SEEING ABSENCE

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ABSTRACT

Anna Farennikova: Seeing Absence
(Under the direction of Ram Neta)

Intuitively, we often see absences. For example, if someone steals your computer from a

café, you may see its absence from your table. But absence perception presents a paradox. On

prevailing models of perception, we see only present objects and scenes. So, we cannot

literally see an object that is not present. This suggests that we never literally perceive

absences, but merely infer that something is absent cognitively on the basis of what we do

perceive. But this cognitive explanation does not do justice to the phenomenology. In this

paper, I argue that we can literally see absences. I present a model of absence perception

based on visual expectations and a matching process. I then reply to two pressing objections.

ACKNOWLEDGMENTS

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1   THE PARADOX

Suppose you enter a café, set up your laptop and leave to order a drink. As you make your way back, you glance at your table. The laptop is gone.

Recognizing that the laptop is gone seems to be a sensory event. You do not reason about what's missing; instead, you have an immediate impression of its absence. Ordinary usage tracks this conception as we routinely apply sensory terms to absences. Moreover, some theories of perception presuppose that we can see absences. For example, Noë's account of virtual presence-in-absence assumes perception of absence in occlusion conditions (Noë, 2004, 2006).[1] In addition, standard experimental trials, like rapid visual search tasks, require the subjects to report on absences of prespecified targets.[2] This assumes that absences can be visually detected.

The underlying commitment, then, is that we can literally *see* absences. Here is the problem. Admitting to having absence experiences implies that we see something that's not there. But, things that are not there cannot stimulate the sensory transducers. So, how is it that we manage to see absences? On standard theories of perception this should be impossible. The most obvious resolution is this: positive things are *perceived*; absences of things are merely *conceived*. The perceptual level is restricted to information about present

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[1] Noë: "We experience the presence of the occluded bits even as we <u>experience, plainly, their absence</u>. They are *present as absent*" (Noë, 2006, p. 416, underlining is mine). I will go back to his account shortly to draw an important contrast with my proposal.

[2] Note the "detection" language in Wolfe's review of visual search: "Curvature is a property whose presence is easier to detect than its absence," and, "It is possible to detect the presence or absence of a vernier offset efficiently" (Wolfe, 1998).

objects; data about absences is not available at that level and exists only at the level of higher cognitive processes. Thus, we never literally perceive absences, but merely infer that something is absent cognitively, on the basis of what we do perceive.

Call this view 'Cognitivism.' Focusing on the visual domain, I will argue that Cognitivism is false: absences are represented at the perceptual level. My thesis has three parts. First, I will identify two paradigmatic phenomenological types of absence-representations. Next, I will show that both are specifiable via mismatch mechanism generated by expectations. Finally, I will show that the proposed mechanism meets a more robust test of nonconceptual seeing. The upshot is that contrary to Cognitivism, vision can represent absences.

What turns on this result? An important goal of current project is to draw attention to the phenomenon of seeing absence as a test of a theory of perceptual content. Major theories in perception are tailored to experiences of objects and their features. Marr's theory (1982) targets levels of processing in object-recognition, Clark (2004) analyzes perception as feature-placing, and Gibson's ecological approach (1966) concerns invariant affordances. But, if experience of absence is an indispensable part of our everyday experiences, a theory of perception needs to be able to accommodate major empirical and philosophical results from a theory of seeing absence. For example, what would feature-placing look like if the relevant features were absences? What kinds of affordances are absences?

The plan is as follows. In Part 2, I discuss the desiderata on the account of seeing absence. I present two phenomenological kinds of seeing absence and introduce a new challenge on the account. In Part 3, I validate visual character of experiences of absence by offering a model of seeing absence which involves a mismatch mechanism produced by

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expectations. In Part 4, I address two objections to the account and conclude by sketching possible applications of the model in Part 5.

2   THE LOOKS OF ABSENCES

2.1 What Seeing Absence Is Not

To regain theoretical credibility, an account of seeing absence must overcome the initial obstacle: it must avoid collapsing into the paradoxical claim that to see an absence is to see something that's not there. Let's overview the contenders.

One obvious non-starter is to construe seeing absence as *seeing nothing*. Although this expression is commonly used to report an experience of absence, strictly speaking it means 'not seeing at all.' Clearly, this is not what happened in the Café scenario. The subject did not have a momentary lapse of vision when finding no laptop on the table. In that scenario, seeing what was missing required positive visual input. So, the first lesson to learn is that to *see* an absence, one must *see* something.

If seeing absence involves seeing something, what's that something? Perhaps, *seeing something* is just *seeing something that is not there*. The only way this can be coherent if *seeing* is not used as a success term. So, to see an absence of an object is simply to hallucinate it. We escape the paradox, but during the escape, lose the phenomenon. In the Café scenario, the person who lost the laptop did not hallucinate anything. There was no *misrepresentation* there, visual or cognitive. The laptop really was missing and the one's apprehension of that event was accurate.

Both options fail to capture the target experiences of absence. Another direction to explore is to adopt some elements from Noë's account of virtual presence-in-absence. Noë's core claim is that when we encounter partially-occluded objects, like a cat behind a chair, we

amodally perceive such objects as wholes. He explicates these encounters in terms of "experiences of absences"[3]: amodal perceptions of occluded parts as being present, yet "as not strictly seen." In principle, nothing should prevent us from extending our analysis of seeing absence of *things* to seeing absence of *parts* of things, like seeing no license plate on the car.[4] So, can we make use of his account?

No, and it is important to see why. The experiences of absence I am concerned do <u>not</u> have the same phenomenology as Noë's target experiences of absence. In fact, my experiences of absence have <u>opposite</u> phenomenology: they are impressions of absence, not of presence (more precisely, not of "presence-in-absence"). When the café visitor sees no laptop on the table, she does not also *sense* the laptop *as present*; for example, she does not see it as cleverly hidden or as occluded by the table. So, Noë's use of the term "experiences of absences" diverges sharply from my use and does not purport to be an analysis of impressions of absence that I target.[5]

To sum up, experiences of absence of the sort illustrated by the Café scenario are not episodes of blindness or events in which the missing object is hallucinated or sensed *as present*. So, we are left with the final "paradoxical" translation: to see an absence of an object is veridically to see something that is not there. This, too, is not an option. Veridically seeing

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[3] See footnote 1 for the quote where he uses this terminology.

