The Multisensory Character of Perception[*]

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Sense perception matters because it is our most intimate form of acquaintance with concrete things and happenings independent from ourselves. Perception furnishes materials for thought, grounds empirical beliefs, and guides actions. According to an influential assumption, whether or not cognition is amodal, all perception is modality specific. This assumption is my target.

People see, hear, touch, taste, and smell. Species-typical human perception accordingly is associated with several modalities. Allow that not every perceptual modality is sensory, and allow that some sensory modalities are interoceptive. But restrict attention to the exteroceptive modalities of sensory perception. For simplicity, assume that they are vision, audition, touch, gustation, and olfaction. If the senses number more or fewer than the traditional Aristotelian five, adjust accordingly.

If people only ever perceived with one exteroceptive sensory modality at a time, then perceptual experience at each time would be unisensory, or unimodal.[1] However, at many waking moments, people perceive using more than one sense. Thus, it is typical for human subjects consciously to see and hear, or to see, hear, and taste, and so on, at the same time. Whenever you consciously perceive through several modalities at the same time, say that perceptual experience is minimally multimodal.

Experimental research shows that sensory systems interact with each other, and that stimulation to one sense can shape experience that is associated with another. This influence

sometimes leads to perceptual illusion. For instance, the sound-induced flash effect involves an illusory visual experience caused by sound: a single visible flash presented with two audible beeps causes an illusory visual experience as of two flashes in sequence. Spatial ventriloquism, temporal ventriloquism, and the McGurk effect also are well-established cross-modal perceptual illusions. Cross-modal illusions occur when stimulation to one sensory system affects perceptual experience typically associated with another modality in a way that leads to misperception. These results are surprising. The senses are much more tied up with each other than we might have expected.

Nevertheless, one sense could causally but not constitutively impact another. And sensory processes might interact while every aspect of perceptual experience remains associated with some specific modality or another. So, despite all the cross-talk, conscious perceptual experience might always remain modality specific.[2]

The lesson of this paper is that it does not. My thesis is that perceptual awareness itself is richly multimodal. I argue for this conclusion on the grounds that certain forms of multimodal perceptual experience are incompatible with the claim that each aspect of a perceptual experience is associated with some specific modality or another. The cases to which I appeal involve 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. For instance, spatial, temporal, and causal attributes perceptibly hold between things perceived using different senses. Typical humans can multisensorily perceptually experience a causal relation's holding between something visible and something audible, a unified rhythm comprising audible sounds and felt taps, the pattern of motion between audible and visible happenings, or the identity of something seen with something felt. Moreover, some novel types

of features, such as the distinctive flavor of mint, are perceptible only through the operation of several senses. Such relational feature instances and novel feature types are perceptible only multisensorily, and the perceptual experience as of such a feature is not exhausted by that which is modality specific. Instead, some conscious multimodal perceptual episodes have characteristics beyond those that are associated with each of the respective sensory modalities—in other words, there is more to perceptual experience than what is associated with each of the senses. Thus, perceptual experience is more than just minimally multimodal.

The upshot is that a perceptual experience is more than a co-conscious collection of visual, auditory, tactual, gustatory, and olfactory episodes that could have occurred independently from each other. Perceptual experience involves more than co-consciously seeing, hearing, feeling, tasting, and smelling. Instead, using multiple senses in coordination makes novel features, not revealed through any sense working on its own, available to conscious perceptual awareness. There is more to theorizing about perception and perceptual consciousness than theorizing about each individual sense modality.

First, I explicate what it is for some feature of a conscious perceptual episode to be associated with a given modality, or to be modality specific, since no clear criterion yet exists in the literature on multisensory perception. This groundwork is necessary to state clearly what the thesis that all perceptual experience is modality specific amounts to in its most plausible form. Next, I argue against that thesis. My case is grounded in philosophical and experimental evidence that some intermodal feature instances are perceptible only through the coordinated use of multiple senses. Thus, not every feature of a conscious perceptual episode is associated with some specific modality or another. However, we should not therefore abandon the idea that perceptual episodes may be associated with some specific modality or another. What must go is

the presumption that perceptual experiences apportion neatly into modality-specific components. I conclude by offering an alternative account of how to type perceptual experiences by modality that makes room for richly, more than minimally multisensory experiences. The key is that an experience's being visual does not preclude its being auditory.

1. Multimodality

The first task is to state the opposing thesis. Its slogan is: All perceptual experience is modality specific. To be modality specific in the relevant sense is to be associated with or to belong to one particular modality. So understood, the slogan that all perceptual experience is modality specific yields a first pass at the target.

(MM_1) Each perceptual experience is associated with exactly one modality.

This immediately raises two big issues. The first concerns how to capture minimally multimodal perceptual experiences. The problem is that MM_1 in fact expresses the unimodal thesis. No multimodal perceptual episode is specific to one particular modality. Even a minimally multisensory auditory and visual experience, such as seeing a frog while hearing a duck, is associated with more than one modality.

The idea behind the slogan may be that such episodes are exhausted by modality specific parts, or experiential parts associated with exactly one modality. If so, we have:

(MM_2) Each perceptual experience is exhausted by experiential parts each of which is associated with exactly one modality.

