

# The Subject of Attention

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## Basic Aim

To present a “how possible” account of the ordinary notion of attention, wherein attention is enacted by a **subject**, in opposition to accounts that reduce attention to a mere occurrence or happening.

# Outline

- 1 Introduction
- 2 Phenomenal Criteria
- 3 Behavioral Criteria
- 4 Neural Criteria
- 5 Attention in Three Domains
- 6 Summary

# Motivation

It is sometimes assumed that attention must be limited to what the subject consciously and knowingly chooses to focus on. At other times it is assumed that attention is an emergent process that has nothing to do with the subject. These conflicting assumptions have confused debates on, e.g., whether attention is necessary for conscious perception. A common understanding of “attention” would help to avoid such confusion.

## Background

To understand the concept of attention, I start with trying to understand its ordinary usage. I find that ordinary usage of “attention” centers around a unique concept that is not picked out by any other term in the English language: **the act of mental selection**. Put another way, ordinary usage of “attention” centers around the concept of actively prioritizing select mental entities over others for the use of mental resources, resulting in a particular distribution of the available mental resources, whether the direction of this prioritization is internal/external, focused/spread, undivided/split, or paid/grabbed.

## Prospect

But to what extent is attention an act? In what proceeds I understand attention to be an act insofar as it is directed by a subject. I look to phenomenology, psychology, and neuroscience to specify criteria that reliably separate this type of mental selection from all other mental selection. In finding such criteria I aim to provide a “how-possible” account of the ordinary notion of “attention.” **A central finding of this paper is that the criteria I find in the individual domains depend on each other for evidential support, requiring an understanding of attention that transcends the individual domains.**

## Two Categories

The phenomena immediately and directly available to the subject can be carved up in different ways. One can divide the phenomena into **sensory attributes** and look for criteria of attention among those attributes. One can also divide the phenomena into **experiential modes** and look for criteria of attention among the modes. To illustrate the difference between these, pay attention to *this*.

## Sensory Attributes

Edward Titchener says that “the analytical study of attention must center about the sensory attribute of clearness or vividness” (1910, 180), **but** the history and physical makeup of a subject makes a difference to the clearness or vividness of the subject’s percept, such that our willingness to say that some or another subject is attending to a stimulus will depend on both the history of that subject and the stimulus in question. If we knew, for instance, that a subject was looking at an unfamiliar, degraded stimulus then our assessment of the subject’s attention from the subject’s report of hazy, unclear phenomena would be different than if we knew that the subject was looking at a familiar, clear stimulus.

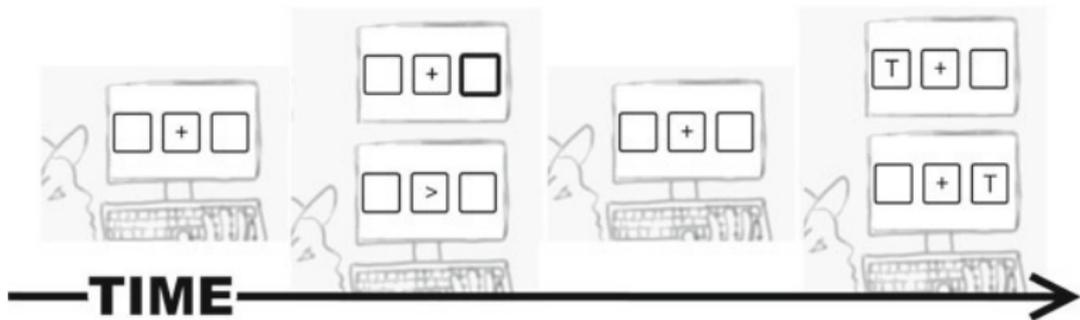
## Experiential Mode

Attention seems to span the full spectrum of experiential mode—from active (“pay attention”) to passive (“it grabbed my attention”). To solve this **problem of captured attention**, one can follow Husserl (1975, 60-80) in presenting a third mode beyond both the active and passive modes: the mode of pure givenness, or the “purely passive” mode. In that case, attention includes everything from willed direction by the subject to willful acceptance of an otherwise passively given stimulus, which can be differentiated from the mere “relief of salience” that occurs in the purely passive mode.

