handful of isolated exceptions, connectionists have had nothing to say about imagery. Whereas in the 1970s imagery theory was widely regarded as fundamental to the theory of cognition, now it gives the appearance of a specialized and quite peripheral sub-field.

But these developments amount to the marginalization of conscious processes in cognitive theory: after all, even conscious linguistic thought, the silent monologue we 'hear' in the 'mind's ear', is a form of imagery (Paivio, 1986; Reisberg, 1992). In such a situation, consciousness can easily come to seem to be quite irrelevant, inessential, to thought (Flanagan, 1992), and we soon find ourselves committed to the possibility of conceptual monstrosities like zombies (see Thomas, 1996), and running smack into problems so "hard" that the only reasonable way to solve them (without backing-up and

rethinking our picture of cognition) seems to be the postulation of properties that are forever beyond the reach of physical science, and the stipulation of 'natural' laws that are untestable *in principle* (Chalmers, 1996).

But the marginalization of imagery and (thereby) consciousness can by no means be blamed entirely on psychologists, or even on computationalism. For most contemporary analytic philosophers the idea that imagery has a fundamental and necessary role to play in human thought is something not to be countenanced. The founding fathers of the analytic movement (especially Frege, Wittgenstein, and Schlick) were very conscious that image-based conceptions of thought had led many of the most acute of their 18th and 19th Century predecessors deeply into skepticism or idealism, and they very much wanted to avoid going down those paths. Thus they took linguistic representation to be fundamental instead and argued vehemently against image-based theories of thought, and particularly against the traditional view (often associated with Locke, 1700/1924) that *language* is somehow grounded in imagery -- that what we say is largely an expression of what we (consciously, but non-verbally) think. In this way, a fervent if rather unfocused 'iconophobia', a skepticism toward all explanatory invocations of imagery, and sometimes even toward the very reality of the experience of imagery (see Thomas, 1989), came to be built into the foundations of the analytic movement that soon came (and continues) to dominate philosophy in the English speaking world.

The actual arguments that were made against image-based theories of thought boil down essentially to four. Now polished by the passage of time, they are routinely trotted out against anyone naive or foolhardy enough to question the iconophobic orthodoxy, but they are rarely seriously challenged (apart from the book under review, Lowe (1996, ch.6) provides a recent and very worthy exception). Still more rarely are any such challenges given their due consideration.

The first of these arguments, which actually goes back to Berkeley (1734/1975), is that images, conceived of as being like inner pictures, cannot possibly embody *general ideas* -- dogs in general, triangles in general, etc. -- but, at best, ideas of the particular individual objects that they do or might derive from. Thus, if images were the fundamental medium of thought we could never think of such generalities, which we clearly can do.

The related second argument is also ultimately rooted in Berkeley, although he himself pressed the basic insight to idealistic rather than iconophobic conclusions: although we normally assume that ordinary pictures represent their subject through resembling it, such resemblance relations are not sufficiently objective to ground our basic capacity for mental representation. Resemblances need to be *recognized*, and being able to recognize something seems to entail having certain mental abilities (including representational abilities) already in place. It seems to follow from both of these arguments that imagery cannot be the *fundamental* form of representation, and thus cannot be *basic* to thought.

Both these arguments are probably sound *provided that*, like Berkeley (and, admittedly, like nearly all theorists until rather recently), we take mental images as being analogous, in the relevant respects, to physical pictures. However, as we shall see, the book under

review rejects that assumption, and provides a quite different account of the nature of image representation.

A third argument that one sometimes encounters, and that probably originated with Frege, points out that the images that different people have of the same sort of thing (or even that the same person may have at different times) may vary widely. My image of a cat today may be of a black cat, where yours is of a marmalade one, and mine tomorrow may be of a calico. Thus no such image can possibly constitute the *meaning* of the word "cat", which means the same thing in my mouth as it does in yours, and the same thing tomorrow as today. (There is a related argument to the effect that imagery cannot be essential to thought because a small percentage of people, who appear to be able to think perfectly well, claim to experience no imagery at all. There are, however, good reasons for *not* taking these claims entirely at their face value (Thomas, 1989).) The 'Fregean' argument may be sound, but it seems to be directed at a straw man. Imagery theories of thought and its relation to language, including Locke's theory and, I think, the theory to be considered below, have generally *not* been intended to be theories of meaning in the Fregean sense (Lowe, 1996). It may very well be the case that such 'Lockean' theories do not tell us all we might wish to know about the nature of linguistic meaning, but they might tell us something that is true, relevant, and important nonetheless.