However, perceptual episodes are events, and they might not involve distinct experiential parts, each of which itself is a token visual, auditory, tactual, gustatory, or olfactory experience that could be associated with a single modality. Tye, for instance, rejects that assumption.

Instead, he holds that each perceptual experience is a single, unified token event that can be classified in several ways, as visual, auditory, and so on.[3]

Even if experiences lack experiential parts, all perceptual experience nevertheless could be modality specific. And, if parts of experiences are experiences, this paper's argument still works. So, rather than experiences or parts of experiences, let us talk instead about aspects or attributes (properties or qualities) of experiences. This yields:

(MM_3) Each perceptual experience is exhausted by features each of which is associated with exactly one modality.

Since debates about perceptual experience typically concern the conscious or subjective aspects of a perceptual episode, rather than what is not conscious or subjective, let us reformulate the slogan that all perceptual experience is modality specific in terms of the conscious attributes of a perceptual episode. Suppose that the conscious attributes of a perceptual experience exhaust what it's like for its subject to undergo it. This yields the slogan that all phenomenal character is modality specific. One caveat is that I wish to remain neutral here about the nature of such phenomenal features. This paper's argument is intended to work whether you are a qualia theorist, an intentionalist, or a naïve realist about phenomenal character.

So revised, the target thesis becomes:

(MM_4) The phenomenal character of each perceptual episode is exhausted by that which is associated with vision, that which is associated with audition, and so on for each modality.

This accommodates minimally multisensory experiences.[4]

But there is a second issue. The unity of co-conscious perceptual experiences presents a counterexample to MM_4. Any phenomenal unity that accrues thanks to mere co-consciousness is

not associated with any specific modality.[5] If phenomenal unity contributes to the character of a conscious perceptual episode, MM_4 fails.

My concern is not the general unity of consciousness, which extends beyond exteroceptive sense perception. Bodily and affective experiences can be co-conscious with visual and auditory experiences. So, just revise the thesis to accommodate it. The slogan that all perceptual experience is modality specific becomes *The Thesis of Minimal Multimodality*:

(MM_5) The phenomenal character of each perceptual episode is exhausted by that which is associated with each individual modality, along with whatever accrues thanks to mere co-consciousness.

There is another benefit to accommodating phenomenal unity in this way. It captures any phenomenal features that supervene on those that are modality-specific. So, for instance, MM_5 captures any complex audio-visual phenomenal features, which are not modality specific, that supervene on auditory and visual phenomenal features, since the former accrue thanks to simple co-consciousness.

2. Distinctiveness

The main task now is to be explicit about what it is for phenomenal character to be associated with a modality, so that we can assess The Thesis of Minimal Multimodality. Here is a first attempt. Some philosophers say that perceptual experiences of a given modality have a distinctive phenomenal character. Grice famously appeals to "the special introspectible character of the experiences of seeing and smelling" to differentiate them. He talks about "a generic resemblance signalized by the use of the word 'look,' which differentiates visual from nonvisual sense-experience."[6] Peacocke says, "the sensational properties of visual and tactual experience

are *toto caelo* distinct; in this sense no ideas are common to touch and sight."[7] And Lopes provides a clear statement of distinctiveness:

> [W]hat it is like to perceive in one sense modality is different from what it is like to perceive in others—each has a unique "phenomenal character"—and this is a fact of which any theory of perception must take account.
>
> It seems to me that tactile and visual experiences have distinctive phenomenal characters through and through. What it is like to see the shape of a cube is different from what it is like to touch the same shape . . . The senses differ because experiences in each sense have a phenomenal character unique to that sense.[8]

So, suppose:

(A_1) Phenomenal character is associated with a modality iff it is distinctive to that modality.

Distinctiveness does not require that some specific qualitative feature is shared by all and only experiences of a given modality. Instead, a perceptual experience of a given modality has a distinctive phenomenal character if and only if it could not be instantiated by any experience that is not of that same modality. So, MM_5 and A_1 imply:

(MM_6) The phenomenal character of each perceptual episode is exhausted by that which is instantiated by an experience of some particular modality but could not be

instantiated by an experience that is not of that same modality, along with whatever accrues thanks to mere co-consciousness.

Appealing to distinctiveness does not help to establish that all perceptual experience is modality specific. First of all, phenomenal character is not locally distinctive. By this I mean that not every phenomenal feature is instantiated by perceptual experiences of at most one modality. Proper sensibles present no difficulty. However, common sensibles, such as spatial or temporal properties, or number, threaten to make trouble. It is not obvious that a visual experience as of, say, sphericity—when it is considered entirely in abstraction from the experience of other visible features—must differ in respect of each phenomenal feature from a tactual experience as of sphericity. If visual and tactual experiences may share phenomenal features, local distinctiveness fails.

There are three good replies to this argument from common sensibles. (1) Phenomenal features could depend holistically on awareness of other sensible features within a modality. (2) Differing modality-specific modes of presentation could generate a phenomenal difference. (3) The modality of experience, construed as a mode of representation, itself could partly determine phenomenal character. Either way, visually experiencing sphericity and tactually experiencing sphericity need not share phenomenal features. So, even given awareness of common sensibles, phenomenal character could be locally distinctive.

