COGNITION AND PERCEPTION

How Do Psychology and Neural Science Inform Philosophy?

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This book is for Ali, Thomas, and Zogia.

Foreword

When I was growing up philosophically, Wittgenstein held broad and deep influence, and a part of the accepted dogma was that philosophy and science were deeply different disciplines that pursued radically different goals by even more radically different methods. This unfathomable demarcation left many of us who were interested in science, history of science, *and* philosophy deeply discomforted intellectually and outsiders socially. The discomfort and the resulting paradoxical attitudes are well illustrated by one of the first real historians *and* philosophers of science, Norwood Russell (Russ) Hanson. Consider these two notes in Hanson's 1958 book *Patterns of Discovery* (Cambridge University Press):

> References to psychology should not be misunderstood; but as one's acquaintance with the psychology of perception deepens, the character of the conceptual problems one regards as significant will deepen accordingly. Cf. Wittgenstein, *Phil. Inv.* . . . p. 193. 'Its causes are of interest to psychologists. We are interested in the concept and its place among the concepts of experience.' (p. 11, n. 2)

> 'Philosophy has no concern with fact, only with conceptual matters' (Wittgenstein, *Tractatus*, 4.11); but discussions of perception could not but be improved by the reading of these twenty papers [Hanson had listed 20 papers with references to Gestalt and other psychologists]. (p. 13, n. 2).

Hanson, at least, was a philosopher who worried about real science and its history and spent considerable time examining issues of perception and how they related to issues to evidence, causation, and scientific theorizing. The imposition of the philosophy/science dichotomy has many roots and many predecessors (e.g. romanticism), but I believe the most immediate cause of its modern analytic form was G. E. Moore and the changes in Cambridge philosophy that followed from his and Bertrand Russell's influence early in the twentieth century. The breakdown of this dichotomy is often attributed to W. V. O. Quine's "Epistemology Naturalized" (lecture

delivered in 1968; published in 1969 in *Ontological Relativity and Other Essays*, Columbia University Press). But such attribution is mostly hindsight, for the dogma of difference held on for some time and indeed is still with us in many ways today.

But what has all this history to do with Athanassios Raftopoulos's book? Well, the book's subtitle is "How Do Psychology and Neural Science Inform Philosophy?" Until the last few decades, such a question would not have been acceptable. Such informing would be taken to be impossible both by those who believe that philosophy is *sui generis* and by those who believe that the only real questions are those that can be answered by science, through eliminativist reduction. Now, Raftopoulos is not the first to propose robust relations between psychology, neuroscience, and philosophy. But he does it in new and concretely novel ways. You may disagree with his interpretation of the science on which he reports, or you may disagree with how he makes connections between visual neuroscience and cognition, or you may hold out for some extra-physical sense of representational warrant, but even if you would pursue any of these options, you must confront and confute the evidence he brings to bear on the questions of noncognitive content, theory-ladenness, and realism.

Some putative counter-instances to Raftopoulos's claims could be based on anticipatory firings in the nervous system, in the retina, in the thalamus, in the hypothalamus, and in various cortical regions, with regard to expectancies and rewards regarding future events. But such data about expectancies do not vitiate Raftopoulos's claim that these, as well as low-level perception, could be noncognitive. What is in question is what mechanisms are subject to cognitive influence, not what may influence whatever anticipatory or attentional mechanisms may be operative. So it all comes down to what counts as cognition. For example, Raftopoulos claims that object individuation precedes object identification, and correlatively that object individuation is noncognitive. Now, many philosophers and psychologists have talked about object individuation in terms of object discrimination, and have held that discriminatory acts or behaviors are not cognitive in some sense. Yet the real question here is "What difference such a distinction makes?" or "What is the distinction used to support?" In this book, Raftopoulos ties these questions to a defense of realism and anti-constructivism. That is, he ties noncognitive perception to a philosophical position in which perceivers really are "directly" aware of some aspects of the world, albeit in a sense limited to spatiotemporal information about objects. Such a conception of objectivity is a most noble philosophical goal, and, given today's rampant tendencies toward

relativism, it deserves a good hearing. And, Raftopoulos argues, that allowing for a noncognitive perception need not commit us to the heinous Sellarsian crime of re-introducing the myth of the given.

