



The Nature of Attention

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Abstract

What is attention? Attention is often seen as a subject matter for the hard sciences of cognitive and brain processes, and is understood in terms of sub-personal mechanisms and processes. Correspondingly, there still is a stark contrast between the central role attention plays for the empirical investigation of the mind in psychology and the neurosciences, and its relative neglect in philosophy. Yet, over the past years, several philosophers have challenged the standard conception. A number of questions concerning the nature of attention arise. This article provides an introduction to contemporary debates concerning these questions. In particular, it discusses the question of how the pre-theoretic conception of attention might be reconciled with a scientific conception, arguments that provide support for an anti-reductionist theory of attention, and sketches several recent anti-reductionist theories and their inter-relations.

1. Introduction

Attention has started to become a central topic of philosophical interest. Until recently, there was a stark contrast between the role attention played for the empirical investigation of the mind in psychology and the neurosciences, and the role it played in philosophy. While most *empirical* research portrayed attention as one of the most crucial components of the mind and while attention consequently was a major topic of empirical investigation, in *philosophy*, by contrast, attention was rarely viewed as a central aspect of the mind. Consequently, attention was almost completely neglected as a philosophical topic.

This situation is beginning to change. Over the past years, more and more philosophers have become interested in attention, and a new and growing body of philosophical literature on attention is the result.

The debates about attention can be divided into two types. On the one hand, a variety of philosophical questions arise concerning the nature of attention (i.e. what attention is). These are the topic of the present article. On the other hand, there are debates surrounding the connections between attention and other topics of philosophical interest. These are the theme of the companion article (Watzl, this volume). Of course, there are strong interactions between what attention is and the roles it can play. While both articles are self-standing, many readers will, thus, want to consult them together.

2. The Intuitive Conception of Attention

Let me start by introducing the intuitive and pre-theoretic conception of attention. This conception is expressed in the following famous quote from William James:

Every one knows what attention is. It is the taking possession by the mind, in clear and vivid form, of one out of what seem several simultaneously possible objects or trains of thought. Focalization, concentration, of consciousness are of its essence [...] (James 1890/1981: 403–4).

We can distinguish two aspects of our familiarity with attention:

First, attention is part of the understanding of the mind we pre-theoretically engage in (it is part of folk-psychology). The notion of attention (like the notions of belief, desire, or intention) is used in ascribing mental attributes to others and in explaining and predicting their behavior on that basis: we speak of focusing attention on the newspaper, or on the delicate lines of a saxophone solo. Because you concentrated attention on a certain train of thought, you might not hear the door bell. And I predict you often play basketball better when you play attentively rather than absentmindedly.

Second, attention also seems to be something we recognize from what-it-is-like for us (it is a component of the phenomenal character of our conscious experiencing; Nagel 1974 and Shoemaker 1994). There is something it is like for you to focus attention on your newspaper instead of the fly that circles around your head, something it is like to concentrate attention on a train of thought, or to play basketball with all your attention. We thus seem to know what attention is by first-person conscious acquaintance just as we know what, for example, pain is (Smithies 2011; see also Mole 2008; De Brigard 2010a).

What, then, is the intuitive conception of attention? Roughly, attention is the selective or contrastive aspect of the mind: when you are attending to something you are contrasting what you pick out with what remains in the background. This rough idea may be articulated in various ways:

First, one might emphasize the phenomenal character of attention (the ‘focalization of consciousness’ James speaks of) and develop the way attention seems to structure consciousness into foreground and background (important for the phenomenological tradition on attention. See Husserl 2004; Sartre 1943/1996; Merleau-Ponty 1945/2008; Gurwitsch 1964; Arvidson 2003, 2006).

Second, one might develop the idea that attention makes its object ‘clear and vivid’ (as James says). As suggested by talk of ‘focusing’ attention like a camera lens, one might argue that attending to something goes hand in hand with a certain form of clarity and distinctness (see Malebranche 1688/1997; Wolff 1738; Titchener 1908/1973).

Third, one might discuss whether the ‘taking possession by the mind’ involved in attention can in fact be as passive as James’ phrase suggests, or whether, by contrast, attending to something, unlike, say, belief or perception, is essentially an activity you may be engaged in and not a passive happening (see Reid 1872/2000; and discussion in Watzl 2010, this volume).

Finally (and relatedly), one might be concerned with the potential importance of the idea that attention is a capacity that unlike the capacity for perception or belief at least *can* be controlled (see Wallace 1999 and Lutz et al. 2006 for scientifically informed discussions of the rich Eastern philosophical tradition on that issue).