Consider, however, an argument from intermodal feature binding. It is possible multimodally to perceptually experience the apparent co-instantiation of attributes perceived through different senses. For example, you might audio-visually perceptually experience an explosion's being jointly loud and bright. This may contrast in phenomenal character with just perceptually experiencing something loud and something bright, as when you hear a trumpet and

see a camera flash. Similarly, you might visuo-tactually experience a brick's being jointly red and rough. This may contrast with just perceptually experiencing something red and something rough, as when you see a stop sign while feeling sandpaper.

Intermodal feature binding can break down. Misaligned movie soundtracks are annoying, but dramatically poor syncing leads to wholly dissociated sights and sounds. Intermodal binding awareness can be illusory. No event in the movie theater has the visible and audible features you attribute to what is on screen. And co-instantiated features can mistakenly be experienced as belonging to distinct things, as when you hear sounds to come from the dummy rather than the ventriloquist. You also could just fail to experience co-instantiated features as bound. So, if you perceptually experience *F* and *G* through different senses, perceiving something's being *jointly F and G* can differ in phenomenal character from perceiving something's *being F* and something's *being G*.

What we need to explain is the phenomenologically evident *sameness* in virtue of which it perceptually appears that the same thing bears features perceptible with different senses. There are three types of options. (1) Distinct visual and auditory experiences might each instantiate a common phenomenal feature. This is intermodal type sharing, with two instantiations of a single phenomenal feature. (2) A single audio-visual experience might instantiate some phenomenal feature corresponding to the impression of a single item that has visible and audible features. This is intermodal token sharing, with one instantiation of a single phenomenal feature. (3) A perceptual experience as of identity or sameness that does not belong to any traditional sense modality might instantiate a novel phenomenal character beyond the visual and auditory experiences. This is not intermodal type or token sharing, but an additional phenomenal feature.

So, either a phenomenal feature is instantiated by experiences of more than one modality (as with type or token sharing) or by an experience of no particular modality (as with novelty). In each case, intermodal binding awareness involves an aspect of perceptual phenomenal character that is not instantiated uniquely by experiences of a single modality, and that does not accrue thanks to mere co-consciousness. Thus, not every phenomenal feature is instantiated uniquely by experiences of a given modality—it is false that for every perceptual phenomenal feature, *f*, there exists a unique perceptual modality, *m*, such that every perceptual experience that instantiates *f* belongs to *m*—or else accrues thanks to simple co-consciousness. So, phenomenal character is not locally distinctive.

This intermodal binding argument is not the traditional argument from common sensibles. It requires that you could perceptually experience visible and tangible features at once to be co-instantiated; the argument from common sensibles does not. And, unlike the traditional argument from common sensibles, you cannot escape it with help from holism, modality-specific modes of presentation, or modality-inflected phenomenal character (phenomenal character that is partly a product of the modality itself). None of these captures the character of perceptually experiencing that a single something has visible and tangible features—the phenomenally apparent numerical sameness of the individual seen and felt.

If for a phenomenal feature to be associated with a modality requires that it is (locally) distinctive to that modality, The Thesis of Minimal Multimodality fails. Local distinctiveness sets the bar too high. Phenomenal character still may be regionally distinctive, or distinctive within the bounds of each modality. That is to say that the overall phenomenal character of a perceptual experience of a given modality is distinctive—it could not be instantiated by a perceptual experience not of that same modality. This makes it possible to deal with intermodal

binding. An auditory and a visual experience could share a phenomenal feature, but neither could instantiate the overall phenomenal character of the other. (Only awareness of proper sensibles or a peculiar arrangement of features is required.) So, suppose:

(A_2) Phenomenal character is associated with a modality iff it is regionally distinctive to that modality.

Put another way, the phenomenal character associated with a given modality includes each collection of phenomenal features that is distinctive to experiences of that modality and thus could not be instantiated by experiences not of that modality.

The Thesis of Minimal Multimodality then says that such distinctive regional collections exhaust the phenomenal character of perceptual experience.

(MM_7) The phenomenal character of each perceptual episode is exhausted by that which is regionally distinctive, along with whatever accrues thanks to mere co-consciousness.

More baroquely: The phenomenal character of each perceptual episode is exhausted by collections of phenomenal features whose members jointly could not be instantiated by an experience that is not of that same modality.

Appealing to regional distinctiveness has a cost. The downgrade leaves us unable to settle whether or not phenomenal character is exhausted by whatever is modality specific. Suppose, for instance, that a case of intermodal binding awareness involves a perceptual experience as of the sameness or identity of what's seen and heard that does not belong to either of those modalities. Instead, it involves a supra-modal perceptual experience that is neither visual nor auditory. That is, novelty rather than sharing explains intermodal binding experience. If this approach is right,

intermodal binding involves phenomenal character that is not associated with any specific modality.

