

10

The Emotional Dimension to Sensory Perception

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10.1. Introduction

Suppose you had a long, tiring, and very stressful day at work. You aren't in a very good mood—you're irritable, tense, and anxious. You arrive home, open the front door, and immediately hear your two toddlers laughing, screaming, and banging away at some pots and pans as they happily play in the kitchen. The sounds grate on your already ragged nerves—they are loud and high-pitched and resonate deeply. Contrast this case with the following variation: you had a nice, relaxing day—you had coffee with a close friend, followed by a full-body massage—and you're feeling calm, rested, relaxed, and happy. You arrive home, open the front door, and immediately hear your two toddlers laughing, screaming, and banging away at some pots and pans as they happily play in the kitchen. The sounds make you smile—they are loud, but not high-pitched and resonating in a painful way; rather they are pleasant and warm, inviting even.

Call the first case the Grating Sound Case (GSC) and the second case the Pleasant Sound Case (PSC). The sounds produced by the children are the same,¹ yet the perceptual experience of these sounds is very different. The experiences differ insofar as the auditory experience is affected by the emotional state that you're in.² Put another way, your emotional state affects how you perceive the world. This observation is not as trivial as it seems at first blush. In most instances we are not fully aware of the emotional state that we're in, nor of the influence that such a state has on our perception of the

¹ The same amplitude and frequency are stimulating your auditory receptors.

² Or so this is the claim I'm defending here. For an alternative account on how emotions affect perception, see Aydede and Fulkerson 2014 and Fulkerson 2014.

world. In GSC, I experience *the sounds* being made by the children as being of a certain quality—loud, high-pitched, resonating. In PSC, I experience *the sounds* as being different. What differs is not the sounds, though, but a state of my being. If states of my being, such as emotions, can affect how I perceive the world, and I'm not fully aware of which emotional states I'm in or how they affect my sensory perception, then we have a problem on our hands. We rely on sensory perception to generate beliefs about the world and justify claims to knowledge on the basis of these beliefs, yet there is an influence on our sensory perception that we are unaware of or unclear about that affects these epistemic moves. Which states affect sensory perception, how they do so, and what consequences these effects have for the justification of perceptual beliefs are the three main questions at the root of the issue. These are large questions that require careful treatment that is beyond what I can accomplish here. My focus instead will be to give a rudimentary map of the landscape of discussion—the kinds of non-cognitive states that can affect sensory perception, how we might understand the influence they have, and what this influence means for our epistemological concerns.³

In recent years there's been a strong move away from vision-centric approaches to understanding sensory perception and a turn to the other exteroceptive modalities—audition, touch, olfaction, and gustation. One result from this move away from vision has been a broader view of what constitutes sensory perception. First, once we move away from vision as the paradigm sense, we find that defining a sense and distinguishing one sense from another are no easy tasks. Moreover, in broadening our view we find that considering the senses in isolation from one another isn't true to how we experience the world. The senses work together, and our sensory perception results from multisensory integration. Indeed, it appears that our sensory perception is influenced not only by what each sense brings to the table but also by other mental states, cognitive states in particular. To be sure, the non-vision-centric approach complicates the discussion, but clearly the discussion needs to be broadened. All of these considerations move us forward in understanding sense perception, and there is still far more to be explored. However, there is one clear area of investigation that's been left untouched by those concerned to look beyond vision. As mentioned, the move away from the vision-centric

³ My focus in what follows will be on conscious perception. There is certainly an equally important and similar discussion to be had about unconscious perception and what influences it succumbs to, but I set that discussion aside here.

paradigm involved turning to the other *exteroceptive* senses. Accordingly, there has been very little consideration of the non-exteroceptive elements to sensory perception—interoception and proprioception. Proprioception, broadly construed, involves our sense⁴ of balance and bodily position in space—the sense that you are now upright and that your legs are beneath your arms, for example. Interoception, broadly construed, is our sense of the inner, visceral body—feeling hungry, tired, ill, for example. I’m not here making a claim as to whether these are senses in their own right—the debate is ongoing as to what constitutes a sense modality. But regardless of whether we grant interoception and proprioception “sense” status, there remains very good reason to include them in our discussion of sensory perception. If I’m sick with the flu and a fever, my sensory perception of the world is affected by my body’s interoceptive state. As we will see, interoception is also associated with emotions—in particular with the feeling of an emotion. Given the GSC and PSC previously considered, this gives us further reason to take a serious look at the non-exteroceptive senses.

My focus here will be with interoception. Specifically, I consider how interoception influences perceptual content and what consequences this influence has for issues of perceptual justification. There are two main types of influence on sensory perception: cognitive penetration and multisensory integration. First, I’ll show there is a clear argument to be made for interoception being an influence on sensory perception. Second, I’ll consider reasons for thinking it might be best understood as a form of penetration, and then reasons for thinking it might be best understood as a sense modality in its own right, and thus a form of multisensory integration. However, regardless of which type of influence it turns out to be—penetration or multisensory integration—we remain faced with epistemological consequences. So I’ll end with a look at what those consequences are.