[4] There will be some differences between seeing absence of things versus of parts of things, but they are irrelevant for the present point.

[5] Interestingly, it is possible to derive perception of absence from Noe's account. His theory says that when one amodally perceives occluded parts, one perceives them as not strictly seen. So, it sounds like perception of partially occluded objects requires <u>perception of absence of strict seeing</u> of occluded parts. The qualification is that this perception of absence is amodal and that what is seen as absent is not an object, but a mental state of strict seeing. Perhaps he does not mean to commit himself to this implication, but the account can be read that way.

what's not there is impossible because what's not there does not have the capacity to affect our sensory organs.

Given that we have no plausible contenders for seeing absence, Cognitivism seems to be the only way to go. Thus, 'seeing absence' must be taken non-literally, as designating absence of some positive visual activity (seeing the laptop) and presence of higher *cognitive* activity (inferring that it's gone on the basis of what is seen). The conviction that we can see absences must be given up because we mistake absence of seeing for absence-seeing.

I think that the Cognitivist is too quick reject seeing absence. There is no pressure to adopt any of these options. One cannot see an absence without seeing something, so, seeing absence must involve representing some positive stimulus. But that's not the whole story. Although seeing absence requires seeing some positive object, it is not *exhausted by* seeing a positive object. Fusing these, seeing *X*'s absence is seeing some positive stimulus *Y* in a certain way. This reconstruction is prima facie coherent and accords with phenomenology of absence. The rest of the paper is devoted to substantiating this thesis.

2.2 Two Ways of Seeing Absence

Assuming that we have a paraphrase of 'seeing absence' that avoids the initial paradox, I now turn to developing the positive account of experiences of absence. The first step involves characterizing two main types of phenomenology of absence.[6] What's the purpose of this step? If these types can be shown to have a common visual denominator, then our account will have certain virtues: it will be a unified model with of seeing absence with a large explanatory scope. Assuming that this is a good goal to have, I will discuss each type in turn, and then conclude the section by looking at the new challenge for the account.

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[6] I believe that all types of seeing absence are subsumable under these two kinds but I will not defend this here.

INTERRUPTION. Imagine that you are at the baseball game and the batter just hit the ball. You see the outfielder run toward the wall and try to make a catch. He leaps, reaching over the wall and extending his glove to get the ball. You anticipate a catch, but the ball bounces off the player's glove. You see the ball disappear over the wall for the home run.

What's distinctive about this kind of phenomenology of absence is that we don't need to attentively examine the wall before we can see that the baseball is gone. Instead, its key determinant is just *loss of perceptual contact* with the ball. Thus, two features mark off this type of this type of representation of absence: (a) it does not involve detailed processing of *what is seen in its place* ('the replacer') but (b) attentively selects interruption in the feed from the tracked object in representing its absence.

What accounts for this profile of seeing absence? The ball is physically salient because fast motion is a dominant visual cue (Wolfe, 1998). Its salience is further amplified by motivational relevance, since trajectory of the baseball is vital for the outcome of the game. Given these factors, attention is likely to prioritize *loss of signal* from the ball over *processing of the replacer* in order to record an absence. Doing this will reduce the computational burden on the system, and sometimes will make information about the replacer only partially available for report, if available at all.[7]

SEARCH/RECALL. Consider an unfortunate traveler, whose luggage was lost by the air company. The traveler is eager to get out of the airport, so she scans the luggage conveyer,

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[7] The claim here is about **priority** of information about *disruption in perceptual contact* over information about the *replacer* in a representation of absence. It would be a stronger claim to say that disruption is *sufficient* to code an absence and no information about the replacer is necessary. I am not defending this stronger claim here. Also, note that this claim has both empirical and theoretical dimensions. Availability of information about replacers can be tested empirically. I am also suggesting that prioritizing loss of contact makes sense theoretically because it's the most efficient way for the visual system to operate in these scenarios.

waiting for her suitcase to arrive. Finally, all luggage from her flight is delivered and the conveyer stops. She glances at the remaining bags and sees that her suitcase is missing.

In this scenario, the traveler does not see the suitcase disappear in front of her eyes. In the Café scenario, similarly, one does not see her laptop get stolen. So, in cases when the object is not tracked before vanishing, vision cannot use disruption in the sensory input from the object in order to detect that it's gone. This results in a different phenomenology of absence.

What determines this phenomenology? Features of the replacer will have to play a large role in indicating an absence in contrast to the INTERRUPTION type (the replacers, to remind, are possible locations of the missing object or objects seen in its place). The traveler must attend to the conveyer or the luggage in order to see that her suitcase is gone. This, again, is not *all* it takes to see an absence, but the critical point of distinction in phenomenology should be clear.

I take INTERRUPTION and SEARCH/RECALL to be the main representatives of the phenomenology of absence. I will say more about the mechanisms recruited for coding absences in those experiences in the next section. For now, I would like to mention two points of clarification.

First, one may wonder why I am choosing these parameters to distinguish the types of seeing absence instead of other dimensions. Other parameters seem equally relevant. For example, why not define types of representations of absence in terms of sudden versus gradual conditions of disappearance, or by whether the representation is conscious or unconscious? The reason I chose to focus on these two types is because I believe them to be peculiar to or characteristic of absence-seeing as absence-seeing. They inform us about what

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it's like to see an absence. Although other variables are important, these variables apply to positive experiences and do not uniquely modulate experiences of absence.

Also, it is crucial to emphasize that these are cases of *seeing* rather than believing. Calling them 'beliefs' implies that we first see a presence and then infer that something is missing. But positing inferences goes against phenomenology of absence. Experiences feel instantaneous, immediate, and lacking in conscious effort. This claim relies on introspection, but there is an even more robust empirical measure. In experiments that controlled for stimulus exposure and response times, presence/absence detection time is too brief to generate a conscious decision strategy (Lin and Murphy, 2008). These experiments mimic real life situations that require speeded behavioral responses to absences (e.g., quick detection that there are no cars when changing lanes). So, it's plausible that conclude that the visual system utilizes detection of absence in a manner that never surfaces in conscious deliberative processing of the data.