## Two Measures

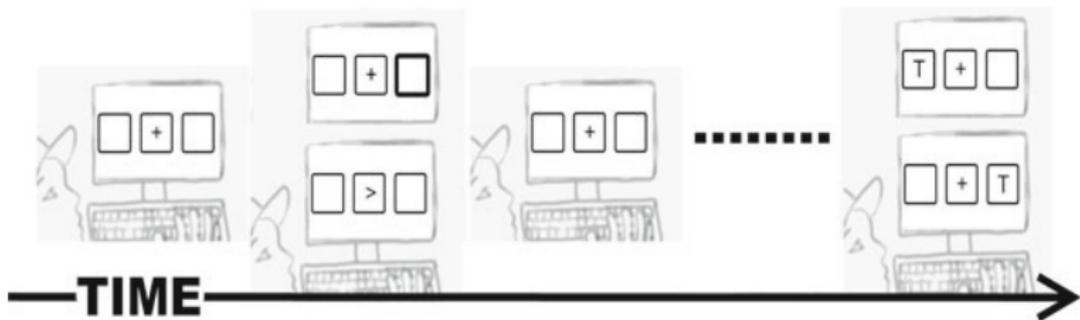
A relevant behavioral divide is that between stimulus-driven, “exogenous” behavior and internally-driven, “endogenous” behavior. The difference between these is largely studied through the difference between **reaction times** to a target following a peripheral cue at the location of the target (*exogenous cue*) and a central cue that symbolically directs attention to the target (*endogenous cue*). The idea is that peripherally-cued behavior is either purely stimulus-driven or at least more stimulus-driven than centrally-cued behavior.

## Reaction Time



Findings: For the **valid condition**, central RT is longer than peripheral RT. For the **invalid condition**, central RT is shorter than peripheral RT (Posner 1980, Jonides 1981). But this difference may have nothing to do with a difference in voluntariness. The central cue is symbolic and in a different location from the target, both of which require more processing than a non-symbolic cue at the same location as the target.

## Inhibition of Return



Findings: peripheral, but not central, cues bring about inhibitory responses at the cued location after around 250 ms (Posner & Cohen 1984). But IOR does take place for central cues when the participants are allowed to move their eyes and even when eye movements are planned and then cancelled by the participant (Millikan & Tipper 1998).

## Two Concepts

Two related concepts have been central to the study of attention within neural modelling: **neural competition** and **top-down feedback** . Work spinning off of these two concepts provides a potential mechanism of attention in the brain and thus further potential criteria of attention.

# Neural Competition

The Normalization Model resolves neural competition through multiple layers of resource distribution. First, there are **stimulation fields**, where stimuli are automatically given relative priority based on the selectivity of an individual neuron. Second, there are **suppressive fields**, where stimuli are automatically suppressed by competitors represented by surrounding neurons. Third, there is an **attentional field** that modulates neural activity based on the organism's current goals (Reynolds and Heeger 2009).

## Top-Down Feedback and Recurrency

Recurrency is a state of electromagnetic phase synchrony between neural areas brought about through neural feedback. The evidence for recurrent processing is the fact that neural tuning changes over time, that these changes can be based on information from outside the receptive field of the neuron in question, and that the entire process of change is slow (Lamme and Roelfsema 2000). While different articles may dispute whether the DLPFC (Hajcak et al. 2010), FEF (Gregoriou et al. 2009), or LIP (Colby and Goldberg 1999) are most central to the feedback of attention, all such articles use the language of **prefrontal feedback** and **recurrent processing**.

## Why Combine These Domains?

The criterion of **clearness or vividness** is incomplete without further information about the subject's history and the objective stimulus, whereas the criterion of **felt effort** fails to provide clear evidence in the hard cases, when there are low levels of effort required. The behavioral criterion of **increased reaction time** mixes in the influence of voluntariness with that of other internal processing demands, making the findings from that area of inquiry difficult to assess on their own. The neural criterion of **prefrontal feedback** depends on subjective phenomena and behavior for its meaning, i.e. for its application to the concept of attention, and will thus need to be tested using the evidence available from those other domains.

# How Combine These Domains?

1 of 2

**What not to do:** One should not combine the domains in such a way that one domain falls prey to the weaknesses of another. For example, it would be a mistake to look for the neural correlates endogenous and exogenous influences by using a single Posner cueing paradigm, since Posner cueing paradigms mix in other influences. One could instead do a contrastive study between Posner cueing paradigms, e.g. between paradigms that use more or less oculomotor planning, to see how the neural distinction between endogenous and exogenous influences might be targeted (by ruling out other influences).

# How Combine These Domains?

2 of 2

**The ideal:** One should take advantage of the information provided by the individual domains while also avoiding the pitfalls of each individual domain when taken alone. At the most general level, a combined approach should use the phenomenological and psychological domains to pick out attentional phenomena within the neural domain, where the divide between attention and non-attentional mental selection appears to be the cleanest. The details of how this should be carried out will depend on the research paradigm in question, but this combined approach should be able to take advantage of the fact that the individual domains are looking at the same underlying phenomena from different perspectives, with different oversights.

## Summary

- In this paper I have put forward several ways of investigating subject-directed mental selection, an understanding of attention that I claimed best fits ordinary use of the term.
- Although I argued that not one of these methods suffices as a specification of attention on its own, I suggested that a combined approach would allow us to move from the imperfect criteria supplied by the individual domains to a more complete specification of attention.
- What I have said here is enough, I think, to provide a “how possible” account of the ordinary notion of attention.
- Further conceptual and empirical work will be required to find more exact criteria of attention through this combined approach.