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Helmholtz on Perceptual Properties

R. Brian Tracz

Hermann von Helmholtz's work on perceptual science had a fundamental impact on Neo-Kantian movements in the late nineteenth century, and his influence continues to be felt in psychology and analytic philosophy of perception. As is widely acknowledged, Helmholtz denied that we can perceive mind-independent properties of external objects, a view I label *Ignorance*. Given his commitment to Ignorance, Helmholtz might seem to be committed to a subjectivism according to which we only perceive properties of our own representations. Against this, I argue that for Helmholtz, the properties we perceive are not monadic properties of either the subject or the object. Rather, Helmholtz endorsed a *relationalism* about the properties we perceive: the properties of objects we perceive are all relational properties. I then suggest that once we take into account oft-neglected terminological distinctions in Helmholtz's corpus, we are better able to make sense of his commitment to relationalism.

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1. Introduction

Helmholtz's innovative account of perception has shaped discussions on the topic from early neo-Kantianism up to contemporary philosophy of perception. His engagement with Kant and his philosophical successors has fostered ongoing discussion about the extent of Helmholtz's own Kantianism.¹ Like Kant, Helmholtz held throughout his career that perceptual representations are fundamentally dissimilar from their objects. "Representation and what is represented," he writes, "belong to two completely different worlds which admit of no more comparison to one another than colors and sounds, or the letters of a book to the sound of the words which they signify" (*PO1.3*, 443).² Just as Kant maintained, the properties of our representations of shape, space, and color are not to be found in things as they are "in themselves," that is, in things considered inde-

¹E.g., [De Kock \(2014b\)](#) separates the distinct contributions both Fichte and Kant made to Helmholtz's theory of perception; [DiSalle \(1993\)](#) and [Friedman \(2000\)](#) discuss Helmholtz's relation to Kant's theory of mathematical cognition; [Lenoir \(2006\)](#) and [Hatfield \(1990, 344–46\)](#) compare Kant's theory of experience with Helmholtz's theory of perception more generally, both concluding that Helmholtz's mature theory of perception was a significant empiricist departure from Kant's own theory of spatial perception.

²All translations are those of the author. Below is a citation key to works by Helmholtz:

- *PO1* is the first edition of the *Handbuch*, [Helmholtz \(1867\)](#).
- *PO2* is the second edition of the *Handbuch*, [Helmholtz \(1896b\)](#).
- *VR*, 1: [page number] is volume 1 of [Helmholtz \(1896a\)](#).
- *VR*, 2: [page number] is volume 2 of [Helmholtz \(1896a\)](#).
- *Tonempfindungen* is [Helmholtz \(1863\)](#).

pendently of our perceptual representations (*VR*, 1: 185–86). In Helmholtz's terms, "our images of the things in our representation are not similar to their objects" (*PO2.3*, 590; compare *PO1.3*, 443, 446).³ And since Helmholtz maintains that we can only obtain knowledge of objects through perception, this fundamental dissimilarity leaves us ignorant, in some respect, of the things we represent. Call this *Ignorance*.

Though it is agreed that Helmholtz maintains Ignorance in one form or another, the trend has been towards developing Ignorance into a kind of subjectivism about the properties we perceive. These views are "subjectivist" in that they tend to take perceived properties to be "in the mind."⁴ This tendency is

³If there is any such similarity, it is incomprehensible: "What sort of similarity is supposed to exist between the perception and the object which I perceive by means of it, I am incapable of comprehending" (*PO1.3*, 446). Compare, "[W]e are acquainted with the external world only through the language of signs" (*PO2.3*, 590; see also *PO1.3*, 443, 446). [Schiemann \(1998, 26\)](#), in particular, argues that Helmholtz's mature theory of perception after 1870 denies that there is a temporal isomorphism between representations and their objects, an isomorphism that Helmholtz allowed in the first edition *Handbook* (*PO1.3*, 445–47).

⁴Heidelberger voices this: "In conceiving of external perception as perception of one's own inner state (of nervous excitations conducted to the brain) Helmholtz, no matter how much he denied it, remained an idealist" (1993, 492). As I argue below, what Helmholtz calls "*Perception*" is only of one's inner state, whereas perception ("*Wahrnehmung*") frequently is not. Other readings are not clearly committed to the claim that external perception is the perception of one's own inner state, but suggest that external perception is either reducible to or entirely grounded in the perception of states in the mind. Gary Hatfield argues that due to his ultimate rejection of causal realism, "Helmholtz robbed that law of its ability to underwrite inferences to an external world" (1990, 213; compare [Hatfield 2011](#), 332ff.). Michael Friedman claims that law-like relations among our sensations "are constitutive of their relationship to an external world" (1997, 33). Scott Edgar likewise argues that for Helmholtz, "the objectivity of human knowledge cannot consist in its having any relation to a mind-independent world" (2015, 102). Each of these authors focuses on Helmholtz's account of the law of cause, and I agree with their consensus view that the law of cause does not apply to mind-independent objects (as against, e.g., [McDonald 2002](#), 167). The present paper qualifies this, how-

quite understandable given Helmholtz's consistent denial that we perceive the properties that objects have independently of our representations. This denial suggests a simple alternative: the properties we perceive are really properties of our representations, not of objects distinct from our representations.

In this paper, I argue for a third way between subjectivism and the mind-independence view of properties that Helmholtz rejects. For Helmholtz, the properties we perceive are not monadic properties of either the subject *or* the object. Rather, the properties we perceive of objects are all *relational* properties—properties that objects have only insofar as they stand in a relation to a subject's sense organs. I label this *relationalism*, following the contemporary views that take color to be “constituted in terms of relations to subjects” (Cohen 2009, viii). Ignorance, on my reading, amounts to an expression of our incapacity to perceptually represent the non-relational features of objects.