Yet, while one might have expected that philosophers evaluate these various conceptions of what the intuitive notion of attention implies, ways in which they should be refined or connected to notions of agency, consciousness, or representation, this has not been how attention was studied over the past 50 years (see Hatfield 1998 for the history before that period).

Unlike consciousness, agency, belief or representation (which were studied both philosophically as well as scientifically), attention has been seen purely as a subject matter for the hard sciences of cognitive and brain processes and not for philosophy (for reviews and textbooks see Allport 1993; Styles 1997; Pashler 1998; Duncan 1999; Parasuraman 2000; Itti et al. 2005; Wright and Ward 2008). Thus, PsycNET, the main database for publications in psychology, contains about four times as many entries with the keyword

'attention' than for 'consciousness' whereas Philosopher's Index, the equivalent for publications in philosophy, has only three percent of the number of 'consciousness' entries for 'attention' (data as of January 2011).

A first question about the nature of attention, then, concerns the way the intuitive conception of attention connects with what gets studied in scientific laboratories.

3. How are 'Intuitive' and 'Scientific' Attention Related?

Many contemporary psychology or neuroscience presentations on attention contain a slide with the quote from William James. Yet despite the continuous appearance of this slide, it is unclear whether contemporary attention scientists talk about the thing that we all intuitively recognize. Many of them have explicitly or implicitly adopted Anne Treisman's point of view (expressed in the 1960s):

Fifty years ago psychologists thought of attention as 'the focalization of consciousness' or 'the increased clearness of a particular idea'. But these and other definitions in terms of mental faculties or subjective experience proved sterile for empirical research and ended in a series of inconclusive controversies. (Treisman 1964: 12)

Instead of developing the intuitive conception of attention, the post-war tradition of thinking about attention in information processing terms, for which Treisman here speaks, can be understood as proposing that we should *give up* the confused folk-psychological conception of attention. Instead we should work on a purely scientific understanding of what attention is and what it does, and focus on elaborating and evaluating these scientific conceptions.

In the past decades a number of scientific proposals about the nature and role of attention have been suggested. Attention might most fundamentally be understood as: a filtering of perceptual information (Broadbent 1958), a feature binding mechanism (Treisman and Gelade 1980), a mechanism of selection of information for action-control (Allport 1987; Neumann 1987), a general purpose resource (Kahneman 1973), a broadcasting of information to working-memory (Prinz 2005, 2011), or a bias-and-competition process (Desimone and Duncan 1995) (see below for a little more detail).

What, then, is the connection between ordinary talk about attention and the scientific conceptions of attention?

A first answer would be *eliminativism*: given the divergence between what we have learned about attentional processes in the brain and our intuitive conception we might conclude that there is no such thing as ordinary attention. This view about attention would mimic the one Churchland (1981), for example, has defended for the propositional attitudes.

Eliminativism presupposes not only that science provides better insights than ordinary practice (about which few would disagree), but also that ordinary practice is seriously deficient. Yet, maybe the intuitive conception of attention is fine in its own right and picks out one thing, while the scientific conception picks out a distinct, though probably related, thing. We would thus have the view that there are *two types of attention*: ordinary attention and scientific attention. One option, for example, would be that there is both a certain focalized way of being conscious of something, as well as a certain set of selective brain mechanisms. The two, though related, need not be co-extensive (see Chalmers 2009 for hints in this direction).

The two types view implies that ordinary and scientific discourse about attention are (at least to some degree) talking past each other. For that claim, ordinary practice must have a fairly specific conception of attention, which can be contrasted with the scientific

one. But maybe folk-psychology is not precise enough to make that contrast? Another view, thus, would be that ordinary discourse expresses a crude and confused conception of the same thing whose nature the science of attention investigates. ‘Attention’ might work roughly like a natural kind term: its reference is not completely fixed by folk usage or by what we are acquainted with in conscious experience but in part by deference to the experts in the relevant fields (see De Brigard and Prinz 2010b; Watzl 2010; Prinz 2011).

The natural kind view can come in different flavors. De Brigard and Prinz (2010b) endorse it in the course of a reductionist program: attention can be identified with a natural kind of neuronal or computational processes. Though ordinary parlance attributes attention, like belief, desire or reasoning, to the whole person, it can be reduced to something on the sub-personal level. The reductionist conception, thus, shares with eliminativism the view that the most fundamental theory in the area will be a completely sub-personal computational or neuroscientific theory while disagreeing on whether that discredits ordinary, personal level talk of attention. As Prinz (2011: 185) says: “[w]e need not eliminate the folk construct; we have found a functional analysis.”