10.2. Types of Influence on the Content of Perception

For ease of discussion, I assume here a representational view of perception, though nothing that I will discuss hinges on this view. Accordingly, the content of perception is the content represented in a perceptual state, usually

⁴ I’m using the term “sense” here loosely and only to refer to what we are aware of on the basis of proprioception. I’m not making any claims about its status as a sense modality.

as a result of a sensory interaction with the environment. For example, if I hear a bird chirping, then the content of my sensory perception will be the represented sounds of a bird chirping. My perceptual experience is said to be veridical if indeed my auditory system picked up the chirping of a bird and thus correctly represented the environment as involving a bird chirping. I'll return to considerations of veridicality in section 10.4. For now it suffices to understand the content of perception as the way the environment is perceptually represented as being. The content of perception is typically complex and influenced in a number of ways. Broadly speaking, there are two ways in which the content of perception can be influenced: non-perceptually and perceptually. The paradigmatic form of a non-perceptual influence is cognitive penetration. In short, cognitive penetration is when a cognitive state penetrates the perceptual representation in such a way as to affect the represented content of the perception.

What we experience isn't always solely constituted by the sensory stimulus we receive. Often the contents of our perceptual experience are shaped by other mental states—most commonly, cognitive states. Take Siegel's example of a sheet of Cyrillic script. To someone who doesn't read Russian, it will appear as a sheet containing various meaningless symbols. However, to someone who can read Russian, the symbols will appear different—they will make sense and convey meaning. The perceptual experience will differ for the reader of Russian, even though the perceptual stimulus remains the same for both subjects. The difference in perceptual experience results from the subject's cognitive state—here, an understanding of what Cyrillic script means—penetrating the content of perception in a way that changes how the content is represented. Note that it's not that the reader of Russian has the same perceptual experience as the non-reader but then deploys her knowledge to interpret the perceptual content. Rather, the reader of Russian *sees* the scripts differently. Her perceptual experience is causally influenced by her cognitive state.

There are all sorts of potential cognitive penetrators: beliefs, hypotheses, knowledge, desires, and so on. Importantly, for the influence to be a case of cognitive penetration, the influencing state must be a non-perceptual state that lies outside the perceptual system.⁵ Moreover, the difference in perceptual experience between the reader and the non-reader of Russian cannot be the result of a difference in attention, sensory organ, or stimulus—proximal or distal. That's to say that if the case is to be made for the difference being due

⁵ Silins 2016, 24. If it were a perceptual state then we'd be dealing with multisensory integration instead.

to cognitive penetration, then all other variables need to be held the same, else the difference could be attributable to a difference in one of these variables. To date, the best approach to defending cognitive penetration is Siegel's (2007) phenomenal contrast method. As Stokes explains, in using this method one will "consider a pair of perceptual phenomena that contrast in some important way (two perceptual experiences with apparently contrasting phenomenal character, two contrasting perceptual reports, two distinct actions in response to the same perceptible stimulus) and then infer some hypothesis about perception on the basis of its best explaining the contrast" (2014, 6).

If we return to our case of Cyrillic script, we have a pair of perceptual experiences with apparently contrasting phenomenal character. Both subjects are related to the Cyrillic text in the same way, yet their experiences differ. "[If] two people are the same with respect to their sensory inputs, the state of their sensory organs, and the orientation of their attention, and they are still different with respect to what their experience is like, [then, by inference to the best explanation, it's] because of their beliefs, desires, or other cognitive states" (Silins 2016, 27). In other words, the only difference between the subjects is a difference in reading knowledge of Russian. This difference in cognitive states, then, is the best explanation for the difference in perceptual experience. Cognitive penetration involves a causal relation between a cognitive state (C) and a perceptual state (E) such that "if C did not occur (antecedent to E), then E would not occur. Thus, the phenomenal character of one's visual or auditory or other perceptual experience depends non-trivially upon a background belief, desire, or other cognitive state" (Stokes 2013, 650).

The important takeaways about cognitive penetration at this point are the following:

- a. One internal type of influence on perceptual content is a non-perceptual causal influence, typically from a cognitive state.
- b. The best method by which to determine if a difference in phenomenal character or perceptual content is due to this type of influence is by phenomenal contrast.
- c. The phenomenal contrast argument runs as follows: if two subjects can have perceptual experiences with different contents even though they are seeing and attending to the same object under the same external conditions, then the best explanation for the difference is that it's the result of penetration from a non-perceptual—commonly a cognitive—state (Siegel 2012).

As mentioned, there are two types of influence, non-perceptual and perceptual. The paradigmatic perceptual influence on perceptual content comes from multisensory integration. For a long time, the prevailing view of perception was that it is unisensory. To be sure, we don't experience from a single modality at a time, but the idea is that each modality generates its own perceptual content and these come together to occur co-consciously, causing our complex sensory perception. Perception, in short, is modality specific. As Nudds put it, the prevailing view was that perception simply is the "sum total of what each sense alone provides" (2001, 224). Giving an account of how perception works in each modality would thereby give us a complete account of perception. Recent work in neuroscience and interesting experiential cases have put pressure on this view. Perception appears to involve more than just different senses working alongside each other. Instead, cases like the McGurk effect (McGurk and McDonald 1976), ventriloquism effect (Bertelson and de Gelder 2004), parchment skin effect (Guest et al. 2002), rubber hands illusion (Botvinick and Cohen 1998), and so on push us toward a multisensory view of perception.⁶

Multisensory perception involves a representational integration across different sensory modalities. What each sense brings to the table may differ from what ends up being experienced.⁷ This is because the sensory information is integrated—the experience associated with one sense is shaped by input from another sense, and, thus, the sensory information is not merely co-consciously presented. The integration is not merely the collection of multisensory content, but the creation of one multimodal representation.⁸ Take, for example, the McGurk effect. You perceive a video of someone mouthing [ga], along with a soundtrack playing the sounding of [ba]. When you are presented with both of these simultaneously, you experience the person saying [da]. However, if you perceived each of these inputs separately—just the video or just the audio—you'd perceive either [ga] or [ba], respectively. "The response produced by [both] of the senses differs from that which would have occurred had the two stimuli not been presented together"

⁶ See Bayne and Spence 2015 for a discussion of these cases in relation to multisensory perception.