This new interpretation of Helmholtz is particularly illuminating in three ways. First, Helmholtz's relationalism should be of interest to readers of Kant, for according to one of the main strands of interpretation, Kant's transcendental idealism treats *all* properties that appear in perception as relational properties. Rae Langton (1998, chap. 2), for instance, has argued that something like Ignorance is a basic tenet of Kant's views on things as they are in themselves, and that Kant's commitment to this view is explained by his commitment to relationalism.⁵ Recently, Lucy Allais (e.g., 2015, 117ff.) has explicitly suggested that transcen-

ever, by claiming that perceived properties are neither mind-independent nor object-independent, but relational. Whether these views are ultimately compatible with my proposal depends on the exact formulation of “subjectivism” or “phenomenalism” in question, which would be the subject of further work.

⁵She calls what I call Ignorance “Humility”; I use a different term because I do not want to pitch Ignorance in terms of Kant's own distinction between appearances and things in themselves. Tolley (2013) is sympathetic with Langton's view and further emphasizes Kant's insistence that appearances are themselves representations.

dental idealism, in an important aspect, is a generalized form of color relationalism. It would thus be interesting if Helmholtz formulated a version of this view much in the spirit of Kant. I think there is good reason to think he did.

Secondly, the distinction between primary and secondary qualities is often characterized as a distinction between perceived properties that are non-relational (primary) and those that are relational (secondary). A characterization of Helmholtz's relationalism helps to situate him with other figures in the history of modern philosophy (for a discussion, see Hatfield 2011). Finally, relationalism, particularly color relationalism, is alive in contemporary philosophy of perception (e.g., Chirumuuta 2015, Cohen 2009). Despite this, the history of relationalism is rarely thematized, so Helmholtz's views provide some historical context of interest to present work in philosophy of perception.

The plan for the paper is as follows. I begin by providing the textual basis for attributing relationalism to Helmholtz (Section 2). I then argue that the *representational* aspect of relationalism is better understood once we acknowledge Helmholtz's division between sensation (*Empfindung*) (Section 3) and perception (*Wahrnehmung*) (Section 4). My main argument here is that for Helmholtz, conscious attention to the qualities of sensations as “signs [*Zeichen*]” yields perceptions of distal properties. While *some* states, like what Helmholtz calls “*Perception*,” are direct perceptions of our inner states, other stages of perception (*Wahrnehmung*) more generally are not perceptions of our inner states. Unfortunately, English translations of Helmholtz's work often obscure important distinctions between terms that are crucial for distinguishing the physiological and psychological stages leading up to the perception of properties distinct from the subject's inner states. Once we respect these distinctions, we can more clearly see that perception of properties is a multi-step process, as I outline in Section 4. Furthermore, we

can see this process at work in Helmholtz's account of sound and color perception (Section 5). I conclude with some reflections on how the account of perceptual properties interacts with the psychological account of how they are perceived, highlighting recent work in philosophy of perception and the secondary literature on Kant (Section 6).

2. Helmholtz's Relationalism

Relationalism, as we noted, is a view about the metaphysical status of the properties that we perceive. One of Helmholtz's primary reasons for maintaining relationalism arises from his observations regarding inter-subjective variation in the perception of color properties. I want to set up Helmholtz's treatment of inter-subjective variation by contrasting it with a subjectivism that Helmholtz rejects. This rejection can seem surprising, since some of Helmholtz's remarks invite a subjectivist view of color properties, on which they are non-relational properties of sensations or mental states. But there are reasons against this interpretation that also motivate Helmholtz's positive account of relationalism.

Helmholtz often talks as if our experience does not *really* put us in touch with properties distinct from our sensations. For instance, he remarks that . . .

. . . the objects in the space around us appear to be clothed [*bekleidet*] in the qualities of our sensations. They appear to be red or green, cold or warm, to have an odor or a taste, and so on. Yet these qualities of sensations belong only to our nervous system and do not reach out at all into the space around us. Even when we know this, however, the appearance [*Schein*] does not cease, for this appearance is the original truth. It is precisely the sensations which initially offer themselves in spatial order. (*VR*, 2: 228–29; see also *PO1.3*, 430)

If color sensations “belong to our nervous system” and do not “reach out into the space around us,” then it might seem natural

to assert that color properties cannot be anything but properties of our nervous system. The qualities of color sensations seem to be located in space on the surface of objects; however, Helmholtz maintains, the physiological theory of sensation denies just this. If we couple this with a tendency to translate *Schein* as “illusion” instead of “appearance,” then the subjectivist account seems promising.⁶

In response to this, note first of all that relationalism about color, say, requires us to distinguish color *sensations* from color *properties*.⁷ Color properties can be relational properties even if qualities of color sensations are not themselves relational properties. The above passage is not obviously incompatible with such a distinction: Helmholtz claims that red as a *sensation quality* belongs to the nervous system, not RED as a property of objects.⁸ If Helmholtz actually sustained such a distinction, then the subjectivist account cannot be right.

I argue that Helmholtz's other discussions of sensible properties support just this distinction.⁹ Helmholtz explains his striking view of properties:

[I]n truth the properties [*Eigenschaften*] of objects of nature, despite this name, denote nothing in and of itself proper [*eigenes*] to the

⁶Some translations render *Schein* as “illusion,” which is infelicitous if it is the “original truth.” Helmholtz tends to use *Täuschung* to denote an illusion (e.g., *PO1.3*, 429, 443, 445), though he sometimes uses *Schein*, but only to indicate cases in which the inductive processes underlying perception make incorrect predictions (*PO1.3*, 450).

⁷This is readily apparent in contemporary formulations of color relationalism: color properties are certainly analyzed in terms of color experiences, but are distinct from those experiences. See Chirumuuta (2015), Cohen (2009, 184), and especially the formulation in Byrne and Hilbert (2017, 186–87).

⁸I shall use small caps to indicate properties.