The fourth, and perhaps the most telling, argument (or family of arguments), which probably originated with Wittgenstein, points out that many of the things that we can think are really quite unimageable, and even in cases where it does seem to be possible to picture something appropriate, we can make distinctions in thought that we would not seem to be able to make in imagery. Surely we cannot have images of abstractions like justice, or evil, per se, or, say, the presidency (the office, as opposed to some particular president); yet we can certainly think about these sorts of things. Furthermore, pace Titchener (1909), logical and syntactic operators and connectives ("if", "but", "not", "because", "therefore", "or" etc.) cannot be imaged, and neither can grammatical and logical properties like tense, mood, mode, and quantification. I might have an image of a cat on a mat, but (it is asked) does this correspond specifically to the thought that "the cat is on the mat", or to "a cat was (or will, or might, or should be) on the mat", or "if there were a mat, some cat might possibly be on it", or any one of innumerable further possible thoughts? Is it possible to form an image at all that will correspond to a thought like "If the presidency did not exist, liberty might come under threat"? These are all thoughts that are thinkable, and easily expressible in language, but it would seem that either they cannot be visually imagined at all, or else that there is no possible image that could correspond to them specifically. In the light of such considerations, language, not imagery, came to be seen as the fundamental, indeed the only adequate medium for cognition. But although the anti-image argument is very persuasive, the view that we are offered in its stead, of the mind as an entirely linguistic system, is surely highly counter-intuitive to almost anyone who has not been thoroughly indoctrinated into the relevant philosophical tradition, or its psychological counterparts (Price, 1969).

Of course, these days some of the more influential heirs of the analytic tradition have moved on from taking *natural language* as representationally basic to giving that role to

some sort of language-like computational representation system (on the analogy, originally, of LISP data structures), but although they are less inclined than their predecessors to deny the existence or the cognitive utility of images altogether, their inherited iconophobic prejudices have really only become slightly attenuated. It has actually been these philosophers, much more than the computational modelers themselves, who have really (and, I should say, rightly) made it clear that the sort of quasi-pictorial images championed by cognitive scientists such as Kosslyn cannot be the *fundamental* form of mental representation in a computational cognitive system, even though there might be the theoretical space, and good empirical reasons, to incorporate them somewhere within it (Fodor, 1975; Tye, 1991). There has been a considerable synergy between philosophy in this sort of vein and the sort of computational cognitive science that has relegated consciousness and imagery to the mental sidelines; the two traditions have lent enormous credibility to one another.

In this theoretical context, the book under review must be seen as a very welcome new departure in philosophical thinking about cognition. Ellis undertakes to give us the outline of a theory of cognition framed in terms of imagery; that is, in terms of truly *mental*, conscious (or potentially conscious) processes and representations, rather than in terms of whatever non-conscious and (in any ordinary sense of the term) non-mental, neurophysiological or computational operations and structures might underlie them. Admittedly, there are psychologists (notably Paivio, 1971/1979, 1986) who have already attempted this, and other philosophers who have rejected the prevailing iconophobia (e.g. Price, 1969; Lowe, 1996; Martin, 1997), but Ellis is unusual in elaborating a clear and positive theory that truly confronts the key iconophobic arguments at their most powerful. This brings him also to tackle the standard views of the mind-brain relation, rejecting not only the various forms of dualism (these get dismissed fairly quickly, as is usual) but also mind-brain identity theory and functionalism, which, on its usual reading at least, implies that mental states *are* computational states. Battling with entrenched orthodoxies on so many fronts is a tall order indeed, and Ellis can surely be forgiven if his own positive accounts are not always fully convincing in all their details. But the fact that one may have reservations about some of the specifics of Ellis's theories should not detract from the point that this work is a major and most original achievement, and one that I hope will prove to be an important trailblazer. Ellis shows that there are promising ways forward along many theoretical paths which had long been thought quite impassable, and it is to be hoped that others will now be encouraged in the enterprise of opening them up more fully to the progress of scientific understanding.