The trouble is that just appealing to regional distinctiveness cannot rule this out. There are on any occasion lots of overlapping collections of phenomenal character that may be distinctive to any given modality. Just include awareness as of any proper sensible, and the result may be a collection of features that could not be instantiated by an experience not of that same modality. Some such collections will include the relevant phenomenal features that explain binding experience; but some will not. Neither sort could be instantiated by an experience not of that same modality, so each may be distinctive.

Since local distinctiveness fails, even if the overall phenomenal character associated with a modality is distinctive, we cannot through introspection or phenomenological methods tell whether the relevant aspect of phenomenal character is associated with vision, with audition, or with some further, extra-visual, extra-auditory aspect of perceptual experience.

So, of a nice, rich, multisensory perceptual episode, there may be no clear verdict about which collection of features is *the* overall character associated with any given modality. Thus, the boundaries of phenomenal character associated with a modality on an occasion are not introspectible and are not settled by considering what is distinctive. Regional distinctiveness is compatible with too many candidates. Therefore, it leaves open whether perceptual experience is more than minimally multimodal.

We need other tools.

3. Unimodality

Experiences of different modalities doubly dissociate. So, for a multimodal experience involving vision and audition, you could have a corresponding unimodal visual experience without any auditory experience, or a corresponding unimodal auditory experience without any visual experience.

What do we mean here by "unimodal"? First, the notion of a perceptual experience that belongs purely or wholly to one modality is coherent. In *Individuals*, Strawson influentially posits a purely auditory experience.[9] A purely auditory perceptual experience is one that is auditory but not visual, tactual, olfactory, or gustatory. To avoid tainting by experiences of other modalities, let it be presently and historically exclusively auditory. I call such experiences *pure experiences of a modality*.

Now, for any multimodal episode that involves a certain modality, we can say that a *corresponding* pure perceptual experience of that modality is a perceptual experience purely of that modality under equivalent stimulation. This enables us to operationalize what is required on an occasion for phenomenal character to be associated with a given modality.

(A_3) The phenomenal character associated with a given modality on an occasion includes just that which a corresponding pure perceptual experience of that modality could instantiate.

For example, take a multimodal perceptual episode. The phenomenal character that is associated with vision on that occasion is that which a corresponding purely visual experience could have.

Then we can unpack the slogan that all phenomenal character is modality specific and restate the thesis.

(MM_8) The phenomenal character of each perceptual episode is exhausted by that which could be instantiated by a corresponding purely visual, purely auditory, purely

tactual, purely gustatory, or purely olfactory experience, plus whatever accrues thanks to simple co-consciousness.

This helps, but there is a potential problem. Some perceptual experiences of a given modality may require having had perceptual experiences of another modality. Cross-modally dependent experiences could have phenomenal character that a corresponding pure experience could not. Any such experience falsifies MM_8.

For example, there could be intermodal varieties of perceptual completion similar to intramodal sorts of amodal completion. If so, an auditory experience may have phenomenal features any purely auditory experience would lack. Or, there could be cross-modally parasitic experiences. Strawson thought any purely auditory experience would be entirely non-spatial. Nonetheless, he also is clear that typical human subjects do auditorily experience spatial features "on the strength of hearing alone."[10] They do thanks to the fact that they have visual and tactual experiences that are inherently spatial. This is a view in which auditory spatial experiences are cross-modally parasitic upon vision and touch. Accordingly, they have phenomenal character that no purely auditory experience could instantiate.

These are controversial cases. But they are just vivid forms of cross-modal dependence—types of experiences of one modality that could not occur if not for those of another modality. There could be other, less direct forms. For instance, suppose that auditory experiences are required to possess some concept or to have some thought, which then alters visual experience in a distinctive way (as with cross-modally mediated cognitive penetration). Or, suppose that vision makes possible actions that reshape auditory awareness. Or, suppose there is cross-modal perceptual learning. Such cross-modal dependence is compatible with the idea that phenomenal

character on each occasion is exhausted by that which is associated with some particular modality or other. We should not rule it out by fiat.

Typical subjects do have a rich background of prior perceptual experiences of various modalities. So, consider what I call *mere experiences of a modality*. These require that a subject's overall perceptual experience remains wholly or solely or entirely of the relevant modality, but only while that experience occurs. For instance, a merely visual experience is visual but not auditory, tactual, olfactory, or gustatory. To get a fix on this, consider the other sense organs as blocked or anesthetized.

Now, for any multimodal perceptual experience involving a certain modality, say that a corresponding mere perceptual experience of that modality is a perceptual experience merely of that modality under equivalent stimulation. Since corresponding mere and pure experiences of a modality may differ phenomenally, this captures any cross-modally dependent experiences. So, stipulate:

(A_4) The phenomenal character associated with a given modality on an occasion includes just that which a corresponding mere perceptual experience of that modality could instantiate.

For example, the phenomenal character associated with vision on an occasion includes only that which a corresponding merely visual experience could have.

This yields the repaired Thesis of Minimal Multimodality:

(MM_9) The phenomenal character of each perceptual episode is exhausted by that which could be instantiated by a corresponding merely visual, merely auditory, merely tactual, merely gustatory, or merely olfactory experience, plus whatever accrues thanks to simple co-consciousness.