This is a most carefully written book. It is one of the first philosophical works to pay explicit attention to the timing of neural processes, which are being seen as more important each day in the writing of neuroscientists. Raftopoulos makes excellent use of the science at his disposal. So read the book carefully, and draw up what arguments you may. It is certain that future accounts of perception will have to deal with the positions defended herein. What more could one ask from a book?

Peter Machamer
Professor of the History and Philosophy of Science
University of Pittsburgh

Preface

The theory regarding the issue of the cognitive penetrability of perception and its philosophical ramifications presented in this book has been gradually evolving over about nine years. Being a member of the Fuzzy Guys Club (a term that Peter Achinstein, my professor at The Johns Hopkins University, reserved for those among us who subscribed to Hanson's, Kuhn's, and Feyerabend's view that perception is theory-laden), and also being very much impressed by Paul Churchland's arguments to the same effect based on neuroscientific findings, I decided to use my strong background in psychology and show once and for all that Churchland is right. Recent neuroscientific findings prove beyond any reasonable doubt that higher cognitive centers in the brain send information in a top-down manner, through reentrant neuronal connections, to the lower or more peripheral levels of the brain and, hence, modulate perceptual processing. Since these cognitive centers are the loci of our theories and conceptual frameworks, perception is theory-laden and/or cognitively penetrable. My conviction that Churchland's views will triumph was further reinforced by the fact that the theory of Churchland's main rival, namely Jerry Fodor's modularity theory of perception, seemed to be contradicted to some extent by empirical findings about, say, perceptual learning and the relative plasticity of the brain. All the scientific evidence pointed to the likelihood that Fodorian modules exist only in Fodor's mind and certainly not in the brain.

I spent three full years studying the relevant psychological and neuroscientific evidence with a view both to establishing the truth of Churchland's views and to shedding further light on the mechanisms that allow the cognitive penetration of perception. To my dismay, I discovered that I was very wrong. Although Churchland was right that what we see (that is, the final product of vision) depends on our conceptual frameworks, there is a substantial part of visual processing that is cognitively

impenetrable. So I decided to change camps. If there is a part of vision that is cognitively impenetrable, I have to tell the world (or, rather, the philosophers) about it. Of course, I had not discovered the wheel; many psychologists, most notably Zenon Pylyshyn, have been arguing all along for the same thing, to wit that there is a cognitively impenetrable part of visual processing (Pylyshyn has called it "early vision").

Fortunately for my publishing plans, Pylyshyn had demolished the thesis of the continuity of perception and cognition, another term for the cognitive penetrability of perception, on psychological and methodological grounds. In my mind I had undermined the continuity of perception and cognition on neuroscientific grounds, and more specifically using evidence based on brain scanning techniques. This is not to say, of course, that no researchers had used such techniques from various research perspectives to raise the point that what we perceive does not depend on our conceptual frameworks. But philosophers are supposed to put all things together, and I hoped (and still hope) that I had synthesized the vast amount of evidence under the same roof. Furthermore, Pylyshyn and the other similarly minded psychologists and neuroscientists did not use their findings to attack or discuss philosophical problems. This is where philosophers are supposed to step in, and so I decided to do just that. I thought that traditional philosophical issues, including problems related to nonconceptual and phenomenal content, reference, and realism, could benefit from the views that I had formed while examining the issue of the cognitive penetrability of perception.

The first products of my research were two papers on the theory-ladenness of perception and on the Churchland-Fodor debate that were published in the journals *Cognitive Science* and *Philosophy of Science* in 2001. A short version of the second paper was presented by the chairperson of the relevant session, for I was not able to attend the conference, at the biannual conference of the Philosophy of Science Association in Vancouver in November 2000. I was informed by the reader that all the big names were present when my paper was read, and that a lively discussion followed the presentation of the paper. William Bechtel, one of the attendants, commented that the important term in unraveling the mysteries of the interface between perception and cognition was 'attention'. I took him very seriously and spent two more years trying to understand the role of attention in mediating the interaction between perception and cognition. The results include, in addition to this book, a book that I edited in 2005 (*Cognitive Penetrability of Perception: Attention, Action, Planning, and Bottom-Up Constraints*), a series of publications in various conference proceedings,

and papers published in *Behavioral and Brain Science* in 2004 and in *Philosophical Psychology, Mind and Language*, and *Philosophy and Phenomenological Research* in 2006. I collaborated on the last two papers with my good friend and old colleague Vincent Muller, whose knowledge of the philosophy of language proved invaluable.