⁷ At this point I'm not committed to any particular account of how best to distinguish the senses. Depending on which view you take, your interpretation of which senses bring what to the table may differ. For my purposes it suffices to use broad, common sense ways of thinking about the senses as I'm only here proposing that perceptual content is influenced by multisensory integration.

⁸ As one delves more deeply into the multisensory account, one can find variant degrees to which sensory input is integrated—O'Callaghan in his 2015 paper describes 6 distinct types of multisensory perception, each specifying a different level of integration. But, it is beyond my purposes here to consider that discussion.

(Bayne and Spence 2015, 7). If perception were unisensory, then we should have a co-conscious, simultaneous experience of [ga] and [ba]. But this is not what happens. Indeed, the experience is of an entirely different sound—[da]. There is no [da] in either the auditory or visual stimuli; [da] arises out of the combined experience of the auditory and visual stimuli. The conclusion is that this is due to multisensory integration, and that the integration of multisensory stimuli brings forth a novel element in the perceptual content.⁹ “In multisensory integration, the processing of input in one (or more) sensory modality (modalities) is sensitive in content-respecting ways to information about stimuli that have been registered in another sensory modality” (Bayne and Spence 2015, 7).

The argument for multisensory integration, again, relies on drawing a phenomenal contrast. There is a phenomenal difference between what the content of perception would be in each individual sense, and what it is in the integrated experience. As O’Callaghan explains it, the lesson here is the following: when you have consciously perceptible feature instances and feature types that could not be perceptually experienced through the use of individual sense modalities working on their own or simply in parallel, then this can only be explained by perception being richly multimodally integrated (O’Callaghan 2015, 2).

The important takeaways about multisensory integration at this point are the following:

- a. One internal type of influence on perceptual content is a perceptual influence, typically from multisensory integration.
- b. The best method by which to determine if a difference in phenomenal character or perceptual content is due to this type of influence is by phenomenal contrast.
- c. A phenomenal contrast argument might run as follows¹⁰: if the perceptual content of a multisensory experience cannot be fully reduced and explained by the perceptual content of each participating sensory modality, then there is something in addition to what each sense modality brings to the table that produces the multisensory content of the

⁹ Note that there are different models of integration, and not all take it to involve blending.

¹⁰ I suggest here one phenomenal contrast argument, but there may be more. Which phenomenal contrast argument one prefers will depend on the view taken with respect to how we ought to individuate the senses, and on the view taken with respect to what mechanisms are at play in multisensory integration. What I argue for here doesn’t hinge on which phenomenal argument I make, but only on the ability to make such an argument.

experience. The addition must be the result of the integration of the sensory stimuli.

What should become clear here is that a similar argument, a phenomenal contrast argument, is deployed for each type of influence on the content of perception: there is some relevant phenomenal contrast that cannot be explained by the external signal—as this is the same in each instance—and so our best explanation for the difference is an influence by an internal process, cognitive state, or input from another set of transducers.¹¹ If there is a difference in the content of experience, then, using this argument, we can show that the difference is the result of an influence on perception. Once we've determined that an influence is in play, we need only ascertain whether it is a non-perceptual influence—and thus cognitive penetration—or a perceptual influence—and thus multisensory integration. I now consider whether interoception is an influence on perception by means of a phenomenal contrast argument and then evaluate if it is best counted as a non-perceptual or perceptual influence.

10.3. Interoception and the Content of Perception

10.3.1. Is Interoception an Influence?

One of the goals for this chapter is to consider whether interoception is an influence on the content of perception. To do this, I'll consider two cases and see whether there is a phenomenal contrast between them that reflects an influence by interoception. But first we must look closer at what interoception involves.

As mentioned, interoception is the sense¹² of the inner, visceral body. It comprises a variety of receptors—pain, chemical, stretch, temperature, and so on—and monitors the state of the body, seeking to maintain the body in a state of health. Digestion, pain, fatigue, feeling hot or cold, breathing, heart rate, and so on are all aspects of interoception—turn your gaze to the workings of the visceral body and you'll be turning your gaze toward interoception. Emotions are in large part interoceptive states; they involve the

¹¹ I thank Mohan Matthen for help in formulating the argument.