2.3 The New Desideratum

We have just looked at two distinct ways of seeing absence, whose phenomenological profiles are a function of the nature of the external stimulus (whether the object is tracked) and patterns of attentional allocation (whether the replacer is crucial for seeing absence). Before I argue for the specific mechanism that subserves these types of experiences of absence, I would like to present an important new challenge for the account.

Let's go back to the Café scenario. Suppose that the day before the theft, you were casually glancing at the table when standing in line for coffee and thinking about whether you want to sit there or outside. How does this earlier episode of looking at the table differ from your experience of absence? Holding perspectival facts fixed, identical light patterns

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are hitting the retina, so the two experiences seem to be visually indiscernible. But if they are indiscernible in this way, then seeing absence is nothing but seeing positive things plus some cognitive activity. Absences don't have characteristic looks.

We can easily recast this challenge from indiscriminability as a new argument for Cognitivism. Here it is in an outline:

IC (1)   Positive experiences are visually indiscernible from their correlate absence-representations.
(2)   If so, then their difference-maker is non-visual.
(3)   If their difference-maker is non-visual, then absences cannot be seen.
(C)   So, absences cannot be seen.

The weight of the argument is in premise (1). Before I evaluate IC, let me try to tip the scale back for the view that there is phenomenal difference between seeing absence and seeing present objects, even if the difference is not obviously visual. For that, let's modify the Café scenario. You leave your laptop at the table, and after getting your coffee, you stop to chat with a friend. During the conversation, you absent-mindedly glance at your table. After a while, it hits you that the laptop was missing. Although the table has not changed any of its physical properties, your experience went through a radical shift. It began as an experience of the table as such, consequently switching to representing no laptop. There is sharp phenomenal contrast in the way the table was seen before and after your discovery. I'd like to overview two ways to undermine premise 1 by accounting for this kind of visual contrast that I find unsatisfying.

The first explanation says that experiences do differ because the table *means* different things to the viewer. This line of defense parallels Siegel's account of perception of natural kinds (2006). She discusses experience of the forest before and after one learns to identify certain trees. She proceeds to explicates phenomenal switch between experiences in terms of

gained recognitional capacity. Why is this strategy unsatisfying? First, it is incomplete. If the shift between <u>seeing the table as such</u> and <u>seeing no laptop on the table</u> is recognitional, then our account must specify what mechanisms are responsible for our recognizing the table as signaling an absence. In addition, recognitional shifts seem to require concepts. This is undesirable if we want to allow nonconceptual representations of absence.

The second explanation of the phenomenal contrast says that the experiences have visual differences that go beyond semantics. Thus, when absence is seen, locations and objects are attentionally modulated in ways distinct from positive seeing. For example, they could be zoomed, or stared at longer due to visual surprise, and so on. So, contrary to premise 1, absences do have characteristic looks.

I have two concerns about this strategy. One concern is that it is inconclusive until more empirical data comes in. So, we shouldn't rely on it until that happens. But, more importantly, even if the proposed mechanism is empirically secured, it may still not help with IC. First, it's plausible to think that certain representations of absence may occur without visual modulations and be just like positive seeing. Think of a habitual search for a pen in a drawer – there may be no zooming or jumping in something as familiar as drawer perception, even when you don't find a pen. Secondly, experiences of positive objects may mimic visually modulated experiences of absence. For example, objects 'pop-out' when unexpected, so certain phenomenology is not exclusive to seeing absence. These arguments counter necessity and sufficiency of visual differences respectively. Thus, the Indiscriminability challenge still stands.

Let's review the results. The modified Café scenario counters our intuitions about visual indiscriminability as captured in IC. But, none of the strategies we've reviewed are able to

overthrow IC. What should we do with conflicting intuitions about differences between experiences of absence and their positive correlates?

I think that the conflict can be attributed to an ambiguity in 'visual indiscernability' in Premise 1. The Pro-Cognitivist intuition behind the claim in Premise 1 stems from a conception of absences on which they are perceptually "ephemeral:" i.e., reducible to positive experiences, or not real, or not really there. This seems to imply that the only reference-frame for evaluation of visual contents of the two experiences is external stimulation. External stimuli per our stipulation are invariant across these experiences (it's the same table in both viewing conditions), so the experiences are visually indiscernible.

The Anti-Cognitivist intuition rejects this criterion of what it takes to be visually indiscernible. Sameness of environmental inputs does not exhaust experiential content. Identical external stimuli can have differential processing and produce *visually* distinct experiences. I think that the Anti-Cognitivist intuition is right. Visual experiences are not mere snapshots; differential visual processing generates different visual contents. So, if I can specify the differential visual processing of the two experiences and show that absences are not 'ephemeral,' then premise 1 in IC is false. This, in effect, will be my strategy.

3   THE EXPECTATIONAL MODEL OF SEEING ABSENCE

3.1 Absences and Expectations

In the previous section, I set up the Indiscriminability challenge in order to draw attention to an important desideratum on the account of seeing absence. I then explained why some ways of answering the challenge are inadequate. The strategy I'll be pursuing here consists in specifying the differential processing of the stimulus that yields a visual experience of

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absence, rather than a positive experience of an object. In the present section, I propose the mechanism that I believe to be a good candidate for this job.

I'll begin by reviewing the examples of seeing absence introduced throughout the discussion. The CAFE scenario highlighted immediacy of impressions of absence. The Café visitor was walking back to her table, anticipating a few hours of work. She was confident that the laptop would be there, and became instantly aware of its absence when the table was in view. The next scenario (BASEBALL) illustrated one kind of phenomenology of absence. The viewer was expecting a great catch, but instead saw the ball fly over the wall and disappear. The final scenario, LOST LUGGAGE, falls under a general paradigm of failed visual searches. The traveler was monitoring the luggage conveyer and saw that her suitcase was missing when the conveyer stopped.

It should be apparent now that these scenarios operate via the same mechanism. This mechanism is breach of expectation. In each scenario, the viewer anticipates an object to be at some place and sees its absence due to disconfirmation of that expectation. Given that this mechanism is operative in a wide range of scenarios in which we take ourselves to be seeing absence, it seems promising to explore whether we can account for the visual content of absence via violation of expectation. So here is the initial conjecture:

VE   Visual representation of absence consists in the representation of violation of visual expectations.