Although the present book relies on the ideas developed in the aforementioned publications, it goes much beyond them both with respect to the empirical evidence adduced and discussed and with respect to the ideas elaborated, the theses expounded, and the issues examined. There are, in addition, some modifications of earlier arguments—a good thing, because, notwithstanding their validity, they were based on wrong premises.

It is time now to acknowledge the contribution of all those who helped me see this book through. First, I would like to thank the Department of Psychology, the School of Social Sciences and Sciences of Education, and the Rector's Council of the University of Cyprus for granting me a sabbatical for the spring semester of 2005–06, which I desperately needed to finish the manuscript. At the same time, I was honored by the Center for Philosophy of Science at the University of Pittsburgh to be elected as a visiting fellow. That gave me the opportunity to spend the spring semester ('spring' being a euphemism for the bitter cold weather in Pittsburgh during that time) at the Center. I do not exaggerate when I say that I cannot think of a better and more stimulating academic environment for philosophers of science than that provided by the Center. Therefore, I wish to express my gratitude to the members of the committee who elected me as a Fellow; to the Chairperson of the Center, Professor John Norton, for being largely responsible for the excellent academic environment that prevailed at the Center; and to all the staff there, especially Karen, for making me feel comfortable and welcome. Special thanks to the other fellows during the spring semester of 2005–06, who, with their helpful comments during our weekly meetings, helped me to better my ideas on various topics and made very helpful suggestions regarding some of my papers: Gabriele de Anna, Carla Fehr, Malcolm Forster, Lilly Gurova, Nikolay Milkov, and Wang Wei.

Special mention should be made of Professor Peter Machamer, who spent many hours with me discussing the first draft of the book and helping me to improve it. I would also like to thank Peter for giving me the opportunity to present some of the topics of the book in his graduate seminar in the Department of Philosophy and History of Science at the University of Pittsburgh, and, most important, for his constant and enthusiastic support during the five years I have known him.

I would also like to thank Vincent Muller for collaborating with me on two papers, and the audiences at the various conferences at which I presented papers. Marios Avramides, a colleague in the Department of Psychology at the University of Cyprus who specializes in visual attention and spatial representations, read drafts of the first and second chapters of this book. His enthusiastic reaction was a great motive for me to continue writing the book, and so special thanks are due to him.

Finally, I would like to thank the publishers and editors of the journals in which I published the papers parts of which are included in this book for allowing me to reproduce material. The original publications are listed here.

A. Raftopoulos, "Is perception informationally encapsulated? The issue of the theory-ladenness of perception," *Cognitive Science* 25 (2001): 423–451, published by the Cognitive Science Society

A. Raftopoulos, "Reentrant pathways and the theory-ladenness of observation," *Philosophy of Science* 68 (2001): 187–200, published by the University of Chicago Press.

A. Raftopoulos, "Two types of object representations in the brain, one nondescriptive process of reference fixing," *Behavioral and Brain Science* 27 (2004), no. 1: 47–48, published by the Cambridge University Press

A. Raftopoulos, "Defending realism on the proper ground," *Philosophical Psychology* 19 (2006), no. 1: 1–31, published by Routledge

A. Raftopoulos and V. Muller, "The nonconceptual content of experience," *Mind and Language* 27 (2006), no. 2: 187–219, published by Blackwell

A. Raftopoulos and V. Muller, "Nonconceptual Reference Fixing," *Philosophical and Phenomenological Research* 72 (2006), no. 2: 251–285, published by the International Phenomenological Society

A. Raftopoulos, "Perceptual Systems and Realism," *Synthese* 164 (2008), no. 1: 61–91, published by Springer

None of these things would have mattered had I not had permission from my wife Ali and my cats Thomas and Zogia to be away from home for so long during my sabbatical and to be traveling around the world presenting my work, and their continuous support. This book is for them, with my everlasting gratitude.