¹² I'm using the term "sense" here loosely and only to refer to what we are aware of on the basis of proprioception. I'm not making any claims about its status as a sense modality.

body.¹³ An emotion is a complex state that comprises various elements. Take, for example, an instance of anger. Suppose I suffer from road rage because I've just been cut off by another driver. I immediately feel certain changes in my body: I get excited and worked up, my face flushes, my heart races, I feel a tightness in my chest. I express my anger with some choice words and hand signals. I understand that I'm angry—I can categorize what I'm feeling as anger, rather than sadness, say. What we see here are the three main elements of an emotion: (1) bodily changes, (2) behavioral changes, and (3) cognitive understanding.¹⁴ All three elements form an emotion. Simply stating the same choice words and making the same hand signals on their own would not put me in an emotional state of anger. Similarly, thinking about anger or recalling a previous experience of anger will not, in itself, make me feel angry. The behavioral and cognitive components are part of an emotion, to be sure, but they do not form the feeling of an emotion. If I want to *feel* angry—if I want to *experience* an emotion—then I need to *feel* the bodily state changes that are associated with that emotion. As William James put it,

Without the bodily states following on the perception, the latter would be purely cognitive in form, pale, colourless, destitute of emotional warmth. . . . Can one fancy the state of rage and picture no ebullition of it in the chest, no flushing of the face, no dilation of the nostrils, no clenching of the teeth, no impulse to vigorous action, but in their stead limp muscles, calm breathing, and a placid face? . . . If we fancy some strong emotion, and then try to abstract from our consciousness of it all the feelings of its characteristic bodily symptoms, we find we have nothing left behind, no “mind-stuff” out of which the emotion can be constituted, and that a cold and neutral state of intellectual perception is all that remains. (James 1884, 190–194)

Insofar as the feeling of an emotion involves these bodily state changes, then the feeling aspect of an emotion experience involves interoception.¹⁵

¹³ For many, this is a bold and contentious claim. To be clear, it is still hotly debated whether emotions are interoceptive at all. I, following others such as Damasio (1999), Craig (2002, 2003, 2008), Prinz (2003, 2004), and so on, take emotions—in part—to be interoceptive states, as I go on to explain.

¹⁴ There is much discussion that remains about how these work together, and how these elements related to normative and motivational aspects associated with emotions. I set these discussions aside for now.

¹⁵ As mentioned, this is a contentious claim. I refer the reader to a growing area of research in the neurosciences that looks directly at interoception and the emotions—of particular importance is the work of Craig (2002, 2003, 2008) and Damasio (1999).

Let us now return to the two cases stated at the outset:

Grating Sound Case (GSC): you've had a long, tiring, and very stressful day at work. You aren't in a very good mood—you're irritable, tense, and anxious. You arrive home, open the front door, and immediately hear your two toddlers laughing, screaming, and banging away at some pots and pans as they happily play in the kitchen. The sounds grate on your already ragged nerves—they are loud, high-pitched, and resonate deeply.

Pleasant Sound Case (PSC): you had a nice relaxing day—you had coffee with a close friend followed by a full-body massage—and you're feeling calm, rested, relaxed, and happy. You arrive home, open the front door, and immediately hear your two toddlers laughing, screaming, and banging away at some pots and pans as they happily play in the kitchen. The sounds make you smile—they are loud, but not high-pitched and resonating in a painful way; rather they are pleasant and warm, inviting even.

Let us assume that in both cases all other sensory stimuli at the moment you enter the door are the same, for example, same body position in the doorway, same visual input of the foyer, same non-emotional physical state (such as hunger, pain, etc.), same olfactory stimulus, and so on. For simplicity, let us focus on two elements of the experience in both cases, namely the auditory stimulus and the emotional state. In both GSC and PSC the auditory stimulus is exactly the same. Your attention to the auditory stimulus is also the same.¹⁶ What differs is the emotional state that you're in. All else being equal, you're in a negative mood in GSC (stressed), and you're in a positive mood in PSC (happy). Now there is clearly a phenomenal contrast between the cases: in GSC you perceive the sounds as loud, high-pitched, and resonating—in short, the sounds are unpleasant. In PSC you perceive the sounds as having a normal loudness and pitch—in short, the sounds are pleasant. But the difference is a bit more complex than simply a difference in emotional state. The sounds are *perceived* differently. That's to say, the environmental input of amplitude

¹⁶ To be sure, there is a complex and important discussion to be had on the role attention plays in shaping the content of perception. Moreover, given that attention is an influence on perception, we must be sure that the influence under consideration is not one that can be reduced to a difference in attention. However, for the purposes of the analysis here I set aside the discussion of what role attention plays in shaping the content of the perceptual experience, and I assume that in both cases your attention is the same, i.e. your attention shifts to and is focused on the same sensory stimulus when you open your front door: the sound of the kids playing. That is not to say that attention doesn't play a role here, but simply that the role it plays will not account for the difference that I'm interested in.

and frequency on the auditory receptors is the same, but the auditory experience varies in that the amplitude is experienced as louder and the frequency as higher-pitched in GSC. You don't hear the sounds objectively and then interpret them consciously as one way or another depending on your mood. Rather, the moment you perceive the sounds, they are experienced as having the phenomenal characteristics of being loud, high-pitched, and resonating (GSC), or of normal loudness and pitch (PSC).¹⁷ It is an immediate difference in the content of experience, and one that produces a phenomenal difference. Among all the contributing factors to the content of experience in each of these cases there is one that varies between GSC and PSC: the emotional state that you're in. The emotional state you're in is the only differing contributing factor and clearly influences the content of your perception.

As noted, the phenomenal contrast argument holds that if two perceptual experiences differ and the difference is not explained by looking at each individual contributing sensory modality in turn, or by a difference in attention, external conditions, or sensory organs, then you have a genuine instance of influence. In GSC and PSC, my attention, my sensory organs, and the external conditions are all the same, yet my perceptual experience differs. If we consider interoception as a contributing factor, then there is a clear difference in the contributed content insofar as in GSC interoception contributes the feeling of stress, and in PSC it contributes the feeling of happiness. But the difference between the two cases isn't simply a difference in emotional feelings, but in the auditory experience. The auditory content differs, and not because of a difference in auditory stimulus.¹⁸ All else being equal, the best explanation for the difference in the auditory experience must be that interoception has influenced the perceptual content. What the nature of that influence is remains to be determined; however, it seems clear that whichever way you look at it, interoception is a causal influence on the content of perception.