But reductionism is not an essential part of the natural kind view. Belief, for example, might be a natural kind of mental state, even though beliefs can be multiple realized in a variety of distinct substrates. Similarly, attention might be personal level natural kind (Watzl 2010). According to an anti-reductionist any fundamental theory of attention will essentially involve personal level descriptions (which, of course, need to be compatible with, to explain, and to put constraints on what is going on at the sub-personal level, see Davies 2005 for an overview of the personal vs. sub-personal distinction).

Let me now turn to how one might decide between reductionist and anti-reductionist theories of attention (the issues that come up will also bear on eliminativism or the two types view).

4. Reductionist Theories of Attention

According to reductionist theories attention most fundamentally is a fairly specific type of neuronal or computational process or mechanism.

During the past 50 years, as already pointed out, many proposals concerning the type of sub-personal mechanism with which attention might be identified have been developed. This is not the space to go into the details of these proposal. Here, though, is a very brief overview that should provide some idea of what a reductive theory of attention might look like (see Mole 2009 or a textbook for more comprehensive reviews):

A first proposal, originating with Broadbent (1958), was that attention is a *perceptual filter* or bottleneck. Attention is the mechanism that controls which perceptual information reaches higher cognitive processes or higher brain areas like the pre-frontal cortex.

Second, there is the *feature binding model*. In the early 1980s, Anne Treisman observed that without attention subjects often fail to ‘bind’ features like color and shape together. On that basis one might suggest that attention is the mechanism that binds together (representations of) features (such as color or shape) that are initially processed separately as features of the same object (Treisman and Gelade 1980).

Third, on the basis of observing connections between attention and access to working memory it has been suggested that attention can be “identified with the processes that allow information to be encoded in working memory” (Prinz 2011: 184). Arguably, the *working memory model* is a modern descendant of the filter model (see Mole 2009).

Finally, there are so-called *biased competition models* of attention. It is well known that many brain processes compete for resources, as well as for control. According to the biased competition model, attention can be identified with a neural competition mechanism that is biased by high-level cognitive input: the strength of the competing (sensory) representations is influenced by feedback from higher brain areas that represent the subject's goals, interests, emotional state, etc. (see Desimone and Duncan 1995; Ruff 2011).

5. Challenges to Reductionist Theories of Attention

What, then, should we make of this variety of reductionist accounts of attention? No one doubts that attention research working with the models just sketched has amassed many valuable data and that many fascinating experimental paradigms have been developed. The information processing science of attention is one of the areas in psychology and the neurosciences that has many of the signatures of normal science (Kuhn 1962) and a progressive and flourishing research program (Lakatos 1978).

Yet, the progressive character of attention research does not imply a reductionist account of the nature of attention. The crucial question is whether one of the models just sketched or some future off-spring of them manages to identify attention with a computational or neuronal process. Without thereby challenging the value of sub-personal level attention research, anti-reductionists have expressed their doubts.

One motivation for an anti-reductionist stance is to point to the fact that attention comes in various forms. There are at least the following distinctions: (i) *focal* vs. *global* or *distributed* attention, where the first is narrowly directed at a particular object or event, while the second spreads over a scene as a whole (see Treisman 2006). (ii) *On-off* attention vs. *degrees* of attention, where in the first case you either focus attention on something or not, while in the second case you focus attention on various objects to varying degrees. (iii) *Voluntary* vs. *involuntary* attention, where the first, roughly, is controlled by the subject's intentions or goals (and in this sense an intentional action), whereas the second occurs without such intentional or voluntary control (e.g. when attention is grabbed by a salient stimulus). (iv) *Exogenous* vs. *endogenous* attention, where the first is controlled by the stimulus, while the second is internally controlled (arguably mind-wandering is endogenous, but involuntary; see Smallwood and Schooler 2009). (v) *Perceptual* vs. *executive (or central)* attention, where the first, roughly, consists in prioritizing certain perceptual inputs, whereas the second, roughly, is a central processing capacity (see Pashler 1998 for a review). (vi) The *process* of attending to something vs. the *event of shifting* attention from one thing to another vs. the *state* the process results in (see Watzl 2010; Wu 2011a).

Anti-reductionists might point out that it is unlikely that the various forms of attention just mentioned are going to be unified at the level of neuronal or computational processes. Most likely, their neuronal bases are going to be highly disjunctive, and attention, thus, is not a subpersonal kind.