Introduction

In this book, I discuss the issue of the cognitive penetrability of perception and claim that there is a part of visual processes that results in representational states with nonconceptual content—that is, a part that retrieves information from visual scenes in conceptually unmediated and thus theory-neutral ways. Using the thesis that there exists a conceptually unmediated or cognitively impenetrable part of vision, I first address problems in the philosophy of science, in the philosophy of mind, and in epistemology related to the theory-ladenness or cognitive penetrability of perception. Second, I examine how we access the external world through our perception and what we can know of this world.

Philosophical discussions of realism note that the intervention of perception in our dealings with the world poses a serious problem for our accounts of the world, because perception is deemed to be influenced by our theoretical standings and our cognitive stances. Thus, what we perceive is a blend of what is out there and what we think, believe, and so on. Perception is theory-laden, and thus there is no nonconceptual content in experience on the basis of which one could mount a search for what is really out there and exists independently of our minds. If one holds the above position, then there are two options: either one has to abandon any form of realism, or to salvage realism one has to argue that despite the conceptual character of our experiential content the world is the content of our perceptual states and thus we access it directly. I think the second choice is untenable and deeply problematic: perceptual states are representational states, and thus their content cannot be worldly states of affairs themselves but must consist of representations or presentations of the way worldly states of affairs are. Thus, if no part of this content can be nonconceptual, any attempt to vindicate not only scientific realism but also common-sense realism is hopeless.

The "New Look" theory of psychology (see Gregory 1974 for an overview) in combination with the Gestalt theories of organization of perception left a profound impact on the philosophy of science, mostly through the works of Hanson (1958), Kuhn (1962), and Feyerabend (1962). The older thesis that no observational data are uninterpreted theory-neutral descriptions of events and that every description is made within the framework of a theory (Duhem 1914) was pushed to its full epistemological and ontological consequences. Not only are observational reports embedded in a theory; what we see is already an interpretation of the incoming information based on the theoretical commitments of the perceiver. This being the case, if one does not fear to see the argument through, what sense does it make to talk of a rational choice among theories based on experimental outcome? If what one sees depends on what one believes, and therefore people with different commitments see different worlds, and if there is no neutral basis on which matters of meaning could be resolved, how could people with different commitments communicate? Furthermore, in what sense could one talk of their seeing in different ways the same world?

The undermining of the possibility of theory-neutral perception has led to the abolition of the distinction between *seeing* and *seeing as* (Brown 1987; Churchland 1988; Feyerabend 1962; Hanson 1958; Kuhn 1962), clearing the way for the relativistic theories of science and meaning, since what one sees depends on one's expectations, beliefs, and so forth. Hence, the existence of a theory-neutral basis, on which a rational choice among alternative theories could be based, is rejected, and scientific theories become incommensurable. There can be no communication between scientists who belong to different scientific paradigms, because there is not a theory-neutral perceptual basis that could resolve matters of meaning. Instead, perceptions become parts of a paradigm, modulated by its theoretical commitments, and proponents of different paradigms perceive different worlds. Perception becomes theory-laden. Finally, borrowing the argument from Quine's (1960) discussion of the radical indeterminacy of translation, and borrowing Quine's conclusion that there is not, as a matter of fact, a content that is being translated differently, one can argue that there is no world that is being perceived differently by perceivers with different theoretical commitments. The aforementioned views led to the birth of constructivism in philosophy and to the movement called *conceptual relativism*. Constructivism denies the realist's claims that scientific theories relate mind-independent objects and us. Kitcher (2001) defines two types of constructivism. *Epistemological constructivism* argues that our experience of the world is mediated by concepts, and that there is no direct

way to examine which aspects of objects belong to them independently of our conceptualizations. Perception is cognitively penetrable and theory-laden. There is no Archimedean metaphysical point from which one could compare our representations of objects and the mind-independent objects we represent and then identify in what respects and to what extent those objects are as we represent them to be. In other words, we cannot ascertain whether the properties we perceive the objects as having are really properties of the objects in the world. *Semantic constructivism* attacks realism on the ground that there is no direct way to set up the relation between terms and the entities to which they purportedly refer. That relation can only be indirect mediated through the causal relations between these entities and our behavior; it can only be interest-dependent. Since these relations ground terms in the entities to which they refer by fixing their referents, reference becomes theory-dependent.