Granted, this is only a theoretical analysis, and one might want more robust empirical evidence to support it. However, on the face of it, this isn't a stunning claim and there is much anecdotal evidence to support it—our common metaphors are rife with emotion/perception connections: the warmth of anger, the coldness of being lonely, the weight of sadness, the gray

¹⁷ See Fulkerson's entry in this volume—in particular, the BOMB and LUTEFISK cases discussion—for a nice argument distinguishing an affective character to experience that's the result of background knowledge or other conditions, and an affective character that's primarily sensory. (See also Fulkerson 2016.) In the cases I consider here, the affective element is a sensory one.

¹⁸ Recall that the environmental stimulus to your auditory receptors—amplitude and frequency—are the same in both cases.

hue of depression, and so on.¹⁹ Beyond anecdotal evidence, there is growing empirical evidence that also supports the claim that there is a clear influence of emotions on the content of conscious perception. Depression, for example, causes alterations in sensory perception on many levels (Fitzgerald 2013). In a 2010 study, Bubl et al. show that depression leads to visual alterations, in particular to a significant reduction in contrast gain, which correlates with the subjective reports that when one is depressed everything looks darker or gray. Depression has also been shown to alter auditory perception (Schwenzer et al. 2012) and touch perception (Adler and Gattaz 1993). Beyond depression, anxiety has been shown to affect color contrast perception, in particular processing along the red-green spectrum (Hosono et al. 2014). Feelings of love make distilled water taste sweeter (Chan et al. 2013), and other emotions and moods have been shown to affect local versus global attention, the perception of elements in the environment—hills appear steeper if you're sad—and reduce the effect of visual illusions (Zadra and Clore 2011). In short, our emotional states are contributing factors to our perceptual experience of the world—they are clear influences on the content of our perception.

Importantly, though, it is not only via the feeling of emotions that interoception has been shown to influence sensory perception. There is also empirical evidence showing that various other interoceptive states affect how we perceive the world. As Zadra and Clore review (2011), being in a state of thirst will cause you to perceive a glass of water as taller, being in a state of nicotine craving will cause you to perceive the cigarette as longer, and being in a state of fatigue will cause you to perceive the distance between you and point B as longer or a hill as steeper. In short, it is clear that interoception, via emotions or other bodily states, has a causal influence on sensory perception.

Traditionally, the study of perception has been quite distinct from the study of emotion. Psychologists have tacitly viewed perception, cognition, emotion, and other basic processes as separable phenomena to be studied in isolation. Increasingly, however, we are coming to see relevant areas of the brain and the processes they support as highly interactive. . . . Not only is it possible for emotion to influence perception, but in fact it seems to happen quite frequently—across many levels of [sensory] perception and in response to a variety of affective stimuli. (Zadra and Clore 2011, 10)

¹⁹ See the work of Lakoff and Johnson (1980) for a discussion on the relation between embodiment and perception as portrayed through linguistic metaphor.

The answer to our question—is interoception an influence?—is clearly yes. We know, and have a wealth of empirical evidence to show, that a perceptual stimulus can affect our moods or emotions. But it's now time to grant the reverse causal influence—the effect of our moods and emotions on our perceptual experience. With good reason to accept that there is genuine causal influence by interoceptive states on the content of perception, I explore the next key question: what kind of influence is it?

10.3.2. What Kind of Influence Is Interoception?

As considered in section 10.2, there are two main types of influence on perception: cognitive penetration and multisensory integration. I now look, in turn, at reasons for understanding interoception's influence as one or the other. Note that it is beyond the scope of this chapter to argue for a definitive position on this issue. Instead I set myself the task of laying out a preliminary landscape for ways to argue one view or the other.

First, let's look at reasons to consider interoception's influence a form of penetration, akin to cognitive penetration. There is already precedent in taking emotions to be cognitive penetrators. As Siegel opens her 2012 paper, "It is sometimes said that in depression, everything looks grey. If this is true, then mood can influence the character of perceptual experience: depending only on whether a viewer is depressed or not, how a scene looks to that viewer can differ even if all other conditions stay the same. This would be an example of cognitive penetration of visual experience by another mental state" (201). It is intuitive to think of emotions as cognitive states, and it is intuitive to accept that moods and emotions influence our perceptual experience. Most who discuss cognitive penetration accept emotions as one among many potential cognitive penetrators. But as I have described, emotions are much more than cognitive states—they are also felt. Moreover, we often feel an emotion well before we are able to cognitively grasp it—this is especially clear in the case of background, long-standing moods. I often don't realize that I'm stressed or anxious until well after I've begun feeling stressed or anxious. To be sure, my cognitive grasp of my mood can go on to influence my perception. However, prior to my understanding what mood I'm in, the feeling of stress or anxiety affects my perception. In this way, it might not be cognitive, but nevertheless is a penetrator—call it an interoceptive penetrator. Opening the discussion of penetration to include non-cognitive

penetrators is one way to integrate the evidence discussed regarding the effect of interoception on perceptual experience, whether it be via emotions or various bodily states. And this might be appealing to those who don't endorse the claim that interoception is a sense modality because penetration accounts for the evidence of interoception's influence on perception by counting it a non-perceptual influence. Although there are good preliminary reasons to consider interoception's influence on perception a form of penetration, there are also preliminary reasons for thinking it is better understood as part of multisensory integration.