MM_9 accommodates simple phenomenal unity; it does not appeal to distinctiveness; and it handles cross-modal dependence. It is a good way to capture the spirit of the claim that all phenomenal character is modality specific.

4. Novel features

Some feature instances are perceptible only through multimodal perceptual episodes. You just cannot get at them unimodally. So, you cannot perceptually experience such a feature instance through any corresponding mere perceptual experience of any modality. If the phenomenal character of a multimodal perceptual experience as of such a feature instance is not exhausted by that which is associated with each of the individual modalities, this is a real challenge to the Thesis of Minimal Multimodality.

Intermodal binding is one type of example. Consider multimodally perceptually experiencing something common to jointly bear or to coinstantiate visible and tactual features. For instance, consider visuo-tactually experiencing something's being both red and rough. Take a corresponding merely (wholly) visual experience as of seeing something's being red, and a corresponding merely tactual experience as of its being rough. Neither the corresponding wholly visual experience nor the corresponding wholly tactual experience could have the phenomenal character instantiated by a multimodal experience as of the identity of something seen with something felt. And just co-consciously seeing something's being red and feeling something's being rough, where it just happens that what's seen is what's felt, does not suffice for visuo-tactually experiencing something's being jointly red and rough. You might not perceptually identify it as the same thing. One way to put the point is that intermodal perceptual contents are not closed under conjunction.

So, the phenomenal character of a multimodal episode of perceiving *something's being jointly F and G*, in which you are able to recognize the apparent identity of what's perceived through different senses, need not be exhausted by that which is associated on that occasion with each of the respective modalities, even allowing for what accrues thanks to mere co-consciousness. Therefore, MM_9 is false. Not all phenomenal character on each occasion is modality specific.

One concern is that apparent binding does not involve a novel feature instance of which you are perceptually aware but instead is just a structural feature of awareness itself. However, there is a second sort of example. Some relational feature instances could only be accessible through multimodal perceptual experiences. Start by considering simple spatial or temporal relations between things experienced with different senses. For instance, imagine attending to the perceptible distance between a visible event and an audible sound to its left. Or, imagine perceiving a visible event as occurring just a moment before a sound, which differs from perceptually experiencing their being separated by several seconds.

A natural objection is that these cases involve co-conscious but modality-specific spatial and temporal location experiences rather than perceived intermodal relations. However, these kinds of perceptible relations are the subject of an expanding empirical literature. First of all, there exists mature work on intermodal synchrony perception.

> A great amount of recent research on multisensory integration deals with the experience of perceiving synchrony of events between different sensory modalities although the signals frequently arrive at different times.[11]

Perceiving synchrony intermodally is a significant achievement.

> To perceive the auditory and visual aspects of a physical event as occurring simultaneously, the brain must adjust for differences between the two modalities in both physical transmission time and sensory processing time…the brain attempts to adjust subjective simultaneity across different modalities by detecting and reducing the time lags between inputs that likely arise from the same physical events.[12]

It has been reported that apparent audio-visual simultaneity typically requires a visual stimulus to precede an auditory stimulus by an average of 50 msec, the *point of subjective simultaneity*.[13] And researchers have argued that a "moveable window" for multisensory integration and temporal ventriloquism help explain perceptually apparent synchrony.[14] So, there is good evidence that if you see hands clap at the precise moment you hear the sound, you can perceptually experience the events' *occurring at the same time* as such.

Nonetheless, a skeptic may object that the subpersonal coordination I have appealed to merely grounds synchronous experiences, rather than perceptual experiences as of synchrony.

Intermodal meter and rhythm perception provide the strongest reply. In a fascinating demonstration, Huang et al. establish that it is possible to perceive a novel audio-tactile musical meter that is distinct from any audible or tactual meter.[15] In bimodal experiments, the authors show that "auditory and tactile cues are integrated to produce coherent meter percepts."[16] They claim that such intermodal meter perception provides the first outright demonstration of "cross-modal sensory grouping" between two senses. To simplify, consider an audio-visual rhythm

pattern.[17] For instance, imagine looking a visible light pulsing, *flash–flash–[pause], flash–flash–[pause], . . .* Next, imagine hearing the simple beat, *[pause]–[pause]–tink, [pause]–[pause]–tink, . . .* Now open your eyes and combine the two. You perceive a couple of flashes followed by a *tink*, and so on. In this case, you can attend to the visible rhythm or to the audible rhythm. But you also can attend perceptually to the rhythm formed by the visible flashing and the audible sounds. Perceptually experiencing the novel intermodal rhythm differs phenomenologically from perceiving either of the unimodal rhythms by itself, and it differs from experiencing the two distinct unimodal rhythms in parallel.

Intermodal motion perception grounds a similar argument. Imagine hearing a truck to move towards you then picking it up visually while continuing to track its motion. A more compelling case is a novel motion pattern that differs from both the audible and visible motion patterns. For instance, suppose that a linear sequence of audible blips interleaved with a linear sequence of visible flashes below it appeared to comprise a pattern of zig-zag motion. Or, consider a vertical frontal plane with flashes at north and south positions and beeps at east and west that perceptually appears to involve clockwise or counterclockwise motion.