Constructivism (or Relativism, as it is also known) clearly constituted a coup against the constitutional order for the majority of philosophers of science, who saw the very foundation of their most trusted beliefs crumbling. Being philosophers of science and not epistemologists or metaphysicians, they perceived as the most threatening thesis of the new dogma the claim that all those who live within one paradigm cannot really communicate with those who live in another—that is, the thesis of incommensurability of scientific theories. Accordingly, their efforts were concerted on rebutting this most dreadful consequence of conceptual relativism. I think it is fair to say that these attempts have been mostly successful. Almost no one thinks anymore that there are no communication channels between differing paradigms. The roots of constructivism, however, were left untouched until Fodor (1983) challenged the theory of perception underlying the "New Look" psychological theories. His claim that perception is effected through cognitively impenetrable modules was meant to satisfy Fodor's thirst for restoring order at the level at which it mattered most: that of the status of perception. Fodor saw that the only way to deal effectively with constructivism was to undermine its main tenet, to wit, the theory-ladenness of perception.

Churchland (1988) picked up the glove thrown by Fodor and defended the cognitive penetrability of perception at the level at which Fodor sought to attack it. He defended it by adducing arguments drawn from such diverse areas as cognitive neuroscience, connectionism, and vision. Churchland's strongest points proved to be (a) the claim that the existence of abundant top-down neural pathways from higher cognitive centers to the circuits of low-level vision could be explained only if one assumed that

these pathways allowed top-down transfer of information from cognitive areas in the brain to perceptual processing sites and (b) the claim that the indisputable perceptual plasticity of the brain in general, and of the areas devoted to perceptual processing in particular, proves that perception is not effected by Fodorian modules.

Forty years or so after Hanson's and Kuhn's work, not many philosophers of science take the incommensurability theory seriously; most feel that the history of sciences proves that communication across paradigms is possible. Thus, it may seem that there is not much of a point in trying to prove that communication across paradigms is possible. However, to *feel* that Kuhn and Hanson were wrong because scientific practice does not work the way they suggested is one thing. To *sho*w that Kuhn and Hanson were wrong, one must undermine the "New Look" theory of vision on which their work was based. To do that, one needs a theory of perception, and that is the first aim of this book.

Before I proceed, I should discuss some terminological issues, lest my account be distorted by attaching unattended meanings to the terms I employ. I use the expressions "cognitive penetrability of perception," "theory-ladenness of perception," "conceptual effects on perception," and "top-down effects on perception" roughly interchangeably, the differences being more in emphasis than in substance. Since these terms are not necessarily coextensive, I have to justify my use.

I take "cognitive penetrability of perception" and "conceptual effects on perception" to be synonymous, provided that one takes cognitive penetrability to signify the effects of cognition on the contents of perception and not only on the vehicles of perceptual states (the sub-personal mechanisms and processes that constitute perception). In other words, one is interested not only in whether the perceptual neural pathways receive signals from higher cognitive circuits, but also in whether perceptual content is modulated by cognitive states. Given this, if cognition informs perception, the cognitive states bear on perception, and thus conceptual frameworks influence perception. This is evidenced by the fact that in the literature the thesis of the cognitive penetrability of perception has given rise to the widespread thesis that perception presupposes the application of sortal concepts (Brewer 1999; McDowell 1994).

However, "cognitive penetrability of perception" and "top-down effects on perception" are not coextensive. The reason is that there are top-down and horizontal interactions *within* the various visual modules (Felleman et al. 1997; Lamme and Spekreijse 2000). Thus, top-down flow of information is compatible with a cognitively impenetrable perception. (This is one

of the main theses advanced in the present book; being within the visual modules, these channels of information flow do not threaten the cognitive encapsulation of early vision.) Thus, "top-down effects on perception" is not synonymous with "cognitive penetrability of perception." However, in the literature, and most notably in the work of Churchland (one of the most prominent epistemological constructivists), the term "top-down effects on perception" has been used to signify the top-down modulation of perception by cognition. To be consistent with the existing terminology, I take "top-down effects on perception" to mean "cognitive top-down effects on perception" and thus "cognitive penetrability of perception."