Recall that for an influence on perceptual experience to be part of multisensory integration it needs to be a perpetual influence. That is to say that integration occurs across sense modalities, and thus only sense modalities participate in integration.²⁰ Thus, we must first see whether there are any reasons to accept that interoception is a sense modality.

It must be stated that we do not yet have a definitive account of what makes something a sense or how to clearly distinguish the senses.²¹ However, although the details are still to be worked out, there are two clear lines along which we would distinguish between the senses: the anatomical/functional level and the experiential level. At the anatomical/functional level there is good reason to suggest that interoception is its own sense. Interoception comprises various types of receptor, each specific to one kind of stimuli within the body.²² In primates, interoception has been shown to be strictly associated with specific anatomical structures.²³ At the experiential level there is also good reason to suggest that interoception is its own sense. There

²⁰ There are proposal that something needn't be a sense to be part of multisensory integration—see work by Campos et al. (2012). I set this aside for now but thank Matthew Fulkerson for pointing this out to me.

²¹ There are a few proposals, though, the common ones being the following: Gray (2005), to use typical criteria: a. by the proper objects of the senses (colors, sounds, etc.), b. by the distinctive characters of experience, c. by the physical stimulus (light waves, sound waves, etc.), d. by the distinctive organs. Fulkerson (2014), to use feature binding: a collection of sensory subsystems that function to assign a unique set of qualitative features to individual objects. Keeley (2002), "to possess a genuine sensory modality is to possess an appropriately wired-up sense organ that is historically dedicated to facilitating behavior with respect to an identifiable physical class of energy." Bayne and Spence (2015), the senses differ in terms of the nature of their input, and the bodily organs and neural pathways involved in processing that input, and others such as Matthen 2015.

²² There are chemoreceptors (chemical stimuli), nociceptors (pain stimuli), mechanoreceptors (pressure stimuli), thermoreceptors (temperature stimuli), visceroreceptors (visceral organ stimuli), to name a few.

²³ There is a direct sensory pathway (lamina I) that provides the primary interoceptive representation of the physiological condition of the entire body and that projects to the insular cortex, and the somatosensory cortices I and II. See Craig 2002, 2003, 2008.

is a clear, distinctive perceptual experience of the inner body. I can feel nauseous, I can feel an urge to run to the bathroom, butterflies in my stomach before a first date, depressed, angry, and so on. These experiences are not attributable to any of the standard five senses. They are experiences of a distinct environment, with its own distinct experiential properties and states—the visceral body.

In short, although it is still contentious whether to consider interoception a proper sense, given that we don't yet have an agreed-upon view of how to distinguish the senses, and given that there is reason to claim that interoception is a sense along anatomical, functional, and experiential lines, I will grant it "sense" status for now and consider what this means in relation to multisensory perception. As Bayne and Spence grant:

Although uncertainty about how to individuate the senses "problematizes" the discussion of multisensory perception, we believe that it is possible to make some progress here even without a full account of how the senses are to be individuated. . . . Arguably, the task of providing a taxonomy of the senses ought to proceed in tandem with the task of giving an account of the multisensory nature of perception. And if that's right, then one's model of multisensory perception ought to constrain—and, in turn, be constrained by—one's taxonomy of the senses. (2015, 3)

The model we have is that multisensory perception occurs when perceptual content cannot be clearly divided and reduced to the sensory input from each participating sense. When the experience associated with a sense is shaped by input from another sense. As stated, the feeling of emotions just is the feeling of the inner body and certain sensations and state changes therein. Importantly, by "emotion" we not only mean explicit, strong emotions such as anger, sadness, and joy, but also more subtle emotions and background moods, such as anxiety, tension, stress, and depression. If this is so, then the feeling of an emotion is an interoceptive perceptual experience insofar as it is the perpetual experience of the visceral body state changes associated with that particular emotion. Moreover, we are never in an emotion-less state of being. We may not be experiencing a strong, explicit emotion, but we are always in some state of implicit, subtle emotion or mood. Emotions affect how we experience the world—recall GSC and PSC. Instances such as these are explainable on the multisensory account of perception if we include interoceptive input into the integration account. In short, if interoception is a sense

modality, then we can make sense of the influence it has on perception by including it in our accounts of multisensory integration.

In any case, given that interoception is a causal influence on perception, it will either turn out to be a form of penetration or a part of multisensory integration. Regardless of which one it turns out to be, it can no longer be ignored in discussion of perception and discussion of what shapes our perceptual experience. In light of this, and because discussions of cognitive penetration and multisensory integration have had epistemological repercussions, I end by turning to concerns having to do with the epistemology of perception that arise as a result of adding interoception to the perceptual picture.

10.4. Interoception and the Epistemology of Perception

Both discussions of cognitive penetration and multisensory integration bring up concerns about perceptual justification. These concerns only grow if we add interoception to either of those discussions. The main concern has to do with the veridicality of our perceptual representations. If the content of perception doesn't accurately represent the environment we are perceiving, then it is no longer a reliable source of information on which to build and justify our beliefs. This is problematic, as most theories of perceptual justification take it that, absent defeaters, if you experience seeing an apple—that is, the content of your visual experience is “there is an apple”—then you're justified in believing that there's an apple.