VE accounts for many scenarios and so has a good statistical record. But, that's not its only virtue. The proposed mechanism is also *explanatorily* promising. To see why it is promising, think about what needs to happen in order for someone to see an absence, say, of a laptop from the table. The table, considered on its own, is silent about what could be missing from it. Absences often leave no traces, so, there is no laptop "imprint" on the table,

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no marks on the wood that say: "The laptop was here." So, how is it that we see that the laptop is gone? Since the world offers no visual hints in this case, the representation of the laptop has to be internally generated. Expectation implements this task, as its primary function is to represent advance information. In this case, what we take to be possible just is the laptop.

Of course, more is involved in seeing absence. I will give the details in the next section, but for now, it will help to look at the initial worry with VE. Answering the worry will allow us to introduce an important clarification about the project, so it's worth looking at it in more detail.

The worry is that VE is too liberal. It makes seeing absences too cheap. We generate multiple expectations that are constantly violated, and VE better not imply that we see absences of all objects that violate our expectations. So, the story about seeing absence should be more complicated. I agree; in some sense, the story is more complicated. Seeing absence can be inhibited or facilitated, and there multiple ways of doing that. For example, when walking into an apartment, an art-collector will activate predictions about multiple objects that should be in her living room, like a mirror and artworks on the wall, a couch, and a computer. If the apartment has been robbed, it's plausible that only some of her expectations will be represented as violated and lead to seeing absence. Perhaps, she will see absence of a painting from the wall but not of the mirror. So, some of her expectations will have low activation valence and be dominated by other violated expectations. In addition, seeing absence can be inhibited by the incoming sensory information. Suspicious noise in the kitchen could startle the collector at the moment she glances at the wall, and she may not register that the wall is missing any objects at all.

Examples like these pressure us to introduce more boundary conditions on seeing absence. One suggestion that emerges from these cases is to explicate seeing absence in terms of violation of expectations concerning salient for the viewer objects (objects noticed when present). This sounds right. Since the mirror is something the collector treasures much less than a valuable art photograph, she would be unlikely to see the mirror's absence when first viewing the wall. Call expectations about salient objects as 'dominant.' This suggests the following modification of VE:

VE*   Visual representation of absence consists in violation of dominant visual expectations (i.e., expectations about salient objects).

Is VE* an improvement? No. Restriction of VE specifically to salience turns out to be a bad line to pursue and in fact, it would be misguided to restrict VE to various inhibitors or facilitators.

First, why is salience problematic? Many objects are such that in certain contexts, their absences are more conspicuous than their presence. Suppose that your friend collects artworks but you don't care much for them. So, you never pay much attention to what hangs on her walls. One day a gap in the paintings catches your attention. Absence of the painting becomes perceptually salient due to the fact that it caused a pop-out effect. In this case, salience of absence of the object does not imply that the object itself was salient. So, restriction of expectations to expectations about salient objects is unwarranted.

Secondly and more crucially, introduction of additional boundary conditions misjudges the nature of the current project. I set out to characterize paradigmatic cases where seeing absence does occur; I do not aim to settle on how frequently those conditions are met. My goal is to specify *what* goes into the visual content of seeing absence, rather than to state necessary conditions for *when* seeing absence occurs (or what inhibitors and facilitators are

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relevant). So, VE ought to be read as a constitution thesis, rather a conditions thesis. Given these distinctions, we are now ready to look in more detail at the implementation of violation of expectation in seeing absence.

3.2 The Implementer: The Mismatch Mechanism

The proposal is to account seeing absence in terms of violation of visual expectation. My goal in this section is to get clear on (a) the nature of expectation that is critical for seeing absence and (b) what goes into its violation, such that the resultant mechanism yields a *visual* experience of absence. I'll begin with some definitions.

Perceptual expectation is modality-specific neurally-implemented representation of the forthcoming stimulus (Summerfield and Koechlin, 2008). Previous exposures to an object or to a perceptual regularity cause the observer to form predictions about seeing the object in contextually relevant situations (at a certain time) (Fenske *et al,* 2006; Bar, 2003, 2004; Summerfield and Egner, 2009). So, perceptual expectation is essentially a predictive representation. It is also a conditionalized representation: it presents advance information as conditional on certain cues. These encompass contextual cues or observed perceptual regularities.

So, the first point to note is that visual expectation involved in seeing absence is a condionalized representation of what's possible or probable in the environment that's visual in format. While the cues (conditions) themselves may not be represented visually, representation of the future stimulus must be coded visually. Next, visual expectation needs to be *activated* in order to be coded as disconfirmed and represent an absence (perhaps, this means transitioning from an implicit to an explicit representation). Given that expectations are defined as conditionalized representations, their activation will be a function of what cues

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or conditions are observed. This leads us to introduce another term: '*visual template*.' As used here, visual template will refer an *activated expectation that's been de-conditionalized*, represented as a file in memory that visually simulates an object (a scene, an event) predicted to occur.

Let me illustrate the distinctions we've just introduced. Suppose that practically every kitchen you've seen in your life had a fridge and an oven. So, you come to expect seeing fridges and ovens in other people's kitchens. Your expectation gets activated when you are placed in certain contexts, such as watching a cooking show or upon entering your friend's kitchen. Once you identify the context, your expectation becomes unconditionalized and you activate templates of what you are about to see. So, as you approach your friend's kitchen, you form mental images of a fridge and an oven and project them onto what you see.

Given this characterization of what it takes to expect something, we can now look at the machinery underlying representations of violation of expectation.

Suppose that your friend hates cooking and has recently replaced an oven with a shoe cabinet without telling you. You enter your friend's kitchen, activating templates of a fridge and an oven, and project those images onto their likely locations. To your surprise, you see no oven there. So, what allows you to establish an absence? All it takes is comparison of activated templates with the incoming information and seeing that they do not match.

So, the basic story that emerges is this. In certain contexts, one's visual system activates predictions and compares the incoming information with the predicted information. When the environment fails to conform to one's expectations, visual system registers predictive error and resolves it as a *mismatch* between the expected and observed stimuli (Bubic *et al*, 2009). Which stimuli serve as the grounds for matching when representing an absence? Locations

defined in visual search, uniform or repetitive patterns in static and dynamic conditions, and tracked persisting objects.