⁹Helmholtz's account of color thus falls under the heading of “Lockean” secondary quality accounts, not “Galilean” secondary quality accounts. This distinction is introduced by Hatfield (2011), who claims that while Galilean secondary qualities correspond to nothing in objects, Lockean secondary qualities correspond to something in objects. The Lockean does this by distinguishing between “colors as a type of qualitative experience” and “colors in objects.”

singular object, but rather always denote a relation to a second object (including our sense organs). The kind of effect must naturally always depend on the particularities both of the affecting body and of the body that is affected. . . . [W]ith properties based on the mutual relations of things to our sense organs, humans have always been inclined to forget that we are also dealing here with the reaction against a particular reagent, namely our nerve apparatus, and also that color, smell and taste, feelings of warm and cold are effects that depend quite essentially on the kind of organ that is affected. (PO1.3, 444)

[E]ach *property* or *quality* of a thing is in actuality [*Wirklichkeit*] nothing other than the capacity of the object to exert certain effects on other things. (VR, 1: 321; see also VR, 1: 300)

Helmholtz suggests that the root of *Eigenschaft*—“*eigen*,” meaning “proper” or “own”—can mislead us into thinking that properties are had by “objects of nature” irrespective of their relation to other objects. On the contrary, the properties manifested in nature “always denote a relation to a second object.” The property SOLUBLE indicates a relation between a solvent and a solute, just as BLUE indicates a relation between a sense organ and an external object.

I want to focus on Helmholtz’s latter claim that sensible properties are relational. How does he defend this? In describing cases of intersubjective variation, he denies that an object is either “really red as we see it” or “only a sensory illusion” (PO1.3, 445). Instead, he explains that:

One who cannot see red will see cinnabar as black or dark-grey-yellow; this is also the correct reaction for the particular nature of his eyes. He need only know that his eye just has a different nature from other humans. The one sensation is not in itself more correct or more incorrect than the other, even if those who see red have for themselves a large majority. In general, the red color of the cinnabar only exists insofar as there are eyes that are constituted similarly to those of the majority of humans. With exactly the same right, it is a property of cinnabar to be black, namely for those who

cannot see red. In general, the light reflected off of cinnabar is in itself definitely not to be called red; it is red only for particular kinds of eyes. . . . [I]f we say, “Cinnabar is red,” it is understood implicitly and automatically that it is red for our eyes, and for the eyes of other humans that we assume to be similarly constituted. (PO2.3, 589)

Several things are important to note here. (1) Throughout this passage, Helmholtz is speaking about the color properties of physical objects, and he is *not* attributing these properties to either the eye or to sensations.¹⁰ This supports the idea that Helmholtz distinguished color properties from qualities of color sensations—even if there is a close connection between them. (2) Nevertheless, against those who think cinnabar is “really red as we see it,” no object “is *in itself* . . . to be called red” (my emphasis).¹¹ So RED is a property, but not a “proper” or “in itself”—that is, non-relational—property of anything. (3) The properties under discussion are RED and other color properties. So Helmholtz is not suggesting, as those who view colors as “only a sensory illusion” do, that physical objects lack color properties. (4) Crucially, two subjects can view the same object to have two different colors, yet both be right. In the contemporary lingo, this phenomenon is a case of “faultless disagreement” between two subjects (see Kölbel 2004). BLACK is a property of cinnabar “for those who cannot see red.” It is *correct* that cinnabar is red for some viewers, and black for others.

This passage underscores that color properties are distinct from the qualities of sensation, against the subjectivist reading outlined above. It also rejects a brand of realism on which colors are non-relational features of the properties we perceive. This latter rejection is motivated by an “argument from varia-

¹⁰I thus agree with Hatfield (2011, 335), against Hacker (1987, 44).

¹¹Johannes Müller puts this point nicely: “[L]ightness, shadow, and colors do not exist for the [visual] sense as something ready and external, something that touches the sense, causing the sense to have nothing more than a sensation of it” (Müller 1826, 44–45; quoted in Cassedy 2008, 420).

tion" analogous to traditional arguments for color relationalism: since the experiences of two individuals can disagree about the color of an object, and since there is no independent "in itself" standard for what the "true" color is, relationalists infer that *both* individuals are right.¹² Helmholtz does just this.

We can finally see why relationalism is an essential feature of Ignorance. *First*, since Helmholtz thinks *all* properties of objects we perceive are relational, we do not perceive "in itself" or "proper" features of objects. (Of course, Helmholtz needs to indicate why spatial and temporal properties too are not themselves properties of objects—a topic that has received extensive treatment elsewhere; see, e.g., [Friedman 1997](#).) *Second*, there is no other cognitive access we have to the properties of those objects than through perception. From these premises, Helmholtz infers Ignorance: if objects have non-relational properties, we cannot cognize them. Helmholtz acknowledges this when he claims that it would be "contradictory" to represent the "thing in itself," a thing "persisting as substance," or "real," according to its "positive determinations" (*PO2.3*, 592; *VR*, 1: 321, 2: 241–42). If I am right, these "positive determinations" are non-relational, proper, in-itself properties which, if they exist at all, cannot be cognized by us.

3. Helmholtz's Theory of Sensations as Signs

I have argued that Helmholtz endorsed relationalism. In accepting relationalism, as we saw, he also distinguished between the qualities of color sensations and the color properties themselves. Yet with this distinction in hand, a gap opens up that did not exist for the subjectivist about color—a gap between color sensations (*Empfindungen*) and the perception (*Wahrnehmung*) of color properties. This has several implications for Helmholtz.

¹²The full argument is quite sophisticated, of course. See [Chirimuuta \(2015\)](#) and the master argument in [Cohen \(2009, chap. 2\)](#).

First, the presence of color sensations does not suffice for *awareness of* or *attention toward* a color property. Second, as this section shows, even attending to a sensation does not suffice to perceive a color property. In addition, the sensation must also be a *sign*. Third and finally, once one attends to a sign-sensation, one is in a position to recognize that sign-sensation *as* a sign. This is the topic of the next two sections. In all, this progressive account is a happy result for the relationalist reading of Helmholtz: relationalism avoids subjectivism by distinguishing between color sensations and color properties, and it turns out that Helmholtz's account of perception provides a theory that entails the validity of this distinction.

