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Perceptual Modal Justification

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Abstract
Can experience justify modal beliefs? A long tradition dating back to Descartes, Hume, and Kant, which denies that experience plays a justificatory role in modal justification, says 'no'. Here, I answer 'yes'. Specifically, I argue that perception justifies some of our modal beliefs, namely the perceptual ones. Using a naturalized reliabilist framework for perceptual justification, I argue that one of the assumptions perception makes about the world, which enables it to organize itself, is modal—namely, 'objects presented within peripersonal space are reachable and graspable'—such that relying on this modal assumption, perception outputs modal beliefs reliably, and so we can render perceptual modal justification as a function of the reliability of perception as a modal-belief-forming process.

Keywords
basic beliefs; modal justification; modularity; naturalized modal epistemology; perceptual justification; perceptual learning

1 Introduction, purpose and structure

In the *First Meditation*, with the wax argument, Descartes says that only reason can deliver modal knowledge, discountenancing experiential modal knowledge. In the *Treatise*, Hume famously rejects objective necessity. Kant picks this line of thought up in *The Critique of Pure Reason* [B, Introduction, §II], saying that "experience teaches us that a thing is so and so, not that it cannot be otherwise". Recently, Colin McGinn furthers the thought vividly:

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"[y]ou see only what actually obtains [...] Your eyes do not respond to *woulds* and *might have beens*" [1996: 540]. Simply, there is a long tradition of skepticism about the role of experience in modal epistemology (see Fischer and Leon [2017]). Thus, if you believe that 'your car, though red, could have been green', this tradition says that your experience, which is of a red car, does not play a justificatory role in the justification of this modal belief.

Though empiricist accounts that attribute epistemic/justificational roles to experience in modal epistemology are now available (*e.g.*, Strohminger [2015]), naturalistic ones are not. And if we are to disband this Cartesian/Humean/Kantian modal skepticism, naturalism is our best bet. Experience may work differently than empiricist accounts say, but such a mistake is what a naturalistic account, backed by the natural sciences, would block. After all, as Daniel Nolan [2017] argues, the success of the natural sciences and the expectation to ensure the unity of research investigations suggest that incorporating scientific findings into our modal epistemological analyses may help to address important and difficult issues.

In this paper, focusing on perception, I add my voice to this campaign against the Cartesian/Humean/Kantian modal skepticism by defending a naturalistic, reliabilist, and foundationalist account of modal justification. Specifically, I will rely on cognitive scientific findings to argue that perception justifies *some* modal beliefs. My central claim is that one of the principles that enable perception to organize itself is modal, and this principle allows perception to produce perceptual modal beliefs reliably. Perceptual modal justification is a function of the reliability of perception as a modal-belief-forming process.

This paper will proceed as follows. In Section 2, I briefly clarify my project and highlight its relevance. In Section 3, I discuss the cognitive scientific reliabilist framework for perceptual justification I will adopt. In Section 4, I characterize the relevant organizing perceptual principle that is central to my analysis. In Sections 5 and 6, I use the principle to lay out my account of perceptual modal justification. I give some concluding remarks in Section 7.

2 Setting up the stage

I will assume foundationalism about perceptual justification in that I will take perceptual justification to be immediate or basic, *i.e.*, it is not a function of the justification of any other beliefs (Pryor [2005]). I will assume reliabilism about perceptual justification in that I will take it as a function of the reliability of the processes that produce perceptual beliefs (Goldman [1979]). I will understand perceptual justification in *prima facie* terms in that it can be defeated. In this way, I will defend a defeasible, reliabilist, foundationalist account

of perceptual modal justification.

I will take it for granted that perception has modal content understood in terms of agents perceiving some modal facts (*e.g.*, Gibson [1979], Nanay [2012], Williamson [2017], Vetter [2018]).[1] Under this sense, nonperceptual modal facts, especially imaginative ones, *e.g.*, 'you can exist outside your body', are out of scope. This limitation corresponds to the standard division of modality into "everyday" and "remote" (van Inwagen [1998]). Where everyday modal facts are those used for everyday reasoning and acting (*e.g.*, the possibility of your red car being green, or the impossibility of you lifting a 500 lb stone, or the necessity of food for life), and remote ones are those used for sophisticated philosophical and scientific (often, theoretical physics) reasoning (*e.g.*, the possibility of phenomenal zombies, or the impossibility of traveling faster than the speed of light, or the necessity of God). My concern here is everyday modal facts.