Some clarifications are in order. First, for the visual analysis of the experiences of absence to work, it is crucial for my project that the corresponding templates are visual. Expectations can be generated due to verbal instructions and result in templates merely verbal in format, such that the information never synthesized in form of an image. If this kind of a template was involved in matching, then a critical component of the resultant representation of absence is non-visual. This can be construed as a Cognitivist view, and we want to avoid that.

Secondly, I've said earlier that the template is a file stored in memory, but what kind of memory? It is important for the account that the template has the right kind of a source. There are two options. First, it can be visual working memory that involves active manipulation of information for task-relevant stimuli in addition to short-term maintenance of information. Another option is long-term visual memory, which has recently been shown to have the capacity to store highly detailed visual information (Brady et al, 2008, 2009).

The question about which memory supports the template matters for three reasons. First, it must allow manipulation of what's activated in order to subserve the matching process. Working memory is a natural choice given this requirement since its function is to manipulate information. Secondly, the memory system must have the capacity for representing detailed templates. In the KITCHEN scenario, there was no need for a highly specific template in order to establish a mismatch. You were not expecting to see a Bosch, so it was sufficient to activate *category-expectation* in order to see an absence. But, our model should also be able to explain situations where seeing absence requires fine discrimination, or

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identification of an absence of a highly specific object. If you want to check out the oven that your friend got as a wedding gift, then you will form an exemplar-expectation. Its template will contain more specific, higher-resolution information than those from category-expectations. So, the relevant memory source must support such templates for matching.

The third consideration that bears on the choice of the memory system is the kind of *activation* that templates must have in order to be employed for mismatching and evoke a representation of absence. When we deal with positive object-perception, sometimes a distinction is made between *anticipatory processing* involving visual preparatory attention and *expectations*. The former implies the latter but not the other way around. Does this distinction transfer to absence-seeing? Presumably, in the KITCHEN example, you may activate an expectation about a Bosch oven due to certain contextual clues or associations, but do so without conducting a careful search for the oven. And it seems like you can see an absence of the oven without making necessary preparations to see it. If this is right, then we will want to separate activation in working memory from the pre-stimulus processing by visual anticipatory attention.

I think that specifying the exact relation of anticipatory processing to working memory is a tough question that is debated today and will not argue for the view here. It's just worth noting that the relation between working memory, activation of expectation, and anticipatory processing must be made coherent in one's account of seeing absence, and may have interesting dissimilarities between positive object-perception.

Given these general characteristics of the process of mismatch, let's see how the mechanism applies to two phenomenological types of seeing of absence: RECALL/SEARCH and INTERRUPTION.

It's easy to see that a case like Lost Luggage from the broader paradigm of failed visual searches is nicely captured by the proposed model. Such cases have a common dynamic: one forms a mental image of the searched object, projects it on its likely locations, terminating projection once the visual system establishes an absence via mismatch. The Café scenario, however, does not involve an intentional serial search, so how does the model apply there? As I've already noted, expectations about an object can be activated due to contextual cues or task goals. To illustrate, one can hear the song on a radio that one's grandmother used to play, think about the grandmother as a result, and project her image on the chair where she used to sit. Once the image is projected and a mismatch is established, her absence is seen. So, it's plausible to construe cases that do not involve visual search as making use of projection of an image of the anticipated object and a mismatch.

INTERRUPTION is best construed as involving an expectation of permanence or persistence that's matched against loss of signal from the object that has disappeared. This is captured by the following explanation: "This bias may constitute an innate tendency to anticipate the persistence of a currently available percept, an ecologically plausible assumption in particular in the visual domain, where objects exhibit a gestalt constancy and sensory signals tend to be highly autocorrelated" (Summerfield, Koechlin, 2008).

The upshot of the model is that a representation of absence is a structured representation, relating internally and externally generated modality-specific representations. Both elements are visual. The comparing mechanism, the mismatch, need not be construed as an essentially cognitive mechanism as it is paradigmatically involved in early visual processing, for example, in alignment across trans-saccadic information. This makes the entire structure

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visual. So, we may conclude that representations of absence belong to the visual level and Cognitivism is false.

3.3 Extension: Confirmation of Expectation

VE says that all experiences of absence are represented via violation of visual expectation. Is violation of expectation a necessary constituent of seeing absence? If it isn't, Cognitivism can still be refuted. But, we may do better by increasing the scope. Here I will discuss why VE is false, but will argue that expectations are still centrally involved in representations of absence.

To see why VE is false, consider the following scenario. Suppose your friend likes to demonstrate to you a disappearing coin trick. You know exactly what's coming. So, you observe his hand, expecting the coin to vanish. The trick goes well and you, unsurprisingly, have an impression of the coin's absence. Your expectation, instead of being violated, was confirmed. We can think of multiple cases when we have positive expectations about absences: they are anticipated and confirmed. In fact, confirmation of expectation about an absence of some object is essential to detection of some absences. They won't be seen unless they are expected to be seen. Checking for absence of certain defects in a product, for example, requires expertise and preparatory attention, which often correlate with positive expectations.

Cases like these imply a new paradigm of seeing absence: confirmation of expectation. Expansion of our original proposal VE to include this new paradigm invites clarification on the question about how the mismatch still gets to be an implementer of seeing absence

In the paradigm of the violated expectation, the viewer's visual system makes predictive error and resolves it as a mismatch between the expected and observed stimuli (Bubic *et al*,

2009). Confirmed expectations, however, will work differently. They involve an *expected* mismatch and thus lack predictive <u>error</u>-coding, in contrast to violated expectations. If an absence is expected to be seen, then your visual system ought to code no error when it is seen. The gist of my proposal for this new paradigm is this. Seeing *expected* absences involves projection of a template retrieved from working memory with <u>dual content</u> (or, dual activation of two representations). Its first element is an activated image of the missing object (as in the violation of expectation paradigm). The second component is locational: it is a visualization of locations or objects predicted to be lacking the item.

Seeing *expected* absence, thus, involves the following stages:

(i)   Concurrent activation of an exemplar-file representing the missing object and the location;
(ii) Comparison of those elements with each other and establishment of their mismatch within a template;
(iii) Projection of the dual template onto perceived locations;
(iv) Verification of a match between the <u>locational component</u> of the template and what is perceived.