Helmholtz maintains that sensations can enter into a relation to objects distinct from them—what he calls the "sign [*Zeichen*]" relation. Readers of Helmholtz broadly agree that unlike what he calls "images," sensation qualities do not resemble the qualities they are signs of. "For our representations," a sensation quality is "only a symbol [*Symbol*], a recognitional sign [*Erkennungszeichen*] for the objective quality" (*PO2.2*, 234). "The relation between" a sign and its object "restricts itself [*beschränkt sich*] to the fact that the same object [*das gleiche Objekt*], taking effect under the same circumstances, elicits the same sign [*das gleiche Zeichen*], and that dissimilar [*ungleiche*] signs therefore correspond always to dissimilar influences" (*PO2.3*, 586). Individual sensation qualities are dissimilar from what they signify, Helmholtz argues, because a single stimulus can occasion different sensations in different modalities, and a single sensation can be produced by different stimuli.¹³ To use Helmholtz's favorite example, light produces color sensations in the visual modality, but warmth sensations in the tactile modality. Conversely, a sensation of red can be produced by light stimuli as well as electrical stimuli (e.g., when the optic nerve is stimulated in a lab). From these observations, Helmholtz concludes that sensa-

¹³For a full discussion, see [Cassedy \(2008\)](#) and [De Kock \(2014a, 714–19\)](#).

tion qualities are signs, much in the way that words are signs for what they signify, even though they do not resemble what they signify.

There is less agreement in the literature about under which conditions sensations become signs. Consider the following options:

- (1) *Recognition-dependence*: whether a sensation quality is a sign depends on whether that sensation is recognized or attended to.
- (2) *Recognition-independence*: whether a sensation quality is a sign does not depend on whether that sensation is recognized or attended to.

These two views broadly disagree on whether mental processes—beyond whatever activities are involved in sensation production—are required for sensations themselves to be signs. If we accept (1), then a sensation's being a sign is not an *independent* condition, over and above attention to a sensation, for perceiving the properties of objects. For attention would itself be implicated in the production of signs. View (2) denies this: a sensation's being a sign *is* an independent condition—along with (among other things) attention to those sensations—for perceiving the properties of objects.

Most of what I say in the following sections is compatible with either view. Proponents of either view can accept that *perception* of distal properties requires inferential processes and attention. However, let me provide two reasons to accept view (2).

First, Helmholtz uses the arguments I mentioned above regarding electrical and light stimulation to show that sensations are *dissimilar* to their causes. However, since Helmholtz claims that the *circumstances* in which a sensation arises partially determine whether that sensation is a sign, these arguments do not show that recognition or further psychological processing is

required for the sensation to become a sign.¹⁴ His definitions are quite explicit that the concurrence of a sensation and an object, *holding circumstances fixed*, are the essence of the sign relation.¹⁵ The definition cited above claims that the sign relation “restricts itself” to a relation obtaining between sensations, objects, and circumstances. If this is the case, then the sign relation arises from sparse ingredients: an object, sensations of the subject, and circumstances.

Second, Helmholtz claims that “experience teaches us to recognize [*kennen*] a composite aggregate of sensations as a sign for a simple object,” like a dog (*PO*2.3, 606). (“Experience” here is a stand-in for a process including inferential processes and attention.) Generally, recognizing *X* as *Y* does not make *X* into *Y*. If recognizing *X* as *Y* made *X* into *Y*, then recognition would not be acquaintance with features that an object has, but a projection of features onto objects. The same goes for our sensations. In a similar vein, Helmholtz claims that we “regard [*betrachten*]” certain complex sensations “as the normal sign of the actual

¹⁴De Kock (2014a, 715ff.) observes correctly that Helmholtz endorsed Müller's “law of specific nerve energies.” She then argues that this amounts to an endorsement of a thesis of “sensory underdetermination,” on which “all that is given in perception is a world of underdetermined nervous energies—qualities determined by the specific sense organ involved—that do not inherently refer to anything beyond themselves.” While I think Helmholtz does indeed invoke Müller's reasoning to suggest that qualities of sensation and qualities of their causes are fundamentally dissimilar, it is a second step to then say that because of this dissimilarity, sensations do not “refer to anything beyond themselves,” if lacking reference entails lacking a sign relation. On my view, while the sensation quality *alone* underdetermines what is signified, the sensation quality *in a circumstance* does not.

¹⁵For instance, the following formulation only appeals to sensations, the objects that cause them, and the attendant circumstances: “On the agreement between the quality of the external light and the quality of the sensation, there remains only one . . . : ‘The same light arouses the same sensation of color under the same circumstances. Light is dissimilar that arouses dissimilar sensations of color under the same circumstances.’ If two relations correspond in this way, then the one is a sign for the other” (*VR*, 1: 319).

constitution of the object" (PO2.3, 606). Regarding sensations as signs generally does not make it the case that sensations satisfy the sign relation as Helmholtz defines it. For recall that this relation is defined using a sparse set of ingredients: an object, sensations of the subject, and circumstances. With that in mind, it seems that one can regard a sensation as a sign, even though that sensation is *not* a sign (after all, regarding *X* as *Y* does little to guarantee that *X* is *Y*). For these reasons, I shall treat the multiple stages of perception as the process of *recognizing* and *becoming aware of* sign-sensations as such, not as the process of *making* sensations into signs.

4. Helmholtz's Theory of Perception

In the last section, I noted that perception of properties requires that some sensations are signs. I gave some reasons for thinking that the sign character of sensations is an *independent* ingredient of our perception of properties. In this section, I turn to what is indisputably not contained in sensation, namely, attention and the perceptual processes that give rise to it. As we just saw, one of the major job descriptions of perception is to explain how we recognize a given aggregate of sensations as a sign of some distal object or property. This brings us to the domain of what Helmholtz calls "perceptions" (*Wahrnehmungen*)—"representations about the existence, form, and position of external objects" (PO2.3, 576). It will thus be helpful to sketch Helmholtz's view of perception in broad strokes before proceeding to our case studies: auditory perception and visual perception.

Helmholtz provides an overview in the form of a thought experiment in which we imagine "the standpoint of a person lacking all experience" (VR, 2: 225ff.; the following quotations are from this text). "Lacking all experience" does not mean lacking the capacity for consciousness (like David Chalmers' "zombie"), but rather lacking any prior perceptual input or learning. I will separate the events that follow into four stages, which cumula-

tively lead to the perception of properties.

Stage 1. From this impoverished starting point, all of such a person's representations rely on two basic events: (a) freely initiating a "will impulse" or "innervation" to move, and (b) the occurrence of a "sensation aggregate."

Stage 2. To each of these basic events corresponds a distinct kind of "immediate perception": (a) a *feeling* that he is doing something in initiating a will impulse, and (b) an *immediate perception* of a sensation aggregate (VR, 2: 223). Will impulses initiate movements that he does not immediately perceive. However, these movements can cause alterations in sensation aggregates, and he does immediately perceive these sensation aggregates. There are a number of possible will impulses; consequently, there is a corresponding set of possible sensation aggregates (he has the option to look left or right, say). Helmholtz calls this set of possible sensation aggregates the "occurrent presentables [*die zeitweiligen Präsentabilien*]" or "circle of presentables." But only one sensation aggregate "comes straight to perception [*gerade zur Perception kommt*]" at a given time—only one is directly perceived. This sensation aggregate is called the "*present [präsent]*."

Helmholtz defines the "present" as what comes straight to *Perception*. Interestingly, Helmholtz thought of the Latinate *Perception* as a technical term denoting a kind of "intuition" (*Anschauung*) distinct from representation (*Vorstellung*) and perception (*Wahrnehmung*) more broadly (to mark this, I will spell the Latinate *Perception* with a "z" as it is normally spelled in German: *Perzeption*). A *Perzeption* is "an intuition in which nothing is contained that does not proceed from [*hervorgehen*] the immediately present sensory sensations, thus an intuition as could be formed *even without all recollection of a previous experiencing*" (PO2.3, 609; emphasis added). A *Perzeption* contains an aggregate of sensations and does not depend on prior experience.

What exactly is the representational role of *Perzeption*? Regarding the initial sensation aggregate of "impressions," Helmholtz claims:

Since these impressions are taken up into consciousness [*in das Bewußtsein aufgenommen*], i.e., perceived [*percipirt worden*], their complete manifold remains undiminished, each image in the field of sight [*Sehfeld*] remains differentiable from the others. Each position in it can become independent of every other goal of attention and be compared with its earlier appearance [*Aussehen*]. (PO2.3, 579)

Perzeption is the “taking up” of the sensory manifold into consciousness. However, *Perzeption* is not a consciousness or “attention” to the parts of this manifold. Rather, *Perzeption grounds* such attention by making the parts of the sensory manifold “differentiable” (NB: not *differentiated*) from one another. Helmholtz acknowledges that we are “certainly inclined to believe that we must likewise have been conscious of all that we sense, of all that is contained in our sensations” (*Tonempfindung*, 102). Against this inclination, Helmholtz argues both that (a) merely having a sensation does not imply that it is contained in a *Perzeption*, and that (b) the fact that a sensation is part of a *Perzeption* does not imply that we are consciously attending to *that* sensation.

Stage 3. In order to represent the *circle* of presentables, one must represent that one *could* have accessed a certain sensation aggregate at a different time from which one actually *did*. In other words, one must represent an “enduring persistence of difference,” where the persisting differences are different possible sensation aggregates. Unlike the present, the circle of presentables is represented via “inductive inferences” and is not immediately perceived in a *Perzeption*. The inductive and inferential nature of perception via “unconscious inferences” is one of Helmholtz’s claims to fame, though I will say nothing more about this feature than that it consolidates our massive history of will impulse-sensation pairs into short “major premises” (e.g.: “if I initiate *this* will impulse, then the sensory qualities in the visual field move left.”).

Stage 4. Notice that thus far in the thought experiment, the subject is unaware of anything distinct from his own actual and

possible sensations. The awareness of an object distinct from his own sensations has two components. First, that object is “given” to him in some sense. Second, he *attends* to what is given. As a result of these two components and the stages that precede it, the subject “recognize[s] a composite aggregate of sensations as a sign for a simple object” (PO2.3, 606).

The first component takes us from the circle of presentables to a representation of an object through it. Helmholtz describes this transition as follows:

Now, at another time, the circle of presentables becomes another circle of presentables for the same group of will impulses. Through this, the latter circle confronts us with the individual [*mit dem Einzelnen*], which it [the circle] contains [*was er enthält*], as a given, an “*objectum*.” It divorces those alterations that we can bring forth and remove through conscious will impulses, from such ones that are not consequences of will impulses and that cannot be removed through such impulses. . . . Fichte’s appropriate expression for this is that a “not-I” compels recognition from the “I.” (VR, 2: 226–27)¹⁶

If one alters one’s location (sitting on the beach versus sitting in the office, say), then the same set of will impulses will yield a different set of sensation aggregates. Through this switch, the subject becomes aware for the first time that will impulses are not the sole determinant of the sensation aggregate. He recognizes the “given” or “objectum” that the circle of presentables *contains*. Some not-I demands recognition from the subject.¹⁷

The second component allows the subject to selectively attend to this “given,” “objectum,” or “not-I.” An important observation here is that some sensations affect consciousness but are not *attended to*; others affect consciousness *and* are attended to. Helmholtz explains:

¹⁶Compare Helmholtz’s statement in 1893 reiterating this “not-I” framework (Helmholtz 1903, 14).