It's important to note that not all cases of influence on the content of perception are bad. As Siegel explains, some cases of cognitive penetration can be epistemically beneficial: “If an x-ray looks different to a radiologist from the way it looks to someone lacking radiological expertise, then the radiologist gets more information about the world from her experience (such as whether there's a tumor) than the non-expert does from looking at the same x-ray” (2012, 201). However, there are clear cases where the influence on perception is bad and leads to circular justification.

We've all had something like this happen: I'm angry and irritable. I ask my friend if she can help me with something. She responds no. I experience her response as slightly aggressive and I infer that she must be annoyed or upset with me. I take my belief to be justified by my perceptual experience of her response. However, her response, objectively speaking, is not aggressive,

I simply perceived it to be because of the emotional state that I was in. “Your own mind sometimes unwittingly causes you to experience the world to be the way you antecedently believed or expected it to be. . . . If your experience is influenced in this way, it’s not so clear whether your experience is in a good position to support your belief” (Silins 2016, 24). This is precisely a case of the negative epistemic outcome that certain influences on perception can have. It can lead to a circular justification where your belief in p causes you to see the world as p , which in turn justifies your belief in p .

The problem isn’t resigned to instances of cognitive penetration; the same epistemic concerns come forth in multisensory integration as well. Recall the McGurk effect. The content of the perceptual experience is a feature that is not in the world. The visual stimulus [ga] and auditory stimulus [ba] each on its own accurately represents what is produced in the environment, but the content of perception—what one experiences the world as being—turns out to be something entirely different. The belief formed on the basis of this perception will be that the person said [da], and one will take himself to be justified in this belief on the basis of his perceptual experience.

The problem only gets complicated by adding interoceptive influence to the picture. Emotions are pervasive. We are never in a completely neutral state; rather our conscious lives are always valenced in some way—however slight or strong. This makes sense given that emotions lend an affective and motivational dimension to experience. Whatever is perceived is perceived by an embodied subject that is in a particular bodily state. If, as in the case of PSC, I’m tired and stressed, stimulating sensory input would not be welcome. So there is, at least on the face of it, good reason why I perceive the sounds made by the kids as being a certain way—loud, piercing, grating—a way that will motivate me to move away from them. But, although this makes intuitive sense, it is epistemically problematic as well. If I’m suffering from severe depression, my perception of the world will be influenced in a manner that is not to my advantage—my perception will be skewed.

These issues suggest that threats to the standard view of perception and its role in justifying our beliefs and generating knowledge are not only relegated to atypical cases like the McGurk effect. Instead, the threat is pervasive—as pervasive as emotions are. If this is correct, how are we to handle the problem? “Our knowledge about the world will, ultimately, be based on experience, with perception providing the terminus in the long chain of reasons that support one’s putative knowledge about the world. However, if perception can be infected with [multisensory integration,] background

beliefs and other cognitive states, then the supposed epistemic role of perception is threatened. . . . Experience cannot justify a belief or provide knowledge” (Stokes 2013, 651).

Perhaps we need to rethink how to rationally ground perception and perceptual justification. The current picture of perception—a relation between sensory systems and the environment whereby any further thoughts resulting from the systems’ representation of the environment are justified only if the representation accurately and objectively mirrors the environment—needs revision. Interoception brings to the table the affective and motivational elements to perception. Maybe, then, the picture of perception and perceptual justification would be more rational if taken as a relation between an embodied agent and its environment via its sensory systems, and an accurate representation is one that accounts for what the environment means to the agent. That is to say that, depending on the agent, the states it is in, and the environment, meaning will be fluid rather than objective.

To be sure, this suggestion doesn’t resolve the epistemic issues I’ve highlighted here. But it might move us in a more fruitful direction. Thus far, we’ve wanted perception to remain objective and unbiased—therein lies its rational grounding. Perception is supposed to provide knowledge, of both the everyday and scientific kinds, and if our epistemic practices are to remain rational, they must give accurate and unbiased information about the world. But maybe we need to broaden our understanding of accuracy and avoid rejection of any subjectivity. In some sense, the X-ray technician is biased, but he is biased in a way that has meaning for him and his work, and has benefits for those whose X-rays he’s analyzing. As conceded, not all influences on the content of perception are negative. Although interoceptive influences might at first seem to distort perception in a way that challenges perceptual justification, there is a reason emotions pervade our lives, and they may turn out to be beneficial influences in most instances—and even strengthen perceptual justification.

In the end, I don’t have solutions for the epistemological issues that arise from the discussion here. But by turning toward them I hope to avoid falling into the same problems that we take previous views to have fallen prey to. As Bayne and Spence put it in the context of their discussion of multisensory perception, “Although philosophers, psychologists, and neuroscientists have traditionally taken what can be characterized as a unisensory approach to the study of perception, it is increasingly clear that such an approach leaves us with a view of perception that is at best partial and at worst positively distorted”

(2015, 17). I fear we are repeating the same mistake by focusing our attention only on the exteroceptive senses in discussing what shapes the content of perception and the consequences this has for perceptual justification—leaving us “with a view of perception that is at best partial and at worst positively distorted.” I have shown that there is another important factor in the generation of perceptual content—interoception—and that it is now time we take it seriously in our discussions of perception and epistemology.