After a substantial and helpful introduction outlining the fundamentals of his approach, Ellis, in chapter one, launches into an account of imagery which understands it neither as a matter of having pictures in the head (pace Berkeley -- and Kosslyn too), nor as a subset of computational, quasi-linguistic representations, but rather as the result of acts of selective perceptual attention. Perception, for Ellis, is an active process of *looking for* features of the object or scene before us (presumably features we, or our perceptual systems, expect to be present on the basis of what has been previously found), and it is the notion that this sort of directed '*questioning*' of our (inner and outer) environment is fundamental and essential to consciousness that gives his book its title. Perception is

conscious inasmuch as it involves this sort of active 'questioning', as opposed to the mere passive affection of the sense organs (or even the brain) by impinging stimuli (c.f. Marcel, 1983; Gray, 1995). We experience conscious imagery when we persist in our 'questioning' even though there is no positive answer to be had; when we determinedly 'look for' features that are not in fact there. Thus, if I am imagining what a pink wall would look like if it were blue:

> I focus on the wall as if trying to become intensely aware of any amount of blue that *is* or *might be* mixed in with the pink . . . There is a sense in which I look for blueness in the wall and *do not find it*. (I.e. I look for blue and find pink instead). (p. 37, original emphases).

In fact, a number of imagery theories of this general sort have been sketched (admittedly often in the barest outlines) in the psychological literature (Neisser, 1976, 1978; Hochberg, 1968; Hebb, 1968; Sarbin & Juhasz, 1970; Farley, 1976; Janssen, 1976; Morgan, 1979; -- and I confess that I myself favor such a view -- Thomas, 1994, in press), but the computational bias of most cognitive scientists, and the dust thrown up by the 'analog/propositional' imagery debate mentioned above, has meant that these nascent theories have received very little attention. Indeed, Ellis betrays no awareness of them. It would appear that the actual source of his inspiration here is the phenomenological tradition descending from Husserl and Merleau-Ponty; but I should say immediately that Ellis's exposition is *not* marred by the arcane jargon or the genuflections towards the heroes of the phenomenological movement which so often make work in this tradition impenetrable, or at least rebarbative, to the outsider. In fact, the writing throughout is as clear and lively as one can expect in a serious academic work, and jargon is kept to a minimum.

In his first chapter, and throughout the book, Ellis cites a certain amount of experimental psychological evidence in support of his position, and he also attempts to sketch a neuropsychological framework for his theory (imagery, for example, is depicted as essentially a parietal lobe function, but under the control of frontal cortex and thalamus). This, however, I felt to be the book's weakest aspect. This may be unfair, but I was not convinced that Ellis has a sufficiently deep mastery of either the neuroscientific or the relevant psychological literature to ground the ambitious, if rather generalized, claims he wants to make. From a rhetorical perspective, it might have been better to leave the neuropsychological material out altogether. I fear that if it should prove excessively naive, or demonstrably wrong, to the expert eye, then that might lead to the other elements of his views to receive less consideration than they truly deserve. But in fact, even if Ellis gets the story about the neural embodiment wrong (and I am not saying he does; just that, as an amateur in this area myself, I was not convinced), this is of little relevance to the value of the cognitive and philosophical theories which are the book's main focus and contribution. If Ellis is on the right track in these latter regards, then putting the neuroscientific and experimental flesh on the bones of his approach can, and probably should, be left to the experts.

In any case, having given us his account of the underlying nature of imagery, in chapter two Ellis goes on to present an account of how such imagery might be able to ground more abstract conceptual thought, and how imagery might ultimately ground our use of language. In this and the following chapter, Ellis is directly confronting the post-Wittgensteinian orthodoxy and showing us a real alternative to its exorbitant 'lingualism'. Admittedly, the theory he presents needs further elaboration, and some of its structural components look a bit flimsy (in particular, a lot of reliance is placed on the less than clear notion of the "feeling of confidence" that we *could* generate imagery relevant to some concept, even though we might often not actually do so), but he has done quite enough to show that further research in this area is likely to be very worthwhile, and has begun to map out the territory that such work will need to explore.