Merely apparent intermodal motion (as with an ambiguous display) would be good evidence that intermodal motion is perceptible over and above the sum of intramodal movements. Some researchers do report visuo-tactile apparent motion: "These experiments have confirmed that [apparent] multimodal motion between lights and touches can occur."[18] But this is controversial. Huddleston et al. say of the audiovisual clockwise or counterclockwise motion case: "Although subjects were able to track a trajectory using cues from both modalities, no one spontaneously perceived 'multimodal [apparent] motion' across both visual and auditory cues."[19]

There is room to reply to Huddleston et al. First, while their subjects did not report having subjective impressions of intermodal motion, their results do demonstrate that subjects were able to track apparent audiovisual intermodal motion. Second, their own results in fact suggest an explanation for subjects' diminished performance in the multimodal condition. Motion perception requires identifying some common item as moving. The Huddleston et al. multimodal study used an illuminated LED and white noise. Poorer performance in this condition may stem from the absence of good cues telling in favor of identifying the visual and auditory stimuli over time as a single item that has moved through space (compare this with using all flashes or all beeps). There is evidence for this interpretation. Subjects correctly determined the direction of intermodal motion 90 percent of the time when each stimulus was presented for at least 175 msec in their multimodal condition (vision reaches this accuracy by 100 msec).[20] This performance is better than in their audition-only condition using one type of sound in a vertical display, which never reached above 80 percent.[21] Subjects in fact reached the same accuracy in the multimodal condition as for an auditory stimulus in the horizontal plane (in which localization is much better than in the vertical plane) using qualitatively different sounds.[22] So, my reply is that intermodal apparent motion perception performance and awareness in these studies suffers from missing source identity cues rather than from a missing capacity to perceive intermodal motion.

Someone might insist: The psychophysical results show that perceptual systems detect such features. But you only perceptually experience events in space and time, not spatial and temporal relations.

One way to reply is to argue that there are plausible examples of other types of relations whose instances are perceptible intermodally. For instance, consider intermodal causal relations.

According to a moderately liberal account, humans do perceptually experience causal relations.[23] And intermodal cases provide good examples. For example, you might perceptually experience a visible flash to produce or to generate its audible bang.[24] There is particularly strong empirical evidence that intermodal causality is detectable.[25] And the philosophical arguments, including contrast arguments, are just as good in the intermodal cases as in the intramodal cases. In fact, since it is even more plausible that the appearance of causality can break down intermodally—the causal impression is less mandatory—phenomenal contrast arguments are more compelling intermodally than in the case of vision alone.

Where does that leave us? Each of the cases I have discussed involves a relational feature that holds between things perceptually experienced with different senses. The empirical results can establish that it is possible to perceptually detect and respond differentially to such features. The best reasons to deny that you perceptually experience any such features intermodally also support a skepticism that denies you perceptually experience any such relational features even through a single modality. But, saying that binding, spatial, temporal, and causal relations are never perceptually apparent, even unimodally, leaves us with an implausibly sparse picture of perceptual experience and its character. Thus, according to a moderately liberal general account of perceptual experience, there is no compelling reason to deny that some such relation instance is perceptible intermodally. There is nothing especially problematic about intermodal cases.

If so, we have a counterexample to MM_9, the thesis that all phenomenal character on each occasion is modality specific. That is because, for a multimodal perceptual experience that involves distinct modalities, *m* and *n*, as of a perceptible intermodal instance of a relation, *R*, neither a corresponding merely *m* experience nor a corresponding merely *n* experience could

have the phenomenal character of perceptually experiencing as of *R*, and mere co-consciousness does not suffice.

5. Flavor

Each perceptible feature instance discussed in section 4 belongs to a type some of whose instances are perceptible using a single modality. You can see binding, spatial, temporal, and causal relations. Correspondingly, someone might maintain that multimodal perceptual experiences can instantiate only phenomenal features of types that unimodal perceptual experiences can instantiate, along with those that accrue thanks to simple co-consciousness. Someone might add that qualitative characteristics (such as qualia), which contribute to but do not exhaust phenomenal character, all are modality specific. If so, then each is a respect in which multimodal perceptual experience is not more than a sum of modality-specific parts.

One reply is to argue that there are novel features of a type whose instances are only accessible multimodally—features whose perception requires multiple sensory modalities and that you could not be aware of through any one sense working on its own. Flavor may be an example of such a novel type of feature. The crisp smoky heat of a green hatch chili, the vegetal character of an aging Burgundy, and the "taste" of Vegemite are paradigms of flavor. Flavor perception involves taste, smell, and somatosensation working in concert. Flavors, unlike basic tastes, odors, and textures, are not fully perceptible thanks to any of these senses on its own.[26] Moreover, while it incorporates such features, apparent flavor may be more than just an agglomeration of gustatory, olfactory, and tactual qualities that are attributed to something in the mouth. If flavors are not just undifferentiated mixtures or unstructured collections of features, then they may involve novel or emergent features of a type that cannot be perceived unimodally.