The role of expectation in this process is to move the template in working memory toward matching and evoke matching. So, the model we get is this:

E   Visual representation of absence consists in a mismatch that's implicated either in violation of one's expectation about x's *presence* or in confirmation of one's expectation about x's *absence*.

4   OBJECTIONS

4.1 Is Expectation Necessary?

Let's review the dialectic. I proposed that many cases of seeing absence centrally involve violation of expectations. I then proceeded to analyze them in terms of a mismatch between what is predicted and what is observed. The novel contribution was to apply the mismatch

mechanism to cases involving *confirmed* expectations about absences. This resulted in extension of the original model to the new paradigm (E).

One may find the resultant model unsatisfactory by claiming that it was derived from a narrow base of examples. Sure, failed visual searches typically involve violation of expectation, and we often see absences because we expect to see them. But, we often seem to have experiences of absence that do not involve any expectations at all. Thus, expectation is not necessary for seeing absence. Cases that purport to establish this claim can be classified under three types. I will consider them in turn.

Type 1: Regularities. Imagine a professor who always passes a row of chestnut trees on the way to work. She is usually busy thinking about work and does not pay much attention to the trees. One day, a gap in the row grabs her attention and she notices that several trees are gone. This is problematic for *E* because the example does not seem to straightforwardly involve violation or confirmation of expectation. The professor never consciously attended to the trees and lacked any expectations about them, whether positive ("I'll see a tree") or negative ("I'll see that some trees are missing").

The first point to note about this example is that it is not sufficient to establish Cognitivism. If violation or confirmation of expectation can account for the visual format of some representations of absence, that's all we need to show that Cognitivism is false. So, the fact that there can be cases of seeing absence not involving expectations does not undermine my project as originally stated in the introduction.

E, of course, makes a more ambitious claim by saying that all cases of seeing absence employ the expectational mechanism. So, granting that the example is not a threat for Cognitivism, should we regard it as a threat for *E*? Although I think that there are some

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strong reasons for modifying *E* (if *E* is to account for <u>all</u> cases of seeing absence), such reasons do not stem from the current example. The reason I take the example to be unproblematic for a more ambitious account of seeing absence is because it can be described as involving violation of an *exogenous* expectation.

'Exogenous expectation' sounds like a contradiction in terms, so let me first clarify what I mean. It is standard in the literature to characterize expectations as *top-down*, or *endogenous* mechanisms. This characterization can be misleading. Expectations are top-down in the sense that they are implemented by projections from higher regions in the brain (prefrontal cortex, according to Bar, 2006), and are capable of exerting modulatory control on earlier sensory regions. However, this characteristic does not imply that all expectations have to be set by intentions or conscious goals (this is the second sense of 'being endogenous').

Let's apply this distinction to the tree-line example. Given that that row of trees was irrelevant for the professor's goals at a time, she did not consciously set any expectations about it. Thus, endogenous or intention-based expectations were lacking. But, her expectations could still be set automatically by the *physical features* of the stimuli. Why would this happen? A row of trees is an ordered sequence of objects. It exhibits a certain kind of regularity: in color, shape, size, and orientation. Thus, it's likely that the professor picked up on this regularity when walking to work, even if registering it only peripherally or preattentively. Her repeated viewing of individual trees and the row as a whole had a priming effect, enabling her visual system to set expectations about future cases. Such expectations were activated the day she was walking to work, causing her to project the tree-template on what she was seeing. At some point, her visual system detected substantial disruption in

uniformity and established a mismatch between the projected template and what she was

observing.[8]

   This suggests that seeing absence can be accounted for by violation of an exogenous

expectation; thus, the example is not a threat for *E*.

   Type 2: Random absences. The upshot of the previous discussion is that expectations can

be set by conscious goals (the lost luggage example) or by perceptual regularities (the tree-

row example) and physical features of the stimulus (the baseball example). Thus, *E* ought to

be read as including bottom-up and cognitive types of expectation. Let's now consider

another reason for thinking that expectations are not necessary.

   It's plausible that absences can just be seen randomly. Say, you are sitting in a café and

beginning to feel bored. So, you look around and randomly note that there is no coffee in

somebody's cup. It's not easy to see here how expectations could be involved. Seeing

absence is just a fluke. So, expectations play no role in some cases of seeing absence.

   The example is interesting, but I don't think that it conclusively establishes that absences

can be seen randomly. To see why not, let's first state exactly what element in the process of

seeing absence is supposed to be random. There are three candidates:

> (i)   Activation of the template (an image of a cup filled with coffee pops into your
>   head for no reason),
> (ii) Projection of the template (you accidently project an image of the cup onto
>   somebody's cup), and
> (iii) The comparison process and verification of the mismatch (projected image of
>   the cup is randomly matched against what's observed and a mismatch is
>   established).

   I suppose that images of objects can pop into one's head for no reason. Activation of the

template, however, is not sufficient for seeing an absence. The remaining steps of projection,

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[8] It's possible to construe this case as a pop-out of absence. The target could be the freshly dug soil in the place
where the tree used to stand, and the distracter set could be the grass around it or features of the remaining trees.

comparison, and mismatch are critical. Without the mismatch, for example, activation and projection of the template reduces to mere anticipation or just remembrance of an object. But, supposing that we grant the possibility of (i), it's hard to see why the visual system would want to go through all these steps. Seeing absence is computationally involving, especially in verification of the mismatch. Vision is a system that aims efficiency, and there seem to be better things for it to do than randomly carry out comparison and mismatching.

So, the gist of one response is that seeing absence implemented by random comparison and mismatching is untenable given the goals of the visual system. Here is another response: deny randomness. The template may have the appearance of being randomly retrieved, but was actually activated non-randomly, due to contextual cues. You were in the environment where cups can be empty, and it's possible that the visual system wanted to establish whether a specific cup is. Priming and contextual facilitation often do not have person-level effects. Thus, expectations could be involved on the more subdoxastic, implicit level, prompted by contextual cues or associations.

Type 3: Unknown Outcome. I will now consider the final scenario that I take to be the most persuasive case against *E*.

Consider a typical case involving visual search. Suppose you are visiting a friend and she asks you to get a red cup from the cupboard. Per my story, you activate the template of the cup and project it on its likely locations in the cupboard. You establish that the cup is not there by verifying the mismatch between your template and what you observe. Now, how is it a case of violation of expectation of seeing the cup, or confirmation of expectation about its absence? You didn't know whether the cup would be there or not. You had no advance information. So, it seems like expectations are not involved here at all.