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References

- Adler, G., and W. F. Gattaz. 1993. Pain perception threshold in major depression. *Biological Psychiatry* 34: 687–689.
- Aydede, M., and M. Fulkerson. 2014. Affect: Representationalists’ headache. *Philosophical Studies* 170(2): 175–198.
- Bayne, T., and C. Spence. 2015. Multisensory perception. In M. Matthen, ed., *The Oxford Handbook of Philosophy of Perception*. Oxford: Oxford University Press. 603–620.
- Bertelson, P., and B. de Gelder. 2004. The psychology of multimodal perception. In C. Spence and J. Driver, eds., *Crossmodal Space and Crossmodal Attention*. Oxford: Oxford University Press. 141–178.
- Botvinick, M., and J. Cohen. 1998. Rubber hands “feel” touch that eyes see. *Nature* 391: 756.
- Bubl, E., E. Kern, D. Ebert, M. Bach, and L. Tebartz van Elst. 2010. Seeing gray when feeling blue? Depression can be measured in the eye of the diseased. *Biological Psychiatry* 68: 205–208.
- Campos, J. L., J. S. Butler, and H. H. Bühlhoff. 2012. Multisensory integration in the estimation of walked distances. *Experimental Brain Research* 218(4): 551–565.
- Chan, K. Q., E. M. W. Tong, D. H. Tan, and A. H. Q. Koh. 2013. What do love and jealousy taste like? *Emotion* 13(6): 1142–1149.
- Craig, A. D. 2002. How do you feel? Interoception: The sense of the physiological condition of the body. *Nature Reviews Neuroscience* 3: 655–666.
- Craig, A. D. 2003. A new view of pain as a homeostatic emotion. *Trends in Neuroscience* 26(6): 303–307.
- Craig, A. D. 2008. Interoception and emotion: A neuroanatomical perspective. In M. Lewis, J. M. Haviland-Jones, and L. Feldman Barrett, eds., *The Handbook of Emotions*. 3rd ed. New York: Guilford Press. 215–234.

- Damasio, A. 1999. *The Feeling of What Happens: Body and Emotion in the Making of Consciousness*. Orlando: Harcourt Books.
- Fitzgerald, P. J. 2013. Gray colored glasses: Is major depression partially a sensory perceptual disorder? *Journal of Affective Disorders* 151: 418–422.
- Fulkerson, M. 2014. *The First Sense: A Philosophical Study of Human Touch*. Cambridge, MA: MIT Press.
- Fulkerson, M. 2016. Affective touch from a philosophical standpoint. In H. Olausson, J. Wessberg, I. Morrison, and F. McGlone, eds., *Affective Touch and the Neurophysiology of CT Afferents*. New York: Springer. 323–340.
- Guest, S., C. Catmur, D. Lloyd, and C. Spence. 2002. Audiotactile interactions in roughness perception. *Experimental Brain Research* 146: 161–171.
- Gray, R. 2005. On the concept of a sense. *Synthese* 147(3): 461–475.
- Hosono, Y., K. Kitaoka, R. Urushihara, H. Séi, and Y. Kinouchi. 2014. Anxiety affects the amplitudes of red and green color-elicited flash visual evoked potentials in humans. *Journal of Medical Investigation* 61: 79–83.
- James, W. 1894. The physical basis of emotions. *Psychological Review* 1(5): 516–529.
- Keeley, B. L. 2002. Making sense of the senses. *Journal of Philosophy* 99: 5–28.
- Lakoff, G., and M. Johnson. 1980. *Metaphors We Live By*. Chicago: University of Chicago Press.
- Matthen, M. 2015. The individuation of the senses. In M. Matthen, ed., *The Oxford Handbook of Philosophy of Perception*. Oxford: Oxford University Press. 567–586.
- McGurk, H., and J. W. MacDonald. 1976. Hearing lips and seeing voices. *Nature* 264: 746–748.
- Nudds, M. 2001. Experiencing the production of sounds. *European Journal of Philosophy* 9: 210–229.
- O’Callaghan, C. 2015. The multisensory character of perception. *Journal of Philosophy* 112(10): 551–569.
- Prinz, J. 2003. *Emotional Perception*. New York: Oxford University Press.
- Prinz, J. 2004. Embodied Emotions. In R. C. Solomon, ed., *Thinking about Feeling: Contemporary Philosophers on Emotions*. Oxford: Oxford University Press. 44–59.
- Schwenzer, M., E. Zattarin, M. Grözinger, and K. Mathiak. 2012. Impaired pitch identification as a potential marker for depression. *BMC Psychiatry* 12: 32.
- Siegel, S. 2007. How can we discover the contents of experience? *Southern Journal of Philosophy* 45: 127–142.
- Siegel, S. 2012. Cognitive penetrability and perceptual justification. *Noûs* 46(2): 201–222.
- Silins, N. 2016. Cognitive penetration and the epistemology of perception. *Philosophy Compass* 11(1): 24–42.
- Stokes, D. 2013. Cognitive penetrability of perception. *Philosophy Compass* 8(7): 646–663.
- Stokes, D. 2014. Cognitive penetration and the perception of art. *Dialectica* 68(1): 1–34.
- Zadra, J. R., and G. L. Clore. 2011. Emotion and perception: The role of affective information. *Wiley Interdisciplinary Review of Cognitive Science* 2(6): 676–685.