Though my concern is everyday modal facts, I will only focus on everyday "possibility" facts. It is less controversial to say that perception delivers everyday possibility facts than to say it delivers everyday necessity facts, for we may also need to perceive the categorical basis of the necessity facts to ensure that the involved modal force is indeed necessity and not some weaker form of modality. For instance, to see foods as necessary for life, we may also need to see their nutritional basis (*e.g.*, the lactose composition of milk), which is beyond our perceptual capacities (Vetter [2020]). Consequently, Sonia Roca-Royes calls everyday possibility facts "uncontroversially accessible basic *de re* modal facts" ([2017: 225]). It is wise, therefore, to clarify how perception plays a justificatory role for uncontroversially accessible (*i.e.*, everyday possibility) modal facts before moving to controversially accessible (*i.e.*, everyday necessity) ones. I will, nonetheless, suggest how my account can accommodate controversially accessible modal facts in Section 7.

This then connects us to the first relevance of this paper. It weighs in on the debate about whether possibility facts are epistemically prior to necessity facts (see, *e.g.*, Roca-Royes [2017] and Wallner [2020] for a discussion). If my perceptual modal justification account, which concerns only everyday possibility beliefs, is successful, then there is hope that the justification of everyday necessity beliefs can also be naturalized. If so, then it

[1] Though the Gibsonian notion of affordances is often used to render the modal content of perception (*e.g.*, Siegel [2014], Williamson [2017], Heras-Escribano [2019]), I intend (i) that my account applies to other notions besides the Gibsonian affordances, *e.g.*, Nanay's action-properties, and (ii) to steer clear of any metaphysical commitments that may differ between these terminologies, so I will stick with the neutral 'modal properties'.

would indeed be the case that possibility facts are epistemically (or, at least, justificationally) prior to necessity facts.

The second relevance is that Nolan's [2017] call is harkened to: naturalism is presented as an alternative to empiricism and rationalism in modal epistemology. Both modal empiricism and modal rationalism pursue modal epistemology from a "metaphysics-first" perspective, *i.e.*, they take modal epistemology to depend on modal metaphysics such that by fixing the latter, the former greatly benefits. In contrast, my modal naturalism will present an "epistemology-first" or "metaphysics-neutral" perspective. As we will see, the possible-world semantics, a mainstay in metaphysics-first modal epistemologies, is noticeably absent here.

Third, perceptual modal beliefs are shown to be part of the first basic beliefs in both ontogenetic and phylogenetic terms humans and nonhuman animals form. Since foundationalist constraints mandate that we countenance earlier basic beliefs before later ones, including perceptual modal beliefs in the list of basic beliefs, should, therefore, be uncontroversial and expedient.

Fourth and most importantly, the long-standing Cartesian/Humean/Kantian skepticism about the role of perception in modal justification is disbanded. More importantly, the disbanding comes about not by reasoning through what perception can or cannot do, as Descartes, Hume, and Kant argue (Section 1), but by consulting the natural sciences that study perception. Frankly, since neither Descartes, Hume, nor Kant based their skepticism on any experimental scientific findings, it is surprising that their views are held in high regard in the field. As a result, I am confident that my naturalism, which will be based on scientific findings, will silence even their staunchest ally.

I will cross-refer to some of these relevances as we progress. For now, let us begin by rehearsing the cognitive scientific reliabilist framework for perceptual justification this paper will adopt.

3 Perception, reliabilism and modal epistemology

Perceptual reliabilism[2] is the view that perceptual justification is a function of the reliability of the perceptual process that produces perceptual beliefs (*e.g.*, Goldman [1986], Lyons [2001,

[2] Perceptual reliabilism is a type of process reliabilism, the view that epistemic justification is a function of the reliability of the process that produces perceptual beliefs. Another type of process reliabilism is virtue reliabilism, the view that epistemic justification is a function of agents' "competence", where competence turns on the reliability of the involved belief-forming process (*e.g.*, Sosa [1993]).

2009, 2014, 2016]). Though not without its detractors (*e.g.*, BonJour [1985], Vogel [2000]), I take it that reliabilism is our best bet if we are to address the Cartesian/Humean/Kantian view that perceptual structure is incompatible with modal justification—claims about perceptual structure are reliabilist claims. Since, as we have just seen (Section 2), we must listen to perceptual science to avoid the pit that Descartes, Hume, and Kant fall into, our reliabilism must be naturalistic. Jack Lyons' [2001, 2009, 2014, 2016] version of reliabilism affords such a naturalism.