Yet, in response, reductionists might argue that there is one *fundamental* form of attention and define the other forms on its basis. This, they might argue, is a task that any unified theory of attention (whether reductionist or not) will have to live up to. The reductionist would begin by reducing the fundamental form of attention, and then look for extensions or modifications of that reduction for the non-fundamental forms.

Yet, even when concentrating on *one* form of attention (e.g. on-off exogenous shifts of focal perceptual attention) doubts about a reductionist account of attention might emerge.

To see how, consider the fate of the oldest sub-personal account of attention: the filter model. After vigorous debates in the 1950s and 1960s concerning where in the cognitive architecture to locate the attention filter (a debate between so-called early and late selection models, see Broadbent 1958 vs. Deutsch and Deutsch 1963), it is now widely agreed that our perceptual systems do not contain one, but many distinct types of filters. There is, thus, no unified architectural site at which the attention filter might be located. Consequently, the filter model has now largely fallen out of favor. There is no single process of the right kind.

Anti-reductionists have argued that crucial aspects of the problems that plagued the filter model generalize to any other reductionist theory of attention:

Recent work, for example, suggests that “the early alignment of featural detection with preattentive processing and featural binding with attentional processing can no longer be sustained” (Quinlan 2003: 668–9): the connection between attention and feature binding is much looser than would be required for *identifying* attention with a feature binding mechanism.

Similarly, while close connections between attention and working memory are widely recognized, current scientific work suggests that both attention and working memory are multifaceted and essentially involved in processes distinct from each other (Fougnie 2008). Furthermore, some types of stimuli seem to reach working memory (and thus can be reliably reported) even if the subject’s attention is (almost) completely absorbed by some independent task (Li et al. 2002).

Finally, there seem to be *many* (biased) competition mechanisms in the brain. While some are closely associated with attention, many others operate even in the absence of attention (see Watzl 2010).

Based on results like these and a comprehensive review of empirical research, Alan Allport has prominently argued as follows.

Even a brief survey of the heterogeneity and functional separability of different components of spatial and nonspatial attentional control prompts the conclusion that, qua causal mechanism, *there can be no such thing as attention*. There is no one uniform computational function, or mental operation (in general no one causal mechanism) to which all so-called attentional phenomena can be attributed. (Allport 1993: 203)

Scientific research, thus, suggests that the class of sub-personal attentional processes is highly diverse and not well localized in the brain. The general problem is that it is highly unlikely that there is a natural kind of cognitive or neuronal mechanisms, with which (even one of the forms of) attention might be identified. Attention, Allport suggests, is more like thinking than like perception.

The challenges for a reductionist account of attention can be summarized as follows. First, many of the mechanisms that in some contexts are closely tied to attention, in other contexts seem to operate in the absence of attention. A reductionist account of attention that tried to identify it with a certain mechanism would, thus, predict attention in cases where we don’t seem to have it. Call this *The Overgeneralization Problem*. Second, the mechanisms that in various contexts seem to be associated with attention seem to have nothing fundamental in common. While, for example, in some cases attention seems to be the mechanism that binds features together, in other cases it seems to be the mechanism by which information gets broadcasted to working memory. Call this *The Disunity Problem*.

Reductionists, of course, may respond to these problems with an optimistic outlook, and continue the search for the right sub-personal kind. It is hard to assess such an

outlook in the abstract. Instead, I would like to discuss the alternatives against which the prospects of a reductionist theory of attention should be measured.

6. *Anti-Reductionist Theories of Attention*

One might think that the only alternative to a reductionist account of attention is to completely give up on the prospects of a unified theory of attention (see Styles 1997; Parasuraman 2000; Duncan 2006; and many of the articles in Itti et al. 2005). According to such a view, attention in no sense is a unified type of thing. Just like chemical analysis shows that jade is not a single kind of mineral (instead there are nephrite and jadeite that are superficially similar), cognitive science shows that there are various attentional processes that only share certain superficial similarities, but lack any fundamental unity. Talk about attention does not carve the mind at its joints, because attention, like jade, is not a natural kind. A disunity view thus implies giving up both the natural kind view of attention, as well a crucial attraction of the two kinds of attention view: namely that talk of scientific attention manages to specify a scientifically valuable kind.

The disunity view shares an important feature with eliminativism. It commits the intuitive conception of attention to a certain kind of error: in this case, the error of grouping together what does not in fact belong together (indeed, one might say that, say, jade *as a kind*, or *fundamentally* does not exist. See Fine 2001 and Bird and Tobin 2010 for recent discussion of the general metaphysical issues).