¹⁷For more on how Helmholtz appropriates this Fichtean idea, see De Kock (2014a,b).

We can steer our attention away from sensations, namely, if the sensations are weak and habituated, but as we note those relations of the external world that stand in connection [*Verbindung*] with these sensations, we are compelled to notice them [the sensations]. . . . On the other hand, we can also perhaps not be in the position to isolate a sensation impression [*Empfindungseindruck*] because it enters into the composite sensory sign of an external object. Then, however, the correct apprehension of the object shows that the respective sensation has been perceived [*percipirt*] and used by consciousness. (*PO2.3*, 611)¹⁸

The last sentence claims that if a sensation can be “used by consciousness,” then that sensation has been immediately perceived (i.e., contained in a *Perzeption*). Still, the mere fact that a sensation was contained in a *Perzeption* from **Stage 2** does not entail that one can “isolate” or “notice” that sensation. Helmholtz assumes this in claiming that attention is directed at a “certain part of the present perceptions [*Perzeptionen*]” (*PO2.3*, 604). Instead, one’s attention tends to be aimed at features of the external world that “stand in connection with these sensations,” that is, those features that correspond to particular *parts* of a *Perzeption* that one is “compelled to notice.” These features of the external world, I take it, just are the “given,” “objectum,” or “not-I.” The presence of this given not-I provides an explanation for how attention can direct itself at objects as opposed to mere subjective states in the first place: it provides the initial representation of a distinction between subject and object.¹⁹

Let’s summarize this. In **Stage 1**, the sensation aggregate is a physiological response to stimulation. In **Stage 2**, the subsequent *Perzeption* containing that aggregate enables those sensations to modify one’s consciousness and is experience-independent.

¹⁸Similarly: “We in fact become *conscious*, always quickly and effortlessly, of all that interests us in our sensations for the practical purpose of becoming acquainted with the external world correctly” (*Tonempfindung*, 102, emphasis added).

¹⁹See especially De Kock (2014b) on this initial representation of an object and on Fichte’s influence on Helmholtz.

These sensation aggregates serve as inputs to the inductive inferences that generate a representation of the circle of presentables in **Stage 3**. In **Stage 4**, attention to some part of the sensation aggregate enables one to “note those relations of the external world that stand in connection with these sensations.” It is **Stage 4** that produces the conscious awareness of an object—the representation of an existing object that is the ultimate purpose of Helmholtz’s account of perception (*Wahrnehmung*). As a result, one is not merely aware of sensations, or of sensations that happen to be signs. Rather, one is aware of sign-sensations *as* signs. That is, one “recognize[s] a composite aggregate of sensations as a sign for a simple object.”

5. Case Studies: Auditory and Visual Perception

This summary shows that the conscious representation of features of objects is a late-stage achievement of a process beginning with sensation and willing.²⁰ With that in mind, we can take a look at two cases that show how Helmholtz understood the difference between sensations and the perception of properties. These accounts illuminate the four-stage account I just outlined.

The case of color perception illustrates how sensations are grouped into perceptions.²¹ Helmholtz provides a wealth of data suggesting that three mutually independent “elementary excitations [*Elementarerregungen*],” each “in some segment of the conducting nerve substance,” compose any particular conscious sensation of color (*PO2.3*, 343, 346). Each physiologically distinct

²⁰It also shows how rudimentary the process is that Helmholtz is investigating—as he explicitly notes, for instance, none of this assumes the existence of physical substances. See (*VR*, 2: 226): “With what is posited there as next to one another and persisting, one need not yet think of substantial things.”

²¹Helmholtz’s view of color—formulated in the 1850s and 1860s—builds on Young’s trichromatic theory of color, as well as many of the insights from Goethe, Herbart, and Grassman. For an account of the genesis of Helmholtz’s theory of color, see Lenoir (2006) and Meulders (2010, chap. 8).

elementary excitation corresponds to a different primary color—red, green, or violet—such that different mixtures of elementary excitations can produce sensations of different colors in color space. Echoing Thomas Young’s theory of color, Helmholtz concludes that these elementary excitations can “reach perception [*zur Wahrnehmung gelangen*] at the same time and thereby, so long as they were excited from the same place on the retina, [be] localized in the same position of the visual field [*Sehfeld*] at the same time” (*PO2.3*, 344).

Let’s map this view of color perception onto the multi-stage account. Helmholtz implies in several places that the elementary excitation corresponding to red, say, always produces a sensation of red, even when that sensation of red is part of the sensation of a mixed color like brown. For instance, he says that

The three simple sensations, which correspond to the excitation only of a single of the three nerve apparatuses, and from which all others can be composed, must correspond to the three points of the vertices of a color triangle on the color table. (*PO2.3*, 345–46)

He adds that “all of our sensations of color are mixtures of three different simple sensations” (*VR*, 2: 118; see also *VR*, 1: 303–15). This account of elementary excitations corresponds to **Stage 1**, since these processes merely deal with sensation aggregates.²²

Helmholtz also illustrates how the later stages work for color perception. As Helmholtz notes in his lecture on painting and

²²I thus am unmoved by Lenoir’s claim that “even at the level of sensation psychological factors involving experience and judgment are intermixed with physiological function and physical interaction with light” (2006, 206). He seems to infer this from his interpretive suggestion that “[w]e discover in Book III [of the *Handbuch*], devoted to psychological factors in vision, however, that pure sensations of color unmixed with phenomena of contrast and compensatory judgments concerning expected states of affairs can occur only through careful experimental arrangements and with trained observers” (2006, 206). I argue, on the contrary, that “pure sensations” occur regardless of “compensatory judgments”; as I argue below, these judgments are based on conscious attention (Stage 4), and *different* modes of conscious attention can occur even when the *same* sensation aggregate is present.