In chapter three Ellis takes on developmental issues, and demonstrates how an image-based theory of cognition might accommodate such things as logical inference, negation, and conditionals. Although some aspects of these issues have been explored before by psychologists such as Johnson-Laird (1983), this has been in the context of the sort of computational theory of mind that Ellis is at pains to reject. Ellis's own treatment is most interesting and, to the best of my knowledge, largely original. It appears to be rooted in his own experience as a logic teacher, although some important theoretical debts, especially to the work of Natika Newton (1982, 1993), are acknowledged. Particularly interesting, to my mind, is Ellis' appeal to auditory and kinaesthetic imagery in his account of how we learn to identify valid or invalid argument forms by recognizing how they conform to what he calls "rhythm patterns":

> 'This implies that; not that; therefore not this' is *modus tollens*, whereas 'this implies that; not this; therefore not that' is the fallacy of denying the antecedent. We can hear these temporal rhythms just as we would a recognizable pattern in music. (p. 98)

Once again, one need not be convinced by all aspects of this theorizing ("feelings of confidence" play an ominously large role again) to realize that Ellis has opened up potentially very important new territory here, and has produced significant ideas that deserve further conceptual and experimental exploration.

Chapter four introduces Ellis's account of the mind-body relation, designed to ground his theory of conscious cognition. Again, in what is already a crowded field, Ellis provides fresh and interesting ideas. Standard psychophysical functionalist theories of mind are usually understood as asserting the identity of token mental states with token brain states, but Ellis avoids stipulating such static, internalistic state-state identities. Rather, he suggests, we should think of the mind-matter relation as a relation of a dynamic process (mind) to the material substratum in which it operates (not only the brain, but also the body's sensory and motor systems, and the environment with which they are interacting). Much of the exposition here rests on an analogy to the relation between a sound wave (process) and the material media through which it travels (substratum).

This general picture of the nature of mind has real attractions, but some of the details of Ellis's treatment remained obscure to me, particularly as he attempts to develop and apply the process-substratum idea in chapter five, which I found the least satisfactory part of the book. The chapter is built around an extended discussion of the relationship between literal, conscious desires and metaphorical 'desires' (as when we might say that a neuron 'desires', or 'wants', to bring its ionic potentials into equilibrium). In this context Ellis develops what (if I have understood him correctly) are intended to be two necessary, and perhaps jointly sufficient, conditions for consciousness:

> We have reached the position that desire differs from 'desire' in two important respects. (1) The aim of the desire is not the aggregate of the aims of all the 'desires' that make up the substratum for the desire; instead the aim of desire is to remove an irresolvable internal conflict by changing the overall condition of the organism. And (2) a conscious desire is a process which is capable of appropriating, changing and reproducing elements of its own substratum in order that the process may not only continue, but also may expand in scope; it accomplishes this purpose by imaginatively representing the missing elements or ideas related to the missing elements. (p. 189)

The first criterion here is developed in quite an interesting way, and may be relevant to understanding the notion of the 'unity' of consciousness. However, it was not clear to me that it did much to illuminate the crucial question of how desires (metaphorical or otherwise), construed as bodily needs, can come to be subjectively experienced. Indeed, Ellis holds that the metaphorical, unconscious 'desires' of the autonomic system to maintain bodily homeostasis fall under this criterion, so it is certainly not intended as sufficient for consciousness, and I am not convinced that it has been shown to be necessary either.

The second criterion I found hard to understand. The claim seems to be that mental processes are such that they can actually extend their substrate as needed, as if a sound wave reaching the edge of the atmosphere could somehow cause more air to be created to sustain its outward propagation (this is Ellis' own example). But if this means anything more than the truism that our cognitive capacities play an important role in keeping us, and thus our brains, alive, then I cannot say what. Worse, the second clause of the second criterion, which recruits imagination to play a role in the characterization of 'true' desires, would seem to render any attempt to *explain* consciousness in these terms trivial or circular. Desires are conscious inasmuch as they involve imaginative (i.e. conscious) representations -- well, we knew that! What we want to know is why representations of the sort that Ellis envisages (or, indeed, of any other sort) should be consciously experienced, and that remains obscure. Since, in my view, the sort of account of imagery defended by Ellis is much more appropriate to understanding conscious representation than are most other extant pictures of mental representation, I think he may well have brought us close to the threshold of a solution to the problem of consciousness, but he has not carried us over.