How can we respond? We cannot explain this case by expectations that were set by certain perceptual regularities. You didn't observe lots of red cups in your friend's house before and so had no expectation whether it will be in the cupboard. Thus, priming mechanism from Type1 cases is unavailable here. In addition, the context (the kitchen) does not offer any clues as to whether the cup will be in the cupboard or not. So, analysis of Type 2 cases is unavailable as well. To sum up, seeing absence of the red cup cannot be explained via perceptually set expectations. It is also not a case where absence was seen randomly: your behavior was purposeful given the instructions you've received.

The threat is serious. Let me sketch two ways to response. One is to say that expectations were set implicitly, by the context. So, one's visual system formed a hypothesis about what it will see either due to contextual cues or associations, without the subject being aware of it. I want to note that this can sound implausible because we often equivocate expectation with the *feeling of anticipation*. But, expectation can be coded sub-doxastically, without the subject feeling like she is expecting anything at all. Expectation, per our definition (borrowed from Summerfield), is simply a representation of what is possible or probable in the environment. This representation may not be accompanied by any phenomenology at all.

Another way to respond is perhaps less satisfactory. Suppose that when you were given the task of looking for the red cup, the visual system did not resolve what it is likely to find. Contextual associations assigned equal probabilities to both options. But, recall our definition of expectation: it is a representation of what's possible in the environment. Seeing a red cup is certainly possible; otherwise, why would your friend ask you to look for it? So, given that the cup is possible, that's all you need to token its template in your mind and make it

available for matching. Thus, representing a possibility of a cup in form a template does meet our definition of expectation.

Perhaps the second response is a stretch. Our working definition is too sloppy and should define expectation as a representation of the forthcoming stimulus *as forthcoming*: as probable or highly likely, not merely as possible. This may be a welcome refinement for current theories of visual expectations. But even supposing that it is welcome, I still think that it will not decisively refute *E*. An additional claim that needs to be verified is that in cases of seeing absence resulting from visual searches, the visual system did represent an outcome as unknown (or assigned equal probabilities to both options). Until this is shown, my first response above applies and *E* stands.

4.2 Does Expectation Invite Cognitivism?

Suppose that I've successfully answered the previous objections and expectations are critical for seeing absence. One may say in response that even though expectations are necessary, they are undesirable for an account of seeing absence. I anticipate two objections in that vein.

First, my account may be criticized because it involves top-down facilitation. One may take this to imply that absences are mere doxastic outputs resulting from essentially inferential state transitions. Here are the steps. Let R1 be mental representation of some positive object or location y, and R2 represent *x*'s absence from *y*. R2 is inferred from R1 if R2 is an output of a reliable mismatch-detection function on R1. If R2 is inferred, then it is doxastic.

I don't think that the inferential origin of representations of absence makes them doxastic. Visual awareness of positive stimuli relies on various inferential mechanisms. For example,

contextual associations facilitate coding of the initial coarse input representation via inferences on likely interpretations (Fenske, 2006). Moreover, predictive mechanisms are said to be central to many processes in object-perception (Kveraga *et al*, 2009; Summerfield and Egner, 2009). So, while inferences do introduce computational burden on representing absences, that does not yet establish that output representations of absence are doxastic in format.

Let's now look at the second objection. In order to confirm the thesis that we can literally see absences, the proposed mismatch mechanism must suffice to make a representation of absence visual. That entails that we can't rely on beliefs or concepts do all the heavy-duty work in explicating seeing absence and countering the Indiscriminability challenge. However, are we not helping ourselves to concepts in this model? It is tempting to interpret my model as suggesting that seeing absence requires concepts. The main reason for this interpretation is that templates are those representations in working memory that are coded at the higher level of cognition. So, they must be conceptual in nature.

Why is this result bad? If seeing absence requires concepts, then there is visual level to which absences, unlike positive objects, do not belong. And, one may interpret the failure to be represented at that level as a major drawback for a theory of seeing absence: whatever account of seeing absence we have, it should make it possible for infants to see absences.

My account does meet this goal. My basic response is to deny that back-projection necessarily implies that templates are concepts. Templates may be generated automatically by exogenous expectations, matched rapidly against the observed stimulus, and not available for further recognition or recall due to quick decay. To use a specific scenario, imagine that one evening as you walk home, you see a strange object fly above the forest and disappear. A

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number of things can render the template used for the representation of absence nonconceptual. One is that the viewing conditions were bad. It was foggy and you could barely see anything. Another is that you lacked sufficient background knowledge to resolve an interpretation. For example, you didn't know that there is an Air force base nearby. Another is that you just didn't have enough time to retrieve the relevant category. You knew about flying saucers but the object disappeared too fast for you to conceptualize it as such.

It turns out that nonconceptual seeing of absence is a rather widespread phenomenon. We often have experiences when we see that something is missing, say, from the dresser, but can't exactly figure out *what's* missing.[9] We get a sense of absence. It's plausible that such cases involve expectations about super-ordinate categories of objects or clusters of categories (like 'physical objects that are usually found on dressers or desks').

I conclude that the current model is able to meet a more robust test of nonconceptual seeing. This invites the following modification on the definition of sensations as applied to absences: Sensation of absence is a representation in the visual system that results from stimulation of sensory transducers *matched with internally generated template of an object that is pre-recognitional in format*.[10]

5   CONCLUSION

I avoided the initial paradox by offering a plausible analysis of seeing absence and proposed two types of phenomenology of absence as targets of this analysis. I then suggested that an account of seeing absence must address the Indiscriminability charge: the claim that representations of absence are visual duplicates of positive experiences. Inspection of

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[9] There is a debate about possibility of visual sensing of change without seeing (Rensink, 2005, Galpin *et al* 2007). Sensations of absence may be centrally implicated in visual sensing.
[10] The italicized part is my addition to Prinz's account of sensation in (2006). I am also dropping the 'phenomenal consciousness' requirement on sensations.

examples revealed that representations of absence have one common denominator: matching

process standardly (though perhaps not exclusively) evoked by expectational mechanisms.