optics, bright white light appears yellowish because our perception of that light contains a more intense sensation of red, whereas dull white light appears bluish because our perception contains a more intense sensation of blue-violet (*VR*, 2: 118–19). I suggest that this “appearance” corresponds to **Stage 2**. For even though bright white light “appears yellowish,” and dull white light “appears bluish,” we are not usually “conscious” of this difference in the intensity or presence of these simple sensations of red or violet. We are accustomed to “judging” them as differences in *illumination conditions* of one and the same physical white surface (*VR*, 2: 119).²³ This judgement depends on the outputs of **Stage 4**. The divergence between the *difference in appearance* in **Stage 2** and the *consciousness of sameness* in **Stage 4** can arise because “sensations becoming conscious themselves correspond comparatively little to the convoluted or altered functions of certain elementary excitations” (*PO2.3*, 344). As a result, “there is no reason to assume that we should be able to separate these so determined elements of sensation from one another through an immediate act of consciousness” (*PO2.3*, 344). So elementary excitations do produce simple sensations, but we are usually not conscious of those simple sensations as such. Instead . . .

. . . we fix our attention only on those differences of sensation that cohere in a regular manner with certain objective relations of the nature surrounding us. With regards to color, the main goal of our attention is the correct appraisal of the colors of bodies. (*PO2.3*, 344)

²³Helmholtz explains:

Very bright white appears therefore yellowish, and dull white appears bluish. In our ordinary way of looking at the objects about us, we are not so readily conscious of this; for the direct comparison of colors of very different shade is difficult, and we are accustomed to see in this alteration in the white the result of different illumination of one and the same white object, so that in judging pigment-colours we have learned to eliminate the influence of brightness. (*VR*, 2: 119)

Even though three basic sensation qualities are directly perceived in the same region of the visual field (**Stage 2**), we can selectively attend to one of those co-located qualities only after **Stage 3** and **Stage 4** processes take place. Experienced painters might attend to the yellowness of green grass on a bright day (they have a highly tutored **Stage 4** awareness of the parts of the sensory manifold), whereas ordinary subjects in the same circumstances might abstract from the yellowness of the composite sensation. The ordinary subject does this because she is interested in the properties of external objects (resulting in a “color constancy” effect).

Helmholtz tells an analogous story in his theory of auditory perception.²⁴ The important qualitative features of sound sensations—pitch and timbre—can be “reduced” to “the difference in sensing nerve fibers” (*Tonempfindungen*, 221). These nerve fibers are independent of one another (*Tonempfindungen*, 220). Helmholtz claims that “if we seek to dismantle [a] sound [*Klang*] into its partial tones, this is a matter of pure sensation” (*Tonempfindungen*, 101). And if the physical component of the sound (in German, a *Schall*) of a violin brings “the same sum of partial tones to sensation in our ear always and repeatedly, then this sum of tones in our sensation eventually becomes the composite sign for the sound [*Klang*] of a violin” (*Tonempfindungen*, 105). As explained in Section 3, sensations can become signs when they occur in the presence of the same objects in the same circumstances. These sign-sensations of simple tone qualities (“partial tones”) correspond to **Stage 1** and **Stage 2** processes.

To reiterate our theme, though, the awareness of tones as

²⁴Meulders (2010, 130) suggests that Helmholtz saw a *disanalogy* between sound and light, since mixtures of colors “could not be analyzed” by the subject. Meulders cites Helmholtz (1852, 1), which approvingly attributes to Newton the claim that “the eye is incapable of recognizing from the composite colors their constituent elements.” As we just saw, Helmholtz’s later work suggests that attention is capable of analyzing even these constituent sensations of color in certain circumstances—so the analogy stands.

signs is not reducible to **Stage 2** processes. “Partial tones” can be *perceived* as sounds of some instrument or body: “The taking together [*Zusammenfassung*] of a series of partial tones into a sound [*Klange*], as it is attributed to a particular tonal instrument, is a process that does not fall into the domain of sensations, but rather *perceptions* [*Wahrnehmungen*]” (*Tonempfindungen*, 101). As a result of inferential processes (**Stage 3**),²⁵ sensation aggregates are “taken together” in a certain way and recognized as signs of a single object (e.g., of a *violin*) (**Stage 4**).

Helmholtz states, in summary, that what goes for color and sound perception goes for the other senses: “the same fusion of several sensations into a simple whole of conscious perception occurs in the domain of all our sense organs” (*Tonempfindung*, 105). We constantly ignore certain sensations and eventually become “extraordinarily practiced in persistently abstracting from them, since they would disturb us in the observation of the external world” (*Tonempfindung*, 102).²⁶ In perceiving a blade of grass on a bright afternoon, we “look past,” so to speak, the intense sensation of red and still attend to the grass’ green surface. The grass can *appear* different, due to our differing internal physiological states, even if we *consciously attend* to the same property *through* those different appearances. The same goes for the harmonics that compose the sound of a violin or, presumably, the subtle tastes and aromas that comprise the flavor of bacon or wine. It is in this sense that we perceive “simple wholes” or recognize “objects” that are not identical to our internal states.

I want to note briefly how this interfaces with Helmholtz’s understanding of sign-sensations. Helmholtz notes that when one looks at a landscape upside-down, its coloration becomes more vivid (*PO1.3*, 434). As the physicist and amateur painter

²⁵See especially the discussion of “experience and practice” that corresponds to Stage 3 (*Tonempfindungen*, 102).

²⁶Also: “We must, therefore, at first learn to turn attention to our individual sensations, and we learn this ordinarily only for sensations that serve as a means for cognition of the external world” (*PO1.3*, 432; see also *VR*, 1: 282ff.).