I also found Ellis's subsequent arguments, closely bound up with the second criterion above, to the effect that consciousness and cognition can only occur in an organic system puzzling and unpersuasive. Although he defines "organic" in such a way that it does not necessarily imply a biochemically based system, in practice he treats the term as if it does carry such an implication (pp. 182-3). However, his critique of 'strong' artificial intelligence (which seems intended to cover robotics too) is really rather superficial, and I can see no good reason to agree that a cognitive system of the general sort he proposes could not find its substratum in a silicon and steel robot just as well as in a body made of protoplasm. Of course, this would not be the 'good old fashioned' symbolic AI, where mental contents (including conscious ones) are identified with (some of) the data structures that the program manipulates; neither would it be the sort of connectionism that would identify such contents with weight matrices, unit activation patterns, or the like. But recent work in robotics (e.g., Brooks, 1991), active perception (Bajcsy, 1988; Ballard, 1991; Blake & Yuille, 1992; Swain & Stricker, 1993; Aloimonos, 1993; Landy, Maloney, & Pavel, 1996), and 'dynamic' approaches to cognition (van Gelder, 1995; Garson, 1996) seems to me to be groping towards an account of computational (or, rather, 'computer brained') systems that might be able to embody just the sort of cognitive substrate that could support truly *mental* representational processes of the type that Ellis envisages. In these systems, no symbol or structure in the computer-brain need be taken as representing any of the things in the world of which we might normally be conscious, but the systems interact successfully with their worlds nonetheless. Perhaps that is also how it is with *our* brains and *our* interactions with the world. What these robotic and 'dynamic cognition' theorists seem to be missing, however, is an account of how our normal, contentful, conscious experience could fit into such a picture. Ellis' discussions of imagery and consciousness seem to me to offer at least a hint towards understanding how this vital theoretical gap might be filled. Of course, this is all highly speculative on my part, and Ellis himself might well reject it, but I think it is consistent with the main thrust of his argument, and it has the advantage of pointing the way toward the possibility of a new and powerful synthesis between the computational approach to cognition, which is now so well entrenched, and the phenomenological tradition that Ellis himself seems to represent.

The last major chapter of the book (before a brief conclusion that summarizes and draws together the principal themes) applies the theory as developed so far to the topics of memory, emotion and symbolization. Unlike the majority of cognitive scientists, Ellis does *not* use the last of these terms to signify merely the way in which arbitrary (or even 'natural') signs may be used to represent something; rather, for him, 'symbolization' refers to a process by which an originally inchoate emotion or desire is rendered fully conscious and brought to greater definition through its expression in an imaginative representation. I was somewhat reminded of Collingwood's (1938) account of artistic creation, although, of course, Ellis is thinking of an everyday, and purely mental, activity engaged in by even the least artistic among us, and not just of the creation of concrete works of art.

Likewise, Ellis does not regard memory simply as a matter of storing and retrieving facts (or even images) concerning the past; rather, it is a matter of how current behavior (crucially including imaginative and symbolizing behavior) is to be understood as

displaying continuity with the behavior and the associated symbolizing of the past. In this chapter, the ideas of Eugene Gendlin, whom Ellis acknowledges in his preface as a major influence, play a large and explicit role. In particular, Gendlin's notion of "implicit bodily sense", seems to underlie both Ellis' understanding of preconscious (pre-symbolized) inchoate desire and emotion and his account of memory as essentially bodily and behavioral. I am not familiar with Gendlin's work, but I was somewhat concerned that Ellis might be making this interesting concept of "bodily sense" (how expectations and emotions might be implicitly represented in muscular tensions and the like) carry rather more weight than it could plausibly bear. Also, just as the account of language and thought in the earlier chapters relied heavily on "feelings of confidence", the account of memory here depends on the similarly bothersome notion of "feelings of recognition". However, I found the explication given here of the latter sort of "feeling" actually helped me better to understand what Ellis had had in mind when he invoked the former. Thus, it somewhat increased my confidence that the "feeling of confidence" might really be a coherent construct able to sustain the key theoretical role initially assigned to it.

In conclusion, I ought to point out that Ellis himself does not explicitly situate his work within the historical context of attitudes towards imagery, thought, and consciousness that I described at the beginning of this review. However, I hope that by my so situating it, I have brought out the considerable potential contribution it may be able to make to the development of consciousness studies and cognitive science, showing us a possible escape route from the dead-end view of cognition as mechanical, unconscious computation with which spurious and quite ineffable 'qualia' just happen to be somehow associated. Not only does the book provide a promising new general theoretical direction, but there are also many points of detail that could be usefully tested, explored, clarified, and reworked by experimental as well as theoretical research. Despite my criticisms, I hope it achieves a wide audience and significant influence.