Why do we make such grouping errors? In the case of jade, one part of the answer seems to be, roughly, that nephrite and jadeite *look very similar to us*. Their similar look explains why *we* (given our sensory capacities) originally grouped the two minerals together. But similarity on that highly anthropocentric level does not make for a natural kind. Kinds of minerals are to be identified by chemical analysis (though, of course, one might opt for a more pluralistic conception of kinds. For example Dupré 1993 or Hacking 2007).

Attention, though, plausibly is crucially different from jade. In the case of mental states, processes or events it is highly *unobvious* that the only natural kinds are sub-personal kinds of cognitive or neuronal processes. Reasoning, perception, belief or desire, one might plausibly claim, are respectable kinds with distinct explanatory roles, even though they are not sub-personal kinds. We can learn much about the large variety of sub-personal processes that underpin these kinds, while claiming that the kinds themselves are not to be found at the level of these processes. Maybe, then, attention similarly is not the kind of phenomenon whose nature can be picked out at the level of sub-personal processes. Several philosophers have, thus, recently proposed to re-orient an account of the nature of attention. Their proposals can be seen as models of what an anti-reductionist account of attention might look like (see also Mole 2011 on the metaphysics of attention).

6.1. THE SELECTION FOR ACTION VIEW

A first proposal is *The Selection for Action View* (Wu 2011b,c). According this view, attention has a unified functional role on the personal level. Specifically, attention is the solution to a problem that any agent confronts. Agents are typically faced with many inputs, as well as with many possible responses to these inputs: you perceive many things and you may act on these things in many possible ways. Wu calls this The Many-Many problem. The mapping between the inputs and the responses to these inputs constitutes, in Wu's terminology (Wu 2011c), your behavior space at the time. In order to act at all

you must select a specific path through behavior space. According to Wu, attention is the solution to that problem: it is your selection of some (input) item so as to act on it. In short, attention should be “identified with the processes involved in solving the Many-Many Problem – namely selection of a specific input to inform a specific response.” (Wu 2011c: 103).

According to the selection for action view, attention is a personal level phenomenon: the agent is selecting an item. Mere sub-personal selection is not enough. By moving to the personal level, and by a sufficiently general characterization of the functional role of attention, we overcome the disunity problem: what the diverse variety of processes underpinning attention have in common is that they all play a role in helping the agent solve the many-many problem. Philosophers have overlooked attention because they did not see this problem. The nature of attention comes into view only once we re-orient the theory of action.

6.2. THE STRUCTURING VIEW

A second proposal is *The Structuring View* (Watzl 2010, 2011): like the last view, it conceives of attention as a personal level activity.

The selection for action view – while pointing out an important role for attention – according to this view mischaracterizes the nature of the relevant activity. For this reason, it does not succeed in overcoming the over-generalization problem. You sometimes attend to something without selecting it as an item to act on (consider focusing on the lines of the saxophone solo), and you “often select an object to reason about it or act on it only because you have [already] focused your attention on it.” (Watzl 2011: 155).

The structuring view takes as its starting observation the idea that attention is contrastive: it structures our mental life so that some things are in the foreground of others. For example, when someone focuses her attention on a project like writing a book or raising children, she will structure her life so that other things form the background of that project. In order to pin down the functional role of attention as structuring, the idea continues, we must take its phenomenal character seriously. By doing so, the conception of attention as structuring can unify all forms of attention: attention is the mental activity of structuring the stream of consciousness (see also Evans 1970 and O’Shaughnessy 2000).

According to the structuring view, the nature of attention implies, on the one hand, a certain form of holism about the mental: relations between the parts of our conscious mental life are as important as the intrinsic features of various mental states. On the other hand, the account also implies that agency and conscious experience are more closely connected than has often been assumed.

6.3. THE RATIONAL-ACCESS VIEW

A third anti-reductionist account is Smithies (2011) *Rational-Access View*. Like the structuring view, the rational access view takes the phenomenal character of attention seriously. It attempts to combine the phenomenal and the functional aspects of the intuitive conception of attention. Attention is a form of consciousness that makes information rationally accessible to the subject.

The most striking feature of Smithies’ view is that the distinctive functional role of attention cannot be captured in purely information processing terms. In order to overcome the overgeneralization problem, we need to constrain the relevant functional roles *epistemically*. While information might be available for high-level processing with-

out attention, only when it is made available by attention is high-level processing like reasoning or goal-directed action that is based on it rational from the subject's own point of view. By bringing in such epistemic constraints, Smithies might argue, we can also make the structuring view more informative: the foreground plays a distinct rational role.

6.4. THE COGNITIVE UNISON VIEW

A final proposal is *The Cognitive Unison View* defended by Christopher Mole (2010). This is probably the most radical departure from classic reductionist accounts of attention. Their problem, Mole argues, was not that they tried to understand attention at the sub-personal level. They have made a more fundamental mistake by putting attention into the wrong metaphysical category.

Mole starts by drawing a distinction between two types of phenomena (Mole 2010: Ch. 2). 'Process-first' phenomena (26) are best and most fundamentally explained by reference to the type of process they instantiate. Combustion is an example of a process-first phenomenon. We most fundamentally understand combustion if we understand the process of burning. By contrast, 'adverbial' phenomena (26) are best and most fundamentally explained by reference to the manner in which something is happening. Haste is an example of an adverbial phenomenon. We most fundamentally understand haste, not by identifying a type of process, but by identifying what it is for something to occur *in a hasty manner* or *hastily*.

Mole argues that attention is an adverbial phenomenon: he argues that a process-first view of attention would be committed to the claim that "no change from attention to inattention is possible without a change in the underlying cognitive processes." (Ch. 3: 36). Yet, he argues, while in some contexts attention is wholly constituted by feature binding processes, in other contexts feature binding processes can go on without constituting attention (see Section 5 above).

An adverbialist *theory* of attention, then, will be a theory of the attentive manner, i.e. an account of what it takes for a subject to perform a certain task attentively rather than in-attentively. In this, Mole's view shares important aspects with older conceptions by Bradley (1886), Ryle (1949), and White (1964). Yet, while most of these authors tried to characterize the attentive manner in terms of personal-level activities or dispositions, Mole's cognitive unison account is one in terms of the way *cognitive processes* are occurring (47–50). Roughly: an agent performs a task attentively just in case her performance displays cognitive unison, where that form of unison obtains when none of those cognitive processes that could potentially serve the task at hand are occupied with something that does not in fact serve it (51).

7. Conclusion

Given the central role of attention plays in our ordinary lives, in public debates about mental health, in psychological and neuroscientific research, and in various central philosophical areas (Watzl, this volume), getting clear on the nature of attention is important for anyone working in the philosophy of mind or the philosophy of psychology and the neurosciences.

The discussions about the nature of attention also shed new light on various fundamental issues in the metaphysics of mind: first, they show how talk of levels of explanation is closely tied to questions about how to 'carve the mind at its joints', i.e. questions

about how to divide our mental life into its most natural parts. Second, they highlight the importance of metaphysical categories like *being a state, a process, an activity or a manner of going on* in theorizing about the mind, as well as calling into doubt pre-conceptions concerning the availability of atomistic or non-normative accounts of all mental phenomena. Third, they shed new light on the inter-relations between the metaphysics of mind and the theory of action, and between functional role and phenomenal character. By investigating attention, we can thus learn important lessons for philosophical theorizing about the mind more generally.

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Short Biography

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Note

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Works Cited

- Allport, D. A. 'Selection for Action.' *Perspectives on Perception and Action*. Eds. H. Heuer and H. F. Sanders. Hillsdale, NJ: Lawrence Erlbaum Associates Inc, 1987. 395–419.
- Allport, A. 'Attention and Control. Have We Been Asking the Wrong Questions? A Critical Review of Twenty-Five Years.' *Attention and Performance XIV*. Eds. D. E. Meyer and S. Kornblum. Cambridge, MA: The MIT Press, 1993. 183–218.
- Arvidson, P. S. 'A Lexicon of Attention: From Cognitive Science to Phenomenology.' *Phenomenology and the Cognitive Sciences* 2 (2003): 99–132.
- . *The Sphere of Attention: Context and Margin*. Dordrecht: Springer, 2006.
- Bird, A. and E. Tobin. 'Natural Kinds.' *The Stanford Encyclopedia of Philosophy (Summer 2010 Edition)*. Ed. Edward N. Zalta. Stanford, CA: Stanford University, 2010. [Online]. Retrieved on 15 May 2011 from: <http://plato.stanford.edu/archives/sum2010/entries/natural-kinds/>.
- Bradley, F. H. 'Is There a Special Activity of Attention?' *Mind* 11.42 (1886): 305–23.
- Broadbent, D. *Perception and Communication*. New York: Pergamon Press, 1958.
- Chalmers, D. J. 'Consciousness First? Attention First?' Presented at *The "Attention and Consciousness" Conference*, ANU June 2009 (2009). [Online]. Retrieved on 15 May 2011 from: <http://consc.net/powerpoint.html>.
- Churchland, P. M. 'Eliminative Materialism and the Propositional Attitudes.' *Journal of Philosophy* 78.2 (1981): 67–90.
- Davies, M. 'Cognitive Science.' *The Oxford Handbook of Contemporary Philosophy* Eds. F. Jackson and M. Smith. Oxford/New York: Oxford University Press, 2005. 358–94.
- De Brigard, F. 'Consciousness, Attention and Commonsense.' *Journal of Consciousness Studies* 17, 9.10 (2010a): 189–201.