For instance, apparent flavor could involve a structure (qualitative or temporal) among its sense-specific components; or an organic unity involving them; or an additional qualitative component beyond its modality-specific features. If so, experiencing flavors, such as the distinctive mintiness of mint, is strongly multisensory. Flavor experiences may have entirely novel phenomenal features of a type—even a qualitative type—that no unimodal experience could instantiate and that do not accrue thanks to simple co-consciousness.

If flavor experience is *sui generis*, then that is fuel for my fire—it supports this paper's central claim. If not, my main conclusion nevertheless stands. If flavor experience does not involve entirely novel types of perceptible features, that leaves alive the claim that no perceptual experience has phenomenal features (apart from those that accrue thanks to mere co-consciousness) that are not instantiated by some merely visual, auditory, tactual, olfactory, or gustatory experience. But this is a far weaker claim than we have been considering. First, it does not imply that all phenomenal features originate within a single modality or that being instantiated multimodally depends upon being instantiated unimodally. It just means that all phenomenal features (except those that accrue thanks to mere co-consciousness) possibly are instantiated by some unisensory experience. Alternatively, they belong to types with possible unisensory instances. It is difficult to interpret this as implying that all phenomenal features are modality specific, or associated with a given sensory modality. Moreover, it does not imply that the phenomenal character of each perceptual episode is exhausted by that which could be instantiated by a corresponding merely visual, merely auditory, merely tactual, merely olfactory, or merely gustatory experience. Therefore, it just cannot establish that all perceptual awareness is modality specific.

6. Modalities

My conclusion is that not all perceptual experience is specific to a modality. Not even all phenomenal character is modality specific, even if we allow for co-conscious unity. The argument is that multisensory perceptual phenomena show that there is no plausible sense of what it is for phenomenal character to be associated with a modality according to which all phenomenal character on each occasion is associated with some specific modality. The cases demonstrate that the phenomenal character of a multisensory perceptual episode on some occasions extends beyond that which is associated with each of the respective modalities plus that which accrues thanks to mere co-consciousness. Perceptual experience therefore is more than minimally multimodal. The significant upshot is that some multimodal perceptual experiences are not simply co-conscious visual, auditory, tactual, olfactory, and gustatory episodes that could have occurred independently from each other. Perceptual awareness involves more than just co-consciously seeing, hearing, feeling, tasting, and smelling at the same time. We extend our perceptual capacities through the coordinated use of multiple senses. The important lesson is that no complete account of perceptual awareness or its phenomenal character can be formulated in modality-specific terms. In this respect, the character of perception is constitutively multisensory.

How radical is this revision? For instance, does enriching awareness with further features suffice to address multisensory phenomena? Given the threat of a regress of binding arguments, merely supplementing sense-specific experiential components with further materials may not suffice to capture our richly multisensory perceptual consciousness. Thus, it is tempting now to say that perceptual consciousness cannot be carved up—with or without remainder—into portions belonging to each sense. There is just the one monolithic perceptual field.

Nevertheless, we need not fully abandon common sense about sensory awareness. Conscious perceptual episodes, even if monolithic, still can be classified according to sense modality. We can do so in any number of ways—for instance, by objects, pathway, or character.[27] By phenomenology, awareness of distinctive proper sensibles, such as color and timbre, introspectibly mark visual and auditory episodes, respectively. Moreover, we can say, as section 3 does, which features of a perceptual episode are associated with a given modality on an occasion, even if they are not distinctive to it. However, this approach must break with the entrenched thought that if an experience or feature is visual, it cannot also be auditory or gustatory or tactual. Understood as types of conscious perceptual episodes, rather than as constitutive experiential parts, the modalities of perceptual experience are not mutually exclusive. This allows that the same conscious episode or experience may be both visual and auditory, or both gustatory and tactual, and so on. So, we should scrap the idealization in which perceptual experiences can be surgically apportioned into their sense-specific parts and theorized by modality. We may, however, retain the common sense wisdom that identifies and classifies even richly multimodal experiences by their senses.

Notes

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[1]For instance, Charles Spence and Tim Bayne, "Is Consciousness Multisensory?" in D. Stokes, M. Matthen, and S. Biggs, eds., *Perception and Its Modalities* (Oxford: Oxford University Press, 2015), pp. 95–132, argue that conscious sensory awareness at each time is unisensory.

[2]See also, for example, Frédérique de Vignemont, "A Multimodal Conception of Bodily Awareness," *Mind*, CXXIII, 492 (2014): 989–1020.

[3]Michael Tye, *Consciousness and Persons: Unity and Identity* (Cambridge, MA: MIT Press, 2003); "The Problem of Common Sensibles," *Erkenntnis*, 66 (2007): 287–303.

[4]For such a view, see, for instance, Ophelia Deroy, et al., "Multisensory Constraints on Awareness," *Philosophical Transactions of the Royal Society B: Biological Sciences*, CCCLXIX, 1641 (2014): 20130207, DOI: 10.1098/rstb.2013.0207, especially section 4.

[5]See, for example, Tye, *Consciousness and Persons*; Bayne, *The Unity of Consciousness* (Oxford: Oxford University Press, 2010).