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References

Aloimonos, Y. (Ed.) (1993). *Active Perception.* Hillsdale, NJ: Erlbaum.

Anderson, J.R. (1978). Arguments Concerning Representations for Mental Imagery. *Psychological Review, 85,* 249-277.

Bajcsy R. (1988). Active Perception. *Proceedings of the IEEE, 76,* 996-1005.

Ballard, D.H. (1991). Animate Vision. *Artificial Intelligence, 48,* 57-86.

Berkeley, G. (1734/1975). *A Treatise Concerning the Principles of Human Knowledge.* In M.R. Ayers (Ed.) (1975) *George Berkeley: Philosophical Works Including the Works on Vision* (pp. 61-127). London: Dent.

Blake, A. & Yuille, A. (Eds.) (1992). *Active Vision.* Cambridge, MA: MIT Press.

Block, N. (Ed.) (1981). *Imagery.* Cambridge, MA: MIT Press.

Brooks R.A. (1991). Intelligence Without Representation. *Artificial Intelligence, 47,* 139-159.

Bugelski, B.R. (1984). Imagery. In R.J. Corsini (Ed.), *Encyclopedia of Psychology. Vol.2* (pp. 185-187). New York: Wiley.

Chalmers, D.J. (1996). *The Conscious Mind.* Oxford: Oxford University Press.

Churchland, P.M. (1989). *A Neurocomputational Perspective: the Nature of Mind and the Structure of Science.* Cambridge, MA: MIT Press.

Churchland, P.S. & Sejnowski, T.J. (1992). *The Computational Brain.* Cambridge, MA: MIT Press.

Collingwood, R.G. (1938). *The Principles of Art.* Oxford: Oxford University Press.

Damasio, A.R. (1994). *Descartes' Error: Emotion, Reason, and the Human Brain.* New York: Putnam.

Edelman, G.M. (1992). *Bright Air, Brilliant Fire: on the Matter of Mind.* New York: Basic Books.

Farley A.M. (1976). A Computer Implementation of Constructive Visual Imagery and Perception. In R.A. Monty J.W. Senders (Eds.), *Eye Movements and Psychological Processes* (pp. 473-490). Hillsdale, NJ: Erlbaum.

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

Fodor, J.A. (1975). *The Language of Thought.* New York: Thomas Crowell.

Garson, J.W. (1996). Cognition Poised at the Edge of Chaos: a Complex Alternative to a Symbolic Mind. *Philosophical Psychology, 9,* 301-322.

Gray, J.A. (1995). The Contents of Consciousness: a Neuropsychological Conjecture. *Behavioral and Brain Sciences, 18,* 659-676.

Hebb, D.O. (1968). Concerning Imagery. *Psychological Review, 75,* 466-477.

Hinton, G. (1979). Some Demonstrations of the Effects of Structural Descriptions in Mental Imagery. *Cognitive Science 3,* 231-250.

Hochberg, J. (1968). In the Mind's Eye. In R.N. Haber (Ed.), *Contemporary Theory and Research in Visual Perception* (pp. 309-331). London: Holt Rinehart & Winston.

Holt, R.R. (1964). Imagery: the Return of the Ostracized. *American Psychologist, 19,* 254-266.

Janssen, W. (1976). *On the Nature of Mental Imagery.* Soesterburg, Netherlands: Institute for Perception TNO.

Johnson-Laird P.N. (1983). *Mental Models.* Cambridge: Cambridge University Press.

Kosslyn, S.M. (1973). Scanning Visual Images: Some Structural Implications. *Perception and Psychophysics, 14,* 90-94.

Kosslyn, S.M. (1980). *Image and Mind.* Cambridge, MA: Harvard University Press.

Kosslyn, S.M. (1994). *Image and Brain: The Resolution of the Imagery Debate.* Cambridge, MA: MIT Press.

Kosslyn, S.M., Pinker, S., Smith, G.E. & Shwartz, S.P. (1979). On the Demystification of Mental Imagery. *Behavioral and Brain Sciences, 2,* 535-48.

Kosslyn, S.M. & Shwartz, S.P. (1977). A Simulation of Visual Imagery. *Cognitive Science, 1,* 265-295.

Landy, M.S., Maloney, L.T. & Pavel M. (Eds.) (1996). *Exploratory Vision: The Active Eye.* New York: Springer-Verlag.

Locke, J. (1700/1924). *An Essay Concerning Human Understanding,* In S. Pringle-Pattison (Ed.). Oxford: Oxford University Press.

Lowe, E.J. (1996). *Subjects of Experience.* Cambridge: Cambridge University Press.

Marcel, A.J. (1983). Conscious and Unconscious Perception: an Approach to the Relations Between Phenomenal Experience and Perceptual Processes. *Cognitive Psychology, 15,* 238-300.

Martin, C.B. (1997). *Imagery as the Medium of Conscious Thought, and The Ontogeny of the Uses of Imagery.* Manuscript in preparation, University of Calgary.

Morgan, M.J. (1979). The Two Spaces. In N. Bolton. (Ed.). *Philosophical Problems in Psychology* (pp. 66-88). London: Methuen.

Natsoulas, T. (1974) The Subjective, Experiential Element in Perception. *Psychological Bulletin, 81,* 611-631.

Natsoulas, T. (1978). Consciousness. *American Psychologist, 33,* 906-914.

Neisser, U. (1972). A Paradigm Shift in Psychology. *Science, 176,* 628-630.

Neisser, U. (1976). *Cognition and Reality.* San Francisco: W.H. Freeman.

Neisser, U. (1978). Anticipations, Images and Introspection. *Cognition, 6,* 167-174.

Newton, N. (1982). Experience and Imagery. *The Southern Journal of Philosophy, 21,* 475-487.

Newton, N. (1993). The Sensorimotor Theory of Cognition. *Pragmatics and Cognition, 1,* 267-305.

Paivio, A. (1971/1979). *Imagery and Verbal Processes.* New York: Holt, Rinehart & Winston. [Reprinted in 1979 by Hillsdale NJ: Erlbaum.]

Paivio, A. (1986). *Mental Representations: a Dual Coding Approach.* New York: Oxford University Press.

Price, H.H. (1969). *Thinking and Experience* (2nd ed.). London: Hutchinson.

Pylyshyn, Z. W. (1973). What the Minds Eye Tells the Minds Brain: a Critique of Mental Imagery. *Psychological Bulletin, 80,* 1-25.

Pylyshyn, Z. W. (1981). The Imagery Debate: Analogue Media Versus Tacit Knowledge. *Psychological Review, 88,* 16-45.

Reisberg, D. (Ed.). (1992). *Auditory Imagery.* Hillsdale NJ: Erlbaum.

Sarbin, T.R. & Juhasz, J.B. (1970). Toward a Theory of Imagination. *Journal of Personality, 38,* 52-76.

Shepard, R.N. & Cooper, L. A. (1982). *Mental Images and Their Transformations.* Cambridge, MA: MIT Press.

Shepard, R.N. & Metzler, J. (1971). Mental Rotation of Three- Dimensional Objects, *Science, 171,* 701-703.

Swain, M.J. & Stricker, M.A. (1993). Promising Directions in Active Vision. *International Journal of Computer Vision, 11*, 109-126.

Thomas, N.J.T. (1989). Experience and Theory as Determinants of Attitudes Toward Mental Representation: the Case of Knight Dunlap and the Vanishing Images of J. B. Watson, *American Journal of Psychology, 102*, 395-412.

Thomas, N.J.T. (1994). Review of *The Imagery Debate*, by Michael Tye. *Journal of Mind and Behavior, 15*, 47-50.

Thomas, N.J.T. (1996). Zombie Killer, Paper read at *Toward a Science of Consciousness (Tucson II)* conference, Tucson AZ, April 1996. Forthcoming in S. Hameroff (Ed.) *Toward a Science of Consciousness 2*, M.I.T. Press. [Available at http://web.calstatela.edu/faculty/nthomas/zom-abs.htm]

Thomas, N.J.T. (in press). Are Theories of Imagery Theories of Imagination?. *Cognitive Science.* [Available at http://web.calstatela.edu/faculty/nthomas/im-abs.htm]

Titchener, E.B. (1909). *Lectures on the Experimental Psychology of the Thought-Processes* New York: Macmillan.

Tye, M. (1991). *The Imagery Debate.* Cambridge, MA: MIT Press.

Van Gelder, T. (1995). What Might Cognition Be, If Not Computation? *Journal of Philosophy, 92*, 345-381.

Watson, J.B. (1913). Psychology as the Behaviorist Views It. *Psychological Review, 20*, 158-177.