- and J. Prinz. 'Attention and Consciousness.' *Wiley Interdisciplinary Reviews: Cognitive Science* 1.1 (2010b): 51–9.
- Deutsch, J. A. and D. Deutsch. 'Attention: Some Theoretical Considerations.' *Psychological Review* 70 (1963):80–90.
- Desimone, R. and J. Duncan. 'Neural Mechanisms of Selective Visual Attention.' *Annual Review of Neuroscience* 18.1 (1995): 193–222.
- Duncan, J. 'Attention.' *The MIT Encyclopedia of the Cognitive Science*. Eds. R. A. Wilson and F. C. Keil. Cambridge, MA: The MIT Press, 1999. 39–41.
- . 'Brain Mechanisms of Attention.' *Quarterly Journal of Experimental Psychology* 59.1 (2006): 2–27.
- Dupré, J. *The Disorder of Things. Metaphysical Foundations of the Disunity of Science*. Cambridge, MA: Harvard University Press, 1993.
- Evans, C. O. *The Subject of Consciousness*, London/New York: George Allen and Unwin, 1970.
- Fine, K. 'The Question of Realism.' *Philosophers' Imprint* 1.2 (2001): 1–30.
- Fougnie, D. 'The Relationship between Attention and Working Memory.' *New Research on Short-Term Memory*. Ed. N. B. Johansen. New York: Nova Science Publishers, 2008. 1–45.
- Gurwitsch, A. *Field of Consciousness*. Pittsburgh: Duquesne University Press, 1964.
- Hacking, I. 'The Contingencies of Ambiguity.' *Analysis* 67.296 (2007): 269–77.
- Hatfield, G. 'Attention in Early Scientific Psychology.' *Visual Attention*, 1, Ed. R. D. Wright. New York: Oxford University Press, 1998. 3–25.
- Husserl, E. *Wahrnehmung und Aufmerksamkeit. Texte aus dem Nachlass (1893–1912)*. Dordrecht/Boston: Springer, 2004.
- Itti, L., G. Rees and J. K. Tsotsos. *Neurobiology of Attention*. San Diego, CA: Elsevier Academic Press, 2005.
- James, W. *The Principles of Psychology*. Cambridge, MA: Harvard University Press, 1890/1981.
- Kahneman, D. *Attention and Effort*. Englewood Cliffs, NJ: Prentice Hall, 1973.
- Kuhn, T. *The Structure of Scientific Revolutions*. Chicago: University of Chicago Press, 1962.
- Lakatos, I. *The Methodology of Scientific Research Programmes: Philosophical Papers Volume 1*. Cambridge, New York: Cambridge University Press, 1978.
- Li, F. F., et al. 'Rapid Natural Scene Categorization in the Near Absence of Attention.' *Proceedings of the National Academy of Sciences of the United States of America* 99.14 (2002): 9596.
- Lutz, A., J. D. Dunne and R. J. Davidson. 'Meditation and the Neuroscience of Consciousness: An Introduction.' *The Cambridge Handbook of Consciousness*, 19, Eds. Philip David Zelazo, Morris Moscovitch and Evan Thompson. Cambridge/New York: Cambridge University Press, 2006. 497–549.
- Malebranche, N. *Dialogues on Metaphysics and Religion*. Trans. N. Jolley, D. Scott. Cambridge/New York: Cambridge University Press, 1688/1997.
- Merleau-Ponty, M. *Phenomenology of Perception*. Trans. Colin Smith. London/New York: Routledge, 1945/2008.
- Mole, C. 'Attention and Consciousness.' *Journal of Consciousness Studies* 15.4 (2008): 86–104.
- . 'Attention.' *The Stanford Encyclopedia of Philosophy (Fall 2009 Edition)*. Ed. Edward N. Zalta. Stanford, CA: Stanford University, 2009. [Online]. Retrieved on 15 May 2011 from: <http://plato.stanford.edu/archives/fall2009/entries/attention/>.
- . *Attention is Cognitive Unison*. Oxford/New York: Oxford University Press, 2010.
- , D. Smithies and W. Wu. *Attention: Philosophical and Psychological Essays*. Oxford/New York: Oxford University Press, 2011.
- Nagel, T. 'What Is It Like To Be a Bat?' *The Philosophical Review* 83 (1974): 435–50.
- Neumann, O. 'Beyond Capacity: A Functional View of Attention.' *Perspectives on Perception and Action*. Eds. H. Heuer and A. F. Sanders. Hillsdale, NJ: Lawrence Erlbaum Associates Inc., 1987. 361–94.
- O'Shaughnessy, B. *Consciousness and the World*. Oxford/New York: Oxford University Press, 2000.
- Parasuraman, R. *The Attentive Brain*. Cambridge, MA: The MIT Press, 2000.
- Pashler, H. *The Psychology of Attention*. Cambridge, MA: The MIT Press, 1998.
- Prinz, J. 'A Neurofunctional Theory of Consciousness.' *Cognition and the Brain: The Philosophy and Neuroscience Movement*. Eds. A. Brook and K. Akins. Cambridge/New York: Cambridge University Press, 2005. 381–96.
- . 'Is Attention Necessary and Sufficient for Consciousness?' *Attention: Philosophical and Psychological Essays*. Eds. C. Mole, D. Smithies and W. Wu. Oxford/New York: Oxford University Press, 2011. 174–203.
- Quinlan, P. T. 'Visual Feature Integration Theory: Past, Present, and Future.' *Psychological Bulletin* 129.5 (2003): 643–73.
- Reid, T. *The Works of Thomas Reid*. Edinburgh/London: Elibron Classics, 1872/2000.
- Ruff, C. 'A Systems-Neuroscience View of Attention.' *Attention: Philosophical and Psychological Essays*. Eds. C. Mole, D. Smithies and W. Wu. Oxford/New York: Oxford University Press, 2011. 1–23.
- Ryle, G. *The Concept of Mind*. New York: Barnes and Noble, 1949.
- Sartre, J. P. *Being and Nothingness. An Essay on Phenomenological Ontology*, Trans. Hazel E. Barnes. London/New York: Routledge, 1943/1996.
- Shoemaker, S. 'Phenomenal Character.' *Noûs* 28 (1994): 21–38.
- Smallwood, J. and J. W. Schooler. 'Mind-Wandering.' *The Oxford Companion to Consciousness*. Eds. T. Bayne, A. Cleermans and P. Wilken. Oxford/New York: Oxford University Press, 2009. 143–5.