Things are a bit more complicated with the expressions "cognitive penetrability of perception" and "theory-ladenness of perception." Though in the literature they are almost unequivocally taken to be synonymous, this is not a trivial thesis. On some occasions, the former term is used to express the effects of cognitive mechanisms and processes on the mechanisms and processes of perception, in which case one is situated at the level of the vehicles of perceptual states, whereas the latter is taken to apply to the contents of perceptual states. However, I am not so much interested in whether the perceptual neural pathways receive signals from higher cognitive circuits as in whether perceptual content is modulated by the content of cognitive states. Thus, "cognitive penetrability of perception" signifies the effects of cognitive states on the content of perceptual states. (This way, one secures oneself from the trap of the usual vehicle-content confusion.) I have also explained why "cognitive penetrability of perception" and "conceptual effects on perception" are treated here as coextensive. Now, conceptual frameworks constitute theories (in a broad sense of the term, not necessarily in a strict scientific sense); thus, "cognitive penetrability of perception," by implicating the conceptual apparatus in perceptual modulation, also signifies "theory-ladenness of perception."

The book consists of two parts, the first "scientific" and the second "philosophical." Part I comprises chapters 1–3; part II comprises chapters 4–8. In the first part, I defend the thesis that there is a part of experience, which I call "perception," that is not theory-laden and whose content is nonconceptual and thus theory-neutral. To show that there is a theory-neutral part of experience, I take recourse to cognitive science. In chapter 1, I discuss the current theories of attention and visual processing and argue that visual processing consists of two phases, one pre-attentional and the other attentional. In the pre-attentional early visual phase, information is retrieved bottom-up (that is, without any cognitive modulation) from a visual scene and is bound up to a certain extent to form the proto-objects,

which roughly correspond to structural descriptions of the objects in the scene. At this level there is only a form of awareness that is called *phenomenal awareness*. Attention intervenes later, and characteristics of objects are bound further and behaviorally relevant objects are selected for further processing. The objects that are selected eventually become the contents of our ordinary experience. We have cognitive access to these contents, and thus we have report awareness or access awareness of them.

In chapter 2, I examine the time course of visual processing and attention to delineate the issue of the time course of attentional effects. I argue that object-based attention intervenes relatively late, after the proto-objects have been retrieved from the scene. Thus, the fact that object-based attention may be cognitively driven does not undermine the claim that early visual processing is retrieved from the scene in a cognitively unmediated way. However, spatial attention is a different matter. Its effects are registered at latencies of 70 milliseconds after stimulus onset, which places them well within the time window of early visual processing. Spatial attention is controlled by a mixture of bottom-up and top-down cognitive mechanisms, and therefore this is *prima facie* evidence for the cognitive penetrability of early visual processing. Against that, I argue that the experimental evidence suggests that, although cognitive states may determine where to focus spatial attention, they do not modulate perceptual processing of the incoming information from the focused location; such processing is stimulus driven. In other words, cognition determines where to look but not what one perceives at that location. This is an indirect form of cognitive influence on perception; its repercussions for philosophy will be fully explored in the second part of the book.

In chapter 3, which closes the book's first part, I concentrate on the visual processes that parse objects in a scene and discuss the kind of information that these processes use and deliver. After drawing a distinction between object individuation and indexing (on the one hand) and object identification (on the other), I claim that object individuation precedes object identification, and that object individuation (unlike object identification) is a cognitively encapsulated process. To support this claim, I discuss the kind of information on which object individuation relies and argue that this information is the information retrieved in early visual processing—i.e., information that is retrieved in a purely bottom-up way from a visual scene. The processes of object individuation and indexing are very important for the project in the book, since it is on the basis of these processes that I will develop (in chapter 6) a purely causal theory of reference.