This mechanism is sufficient to account for the visual format of representation of absence

and can be employed at the nonconceptual level. This vindicates the claim that absences can

be coded at the visual level, and in the way that's distinct from experiences of present

objects.

The current proposal invites many research questions. Some of the most pressing include:

(1) Can absences be processed unconsciously or pre-attentively?
(2) What are the implications of an account of seeing absence for change blindness?
(3) How does attention modulate experiences of absence? Is anticipatory processing necessary for seeing absence? In what way does pop-out of an absence differ from how pop-out is processed in regular object perception?
(4) What are the common neural substrates recruited in the two paradigms of seeing absence (violation of expectation about an object and confirmation of expectation about an object's absence) and the two phenomenological types (INTERRUPTION and SEARCH/RECALL)?

In this paper, my main focus was on *visual* experiences of absence, but it will be

interesting to apply the model to other sensory modalities. There is research on silence as an

auditory form of perception of absence (Sorensen, 2008). However, silence will be

dissociated from hearing absence on my model if it is not analyzed in terms of a mismatch

implemented by predictive coding. One may argue, in response, that silence is a case of

seeing absence, and that a plausible model of this phenomenon need not involve a mismatch.

If this is true, can there be a visual analogue of silence (a cousin of seeing absence) and is it

affected by the paradox posed for seeing absence in the beginning of this paper?

Finally, in perception literature, it is standard to categorize seeing empty space

(Richardson, 1999; Ferreira *et al*, 2008) and holes (Casati, 2006, Casati and Varzi, 1994) as

species of seeing absence. However, it is not clear that all cases of seeing holes or empty

space involve a form of mismatch and should automatically fall under perception of absence. These considerations may lead one to reject my model as unduly restrictive. Nonetheless, the current proposal ought to highlight the need for the critical review of such cases as deserving the label 'seeing absence.'

References

Bar, Moshe. (2004). Visual Objects in Context. *Nature Review: Neurosciences*, 5, 617-629.

Bar, Moshe. (2003). A Cortical Mechanism for Triggering Top-Down Facilitation in Visual Object Recognition. *Journal of Cognitive Neuroscience*, 15, 600-609.

Brady, T. F., Konkle, T., & Alvarez, G. A. (2009). Compression in Visual Short-term Memory: Using Statistical Regularities to Form More Efficient Memory Representations. *Journal of Experimental Psychology: General. 138* (4), 487-502.

Brady, T. F., Konkle, T., Alvarez, G. A. and Oliva, A. (2008). Visual Long-term Memory has a Massive Storage Capacity for Object Details. *Proceedings of the National Academy of Sciences, USA*, 105 (38), 14325-14329.

Bubic, Andreja, von Cramon, Yves, Jacobsen, Thomas, Schröger, Erich, and Schubotz, Ricarda I. (2009). Violation of Expectation: Neural Correlates Reflect Bases of Prediction. *Journal of Cognitive Neuroscience¸* 21 (1), 155-168.

Casati, Roberto. (2006). The Cognitive Science of Holes and Cast Shadows. *Trends in Cognitive Sciences*, 10 (2), 54-5.

Casati, Roberto and Varzi, Achille C. (1994). *Holes and Other Superficialities.* Cambridge, Mass.: MIT Press.

Clark, Austen. (2004). Feature-Placing and Proto-Objects. *Philosophical Psychology,* 17 (4), 443-469.

Fenske, M.J., Aminoff, E., Gronau, N., & Bar, M. (2006). Top-down Facilitation of Visual Object Recognition: Object-based and Context-based Contributions. *Progress in Brain Research*, 155, 3-21.

Ferreira, Fernanda, Apel, Jens and Henderson, John M. Taking a New Look at Looking at Nothing. (2008). *Trends in Cognitive Sciences*, 12 (11), 405-410.

Galpin, Adam, Underwood, Geoffrey and Chapman, Peter. (2007). Sensing without Seeing in Comparative Visual Search. *Consciousness and Cognition*.

Gibson, J.J. (1966). *The Senses Considered As Perceptual Systems.* George Allen and Unwin, London.

Kveraga, K., Boshyan J., and Bar, M. (2009). The Proactive Brain: Using Memory-Based Predictions in Visual Recognition. In S. Dickinson, M. Tarr, A. Leonardis and B. Schiele (Eds.) *Object Categorization: Computer and Human Vision Perspectives.* Cambridge University Press.

Lin, Emilie L and Murphy, Gregory L. (1997). Effects of Background Knowledge on Object Categorization and Part Detection. *Journal of Experimental Psychology: Human Perception and Performance*, 23 (4), 1153-1169.

Marr, David. (1982). *Vision*. San Francisco, CA: Freeman.

Noë, Alva. (2004). *Action in Perception*. Cambridge, Mass.: MIT Press.

Noë, Alva. (2006). Experience Without the Head. In T.S. Gendler and J. Hawthorne (Eds.). *Perceptual Experience.* Oxford University Press, 411-33.

Prinz, Jesse. (2006) Beyond Appearances: The Content of Sensation and Perception. In T.S. Gendler and J. Hawthorne (Eds.). *Perceptual Experience.* Oxford University Press, 434-60.

Rensink, R. A. (2004). Visual Sensing without Seeing. *Psychological Science*, 15(1), 27–32

Richardson, Louise. (1999). Seeing Empty Space. *European Journal of Philosophy*.

Siegel, Susanna. (2006) Which Properties Are Represented In Perception? T.S. Gendler and J. Hawthorne (eds). *Perceptual Experience,* Oxford University Press, 481-503.

Sorensen, Roy. (2008). Hearing Silence: The Perception and Introspection of Absences. Matthew Nudds and Casey O'Callaghan (eds.) *Sounds and Perception: New Philosophical Essays*. New York: Oxford University Press.

Summerfield, Christopher, and Koechlin, Etienne. (2008). A Neural Representation of Prior Information during Perceptual Inference. *Neuron*, 59 (2): 336-47.

Summerfield, Christopher, and Egner, Tobias. (2009). Expectation (and Attention) in Visual Cognition. *Trends in Cognitive Sciences*, 13 (9): 403-11.

Wolfe, Jeremy M. (1998). Visual Search. In H. Pashler (Ed.) *Attention.* London, UK: University College London Press.