O.N. Rood, whom Helmholtz cites approvingly in discussing this phenomenon, explains:

In gazing at landscapes, the ordinary habit of most persons, artists excepted, leads them to pay attention to the forms and distances, (which alone have a practical value as objects of observation), and to neglect the color, particularly those portions of it which are subdued. When now by any means the mind is prevented from dwelling on distance, it is thrown back on the remaining element, color; and the landscape appears like a mass of beautiful patches of color, heaped upon each other, and situated more or less in a vertical plane. (Rood 1861, 184)

In such unusual circumstances, we are more likely to attend to the qualities of sensations themselves as they are distributed on a “vertical plane.”²⁷

Helmholtz’s interpretation of this phenomenon is instructive:

The colors thereby also lose their relation to near or far objects and encounter us purely in their unique differences. . . . This entire difference seems to me to rest only on the fact that we regard the colors no longer as signs for the constitution of the objects, but rather only as various sensations, and we therefore apprehend their unique differences more exactly, unperturbed by other considerations. (PO2.3, 607)

I take this to be a case in which we attend to sign-sensations but in which, because **Stage 3** processes are disrupted, we do not *recognize* them as such. This happens when we attend to the components of a sensation aggregate that we usually ignore in **Stage 4**. We stop “recogniz[ing] a composite aggregate of sensations as a sign for a simple object.”

²⁷Helmholtz also thinks of the visual field—*Sehfeld* or *Blickfeld*—as a two-dimensional vertical plane prior to our perception of depth and physical shape; it is a “spherical surface of an infinitely large radius, similar to a celestial sphere whose midpoint lies at the turning point of the eye” (PO2.3, 678).

6. Conclusion

To sum up, I began by noting that Helmholtz accepts Ignorance. I argued that we should understand Ignorance according to Helmholtz’s relationalism. On this view, merely having a sensation—or even directly perceiving it in a *Perzeption*—does not suffice for perceiving a property of an object. I then argued that for Helmholtz, attention is essential for producing conscious perceptions of properties. This is supported by his account of sound and color perception.

What ultimately *are* the properties we perceive for Helmholtz? After all, there are many metaphysically sophisticated relations consistent with relationalism. The comparison with modern relationalism about color is fruitful here. Jonathan Cohen claims, for instance, that to be red for subject *S* in circumstance *C* is “the property of having some or other structural configuration type that realizes the functional role of disposing its bearers to look red to *S* in *C*” (Cohen 2009, 179).²⁸ In contrast, instead of identifying colors with functional roles, M. Chirimuuta’s “color adverbialism” identifies them with “perceptual interactions”: “Colors are properties of perceptual interactions involving a perceiver (*P*) endowed with a spectrally discriminating visual system (*V*) and a stimulus (*S*) with spectral contrast of the sort that can be exploited by *V*” (Chirimuuta 2015, 140; see also 143). For her, color is “not even to be thought of as a property of material substances” (2015, 148).

Facets of these accounts resonate with Helmholtz’s views on the properties we perceive, yet siding with either has different metaphysical outcomes. If Helmholtz is a role functionalist à la Cohen, then he ultimately maintains that objects realize certain functional roles to cause things to appear a certain way to the subject. Helmholtz would need to explain what the realizers of

²⁸Interestingly, Cohen specifically builds in the need for perceptual attention when specifying what a color property is (2009, 183 n 7).

this functional role are. I think he plausibly has an account of forces that could fit the bill.²⁹ This view would obviously need filling out, but Helmholtz has resources in that direction.

If Helmholtz is an adverbialist à la Chirimuuta, then he ultimately maintains that colors, sounds, and so on are perceptual interactions—they are not properties of objects in the way that Cohen describes. Helmholtz could claim that when we “note those relations of the external world that stand in connection with” certain sensations, we are actually becoming aware of an *interaction* between (a) sensations that result from a subject’s willed movement and (b) an object that corresponds to the presence of those sensations as a cause of them. In that case, Helmholtz’s **Stage 4** allows one to selectively attend to this interaction (which importantly has a similar structure to the sign relation). On the resulting view, we do not perceive a distinct set of relational *properties* of the objects with which we interact. Instead, we perceive a distinct object or event—an interaction—that *depends* on those objects.³⁰

In the literature on Kant, Allais (2015) and Langton (1998) argue that appearances are particular relational *properties* of things in themselves.³¹ While the proximity of Helmholtz’s relationalism to their readings of Kant warrants further examination, Helmholtz’s relationalism is representationalist in ways that Allais and Langton either deny or do not explore. In particular,

²⁹Especially the discussions at *PO2.3*, 592, and Helmholtz (1903, sec. 6). For Helmholtz’s account of forces, see Heidelberger (1993) and Schiemann (2009).

³⁰Though I cannot explore it in depth here, this discussion maps onto the debate about whether Kant held a “One Object” or “Two Object” view (see especially Stang 2014). Helmholtz as role functionalist seems to come out with a “One Object” view; as adverbialist, he seems to come out with a “Two Object” view. A lot hangs on how we understand the metaphysics of “interactions” and events, which I leave for another time.

³¹Though McDaniel (2016) notes that Allais is not always clear about whether appearances are relational *properties* of things in themselves, or objects distinct from things in themselves that are *constituted by* relational properties of things in themselves.

Helmholtz would deny Allais’ claim that we have a primitive, non-representational “acquaintance” with these relational properties.³² For Helmholtz’s part, the four stages outlined in Section 4 suggest that perception of a property is a representational accomplishment, beginning with sign-sensations and ending with a recognition of those signs *as* signs.

This paper distanced Helmholtz from more subjectivist accounts of perceptual properties while showing how his account of the properties we perceive is compatible with his multi-stage account of perception. There remain fruitful interpretive questions regarding Helmholtz’s relation to Kant. I hope to have shown how Helmholtz addresses questions live in the secondary literature on Kant and in contemporary philosophy of perception. It remains for additional work to address the remaining metaphysical and psychological questions that face Helmholtz’s relationalism about perceived properties.

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³²Allais (2015), Gomes (2017), and McLearn (2016) have defended a reading of Kant that commits him to what is (confusingly in this context) called “relationalism” or, specifically, “naïve realism.” Helmholtz surely would have no truck with these views.

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