[6]H. P. Grice, "Some Remarks about the Senses," in R. J. Butler, ed., *Analytical Philosophy, Series 1* (Oxford: Blackwell, 1962), pp. 133–153, at p. 37 and 53.

[7]Christopher Peacocke, *Sense and Content: Experience, Thought, and their Relations* (Oxford: Oxford University Press, 1983), at p. 27–28.

[8]Dominic M. McIver Lopes, "What Is It Like to See with Your Ears? The Representational Theory of Mind," *Philosophy and Phenomenological Research*, LX, 2 (March 2000): 439–453, at p. 439 and 445.

[9]P. F. Strawson, *Individuals* (New York: Routledge, 1959).

[10]*Ibid*., p. 65.

[11]Katharina Müller, et al., "Inter- Versus Intramodal Integration in Sensorimotor Synchronization: A Combined Behavioral and Magnetoencephalographic Study," *Experimental Brain Research*, CLXXXV, 2 (2008): 309–318, at p. 309.

[12]Waka Fujisaki, et al., "Recalibration of Audiovisual Simultaneity," *Nature Neuroscience*, VII, 7 (2004): 773–778, at p. 773.

[13]J. V. Stone, et al., "When is Now? Perception of Simultaneity," *Proceedings of the Royal Society of London. Series B: Biological Sciences*, CCLXVIII, 1462 (2001): 31–38. See also, e.g.,

Sharon Morein–Zamir, et al., "Auditory Capture of Vision: Examining Temporal Ventriloquism," *Cognitive Brain Research*, XVII, 1 (2003): 154–163; Massimiliano Zampini, et al., "Audio-Visual Simultaneity Judgments," *Perception and Psychophysics*, LXVII, 3 (2005): 531–544; and Roberto Arrighi, et al., "Perceptual Synchrony of Audiovisual Streams for Natural and Artificial Motion Sequences," *Journal of Vision*, VI, 3 (2006): 260–268.

[14]Charles Spence and Sarah Squire, "Multisensory Integration: Maintaining the Perception of Synchrony," *Current Biology*, XIII, 13 (2003): R519–R521.

[15]Juan Huang, et al., "Feeling Music: Integration of Auditory and Tactile Inputs in Musical Meter," *PLoS ONE*, VII, 10 (2012): e48496, doi:10.1371/journal.pone.0048496.

[16]*Ibid*., p. e48496.

[17]See, e.g., Sharon E. Guttman, et al., "Hearing What the Eyes See: Auditory Encoding of Visual Temporal Sequences," *Psychological Science*, XVI, 3 (2005), at p. 234: "Interestingly, several observers reported experiencing a complex rhythmic gestalt that combined the auditory and visual inputs. However, information from the two senses remained clearly distinguishable."

[18]Vanessa Harrar, et al., "Visuotactile Apparent Motion," *Perception and Psychophysics*, LXX, 5 (2008): 807–817, at p. 816.

[19]Wendy E. Huddleston, et al., "Auditory and Visual Attention-Based Apparent Motion Share Functional Parallels," *Perception and Psychophysics*, LXX, 7 (2008): 1207–1216, at p. 1207.

[20]*Ibid*., p. 1214, Figure 6.

[21]*Ibid*., Figure 6.

[22]*Ibid*., p. 1211, Figure 4.

[23]On the visual perceptual experience of causation, see especially Helen Beebee, "Seeing Causing," *Proceedings of the Aristotelian Society*, CIII, 1 (2003): 257–280; Susanna Siegel, "The Visual Experience of Causation," *The Philosophical Quarterly*, LIX, 236 (2009): 519–540; and Christopher Peacocke, "Representing Causality," in T. McCormack, C. Hoerl, and S. Butterfill, eds., *Tool Use and Causal Cognition* (Oxford: Oxford University Press, 2011), pp. 148–168.

[24]On perceptually experiencing audio-visual causation, see Matthew Nudds, "Experiencing the Production of Sounds," *European Journal of Philosophy*, IX (2001): 210–229.

[25]See, for instance, R. Sekuler, et al., "Sound Alters Visual Motion Perception," *Nature*, CCCLXXXV (1997): 308; Rainer Guski and Nikolaus F. Troje, "Audiovisual Phenomenal Causality," *Perception and Psychophysics*, LXV, 5 (2003): 789–800; Hoon Choi and Brian J. Scholl, "Measuring Causal Perception: Connections to Representational Momentum?" *Acta*

Psychologica, CXXIII, 1 (2006): 91–111; and Ladan Shams and Ulrik R. Beierholm, "Causal Inference in Perception," *Trends in Cognitive Sciences*, XIV (2010): 425–432.

[26]Barry C. Smith, "The Chemical Senses," in M. Matthen, ed., *The Oxford Handbook of Philosophy of Perception* (Oxford: Oxford University Press, 2015), pp. 314–352, provides an illuminating survey and critical discussion.

[27]See Fiona Macpherson, "Taxonomising the Senses," *Philosophical Studies*, CLIII, 1 (2011): 123–142.