- Smithies, D. 'Attention is Rational-Access Consciousness.' *Attention: Philosophical and Psychological Essays*. Eds. C. Mole, D. Smithies and W. Wu. Oxford/New York: Oxford University Press, 2011. 247–73.
- Styles, E. A.. *The Psychology of Attention*. Hove/New York: Psychology Press, 1997.
- Titchener, E. B. *Lectures on the Elementary Psychology of Feeling and Attention*. New York: Arno Press, 1908/1973.
- Treisman, A. 'Selective Attention in Man.' *British Medical Bulletin* 20.1 (1964): 12–6.
- . 'How the Deployment of Attention Determines What We See.' *Visual Cognition* 14.4–8 (2006): 411–43.
- and G. Gelade. 'A Feature-Integration Theory of Attention.' *Cognitive Psychology* 12 (1980): 97–136.
- Wallace, B. 'The Buddhist Tradition of Samatha: Methods for Refining and Examining Consciousness.' *Journal of Consciousness Studies* 6.2–3 (1999): 175–87.
- Watzl, S. *The Significance of Attention*. PhD Thesis, Columbia University, 2010.
- . 'Attention as Structuring of the Stream of Consciousness.' *Attention: Philosophical and Psychological Essays*. Eds. C. Mole, D. Smithies and W. Wu. Oxford/New York: Oxford University Press, 2011. 145–73.
- White, A. R. *Attention*. Oxford: Basil Blackwell, 1964.
- Wolff, C. *Psychologia Empirica*, prostat in *Officina libraria Rengeriana*, 1738.
- Wright, R. D. and L. M. Ward. *Orienting of Attention*. Oxford/New York: Oxford University Press, 2008.
- Wu, W. 'What is Conscious Attention?' *Philosophy and Phenomenological Research* 82.1 (2011a): 93–120.
- . 'Confronting Many-Many Problems: Attention and Agentive Control.' *Noûs* 45.1 (2011b): 50–76.
- . 'Attention as Selection for Action.' *Attention: Philosophical and Psychological Essays*. Eds. C. Mole, D. Smithies and W. Wu. Oxford/New York: Oxford University Press, 2011c. 97–116.