According to Lyons [2009], since forming justified beliefs is a function of the mind, listening to the sciences that study the mind will help to do justice to reliabilism. Listening to such sciences means that cognitive neuroscience (by clarifying what the belief-forming processes and their outputs are), as well as cognitive psychology, developmental psychology, and developmental neurobiology (by clarifying the etiology and operations of the belief-forming processes), will have much to say about whether the belief-forming processes play any justificatory role in epistemic justification. Thus, he naturalizes reliabilism in terms of "cognitive systems", which differ from Jerry Fodor's [1983] cognitive modules.

According to Fodor, modules are, among other things, innately specified, domain-specific, informationally encapsulated (they lack access to the beliefs and goals of the larger organism), and introspectively opaque (their "interlevel" representations are not consciously accessible) information-processing mechanisms. Lyons thinks this Fodorian notion is restrictive. For instance, modules are supposed to be innate, whereas systems can arise from the interplay of innateness and (perceptual) learning—the face recognition system, though innate, can only come to identify someone as my mother from experience. In the same vein, modules are supposed to be introspectively opaque, but we know from David Marr [1982] that we have conscious access to some interlevel perceptual representations, so perceptual systems, at least, are introspectively nonopaque.

Consequently, Lyons defines a perceptual system as:

> [A] cognitive system that starts with the stimulation of sense organs by physical energy as input and processes information about the current environment, where none of the inputs to any of the subsystems are under the direct voluntary control of the larger organism. [2009: 94]

This then enables him to define perceptual belief as "the doxastic outputs of perceptual systems" ([2009: 88]). He reasons that since there is a sense in which systems make *judgments* about the world, and since 'judgment' is a doxastic concept, perceptual judgments are

perceptual beliefs. For instance, the representation 'my mother is in front of me' is a doxastic output of the system that identifies or judges someone as my mother. The representation is a perceptual belief.

One advantage of defining perceptual beliefs as the doxastic outputs of perceptual systems is that the definition is general enough to apply to nonhuman animals. The temperature-sensing systems of rattlesnakes, the echolocation systems of bats and dolphins, and the electromagnetic wave-detecting systems of some birds are all perceptual systems, and so they output perceptual beliefs too. They all make judgments about objects.

Consequently, Lyons distinguishes between "subpersonal" and "person-level" beliefs. Subpersonal beliefs are those that the agent never picks up. In Richard Heck's [2000] "state" sense, subpersonal beliefs are nonconceptual: agents lack the concepts required to specify the beliefs' contents. Thus, systems, small children, and nonhuman animals have subpersonal beliefs. Whereas person-level beliefs are beliefs of the agents. Adult humans belong here. Though Lyons is not so clear on this, I should state that the nonconceptual content of subpersonal beliefs is also agent-level content—the fact that it is characterized in terms of *agents lacking* the concepts required to specify it is a sufficient indication. I am, therefore, not equating the distinction between conceptual and nonconceptual contents with the distinction between subpersonal and person-level beliefs.

All these allow Lyons to characterize perceptual justification in cognitive scientific terms. To do this, he introduces the notion of "inferential opacity" to mean that (i) perceptual systems are "input" systems, (ii) their accessible interlevel representations are nondoxastic, and (iii) their processes are psychologically, not epistemically inferential. To say that perceptual systems are input systems is to say that they take their inputs from the world, and so, any point at which they take a person-level belief as input is where they cease to be perceptual. If so, then whatever interlevel representations are consciously accessible to the agent must be nondoxastic; otherwise, being an input system is lost. If so, then the inferences perceptual systems engage in are psychological, not epistemic, where epistemic inferences rely on doxastic premises. Though perceptual systems run computations before generating their outputs (psychological inference), that is far from them using doxastic premises in running the computations (epistemic inference).

In this way, inferential opacity ensures that the doxastic outputs of perceptual systems, *i.e.*, perceptual beliefs, are basic: "[t]he features of perceptual systems in virtue of which the beliefs they produce are basic include those properties that are characteristic of modular cognitive systems" (Lyons [2009: 19]). The perceptual belief 'my mother is standing in front of me' is basic because the modular features of the face recognition system dictate as such.

The perceptuality of a belief, which arises from the modular features of the system that outputs it, doubles as the belief's basicality.

Lyons extends this cognitive scientific framework for reliabilism beyond perceptual beliefs to basic beliefs in general. Perceptuality, he says, is sufficient but not necessary for basicality. Thus, dropping the input system constraint, he argues that basic beliefs are all and only those output by "primal" systems, where a primal system retains at least one of the remaining features of inferential opacity. The introspection system, for example, is primal because it can take person-level beliefs as inputs, so it is not an input system, but its output introspective beliefs are not based on the input person-level beliefs because its interlevel representations are nondoxastic, which then makes its inferences psychological. The output introspective belief 'I believe that I am in pain' is not based on the input nociceptive belief 'I am in pain'. For one, the latter is a first-order belief about me, whereas the former is a second-order belief about my belief. For another, I do not token the basing relation between them even though I token the input nociceptive belief. Simply, the introspection system is inferentially opaque, and this explains why its doxastic outputs are cognitively spontaneous. *Ergo*, introspective beliefs are basic.

I will say more about primal systems in Section 6.2. For now, what is important is that this naturalized reliabilist framework for perceptual justification helps to easily account for the justificatory role of perception in modal justification. I only need to show that perceptual systems output modal beliefs, and perceptual modal justification would follow. The natural starting place, then, is to ask: how or in virtue of what do perceptual systems output modal beliefs?

4 Perceptual modal assumption

Since perception is psychologically inferential, it relies on some information/data to run its computations. In amodal completion, for example, the visual system uses some such data to perceive partially occluded figures as covered by the occluder, not as fragments of the foregrounded figures (Brogaard and Chomanski [2015]). Similarly, the visual system uses facts about trigonometry to calculate depth from eye convergence (Lyons [2009]). More clearly, to process illumination, the visual system relies on the data 'objects are generally lit from above, not below' (Lyons [2016]). Simply, this sort of data enables perception to *organize* itself, and so they are called 'organizing or perceptual principles' (Fodor [1983], Pylyshyn [1999]).

According to Fodor and Pylyshyn, perceptual principles are clamped in perceptual

databases, and this is because they were evolutionarily and developmentally acquired. As a result, they are not easily revisable in light of new evidence. Even if you come to believe otherwise—perhaps that partially occluded objects are, in fact, hidden behind the occluder or that objects are generally lit from below—your visual system will still process information using the appropriate perceptual principles. If so, then the principles operate independently of person-level beliefs. They are *assumptions* perceptual systems make about the world that agents typically do not make unless trained in perceptual psychology. Lyons puts it vividly:

> The system that calculates depth from eye convergence may base its outputs on facts about trigonometry and the distance between the eyes, facts which it 'knows' but I do not. [2009: 139]

One of these perceptual assumptions, I contend, is modal.

In addition to helping us understand the world, perception helps us act in the world, and the developmental studies of how perception guides action (*e.g.*, von Hofsten [1979], Tröster and Brambring [1993]) suggest that a perceptual principle is responsible for this action-guiding role. Talking exclusively in terms of 'reaching' and 'grasping'—perhaps because they are the first actions human infants perform—these studies say that the visual guidance of reaching and grasping spans about 21 weeks after birth, from around week 15 to 36: "[t]he rather crude and awkward reaching at 15 weeks gives way to smooth and efficient reaching at the end of the period" [Von Hofsten 1979: 174]. Thus, at about week 36, when infants gain motor control, the visual guidance of reaching and grasping is dropped, and the involved pattern of movement is hardwired into visual operations: "[b]y the end of this learning process, the sequence of movement has become almost automatic so that continuous visual feedback is no longer necessary" (Tröster and Brambring [1993: 84]).

This sequence of movement is encoded in terms of "peripersonal space", which is:

> [T]he space immediately surrounding the body [that consists] neither in the perception of one's own body nor in the perception of far space, but stands in between. [de Vignemont 2021: S4027–8]

As a result, when vision reaches functional maturation at about 18 months, *i.e.*, when its functional properties become adult-like (Zimmermann *et al.* [2019])—although anatomical maturity still continues for about seven years (Kozma *et al.* [2001])—the information 'objects presented within peripersonal space are reachable and graspable', has become a datum the visual system uses to run computations. It has become one of the principles the

visual system uses to organize itself. It has become an assumption the visual system makes about the world. The visual system "knows" this fact about the world, even though agents typically do not, unless trained in perceptual psychology. Small children's and animals' visual systems make the same assumption about the world even though they are not trained in anything. Your dog certainly does not know this fact, yet it does not jump to catch the frisbee when it is still 10 meters away.

I should state clearly that my claim is psychological. I am saying that perceptual architecture is partly modally structured, *i.e.*, part of the assumptions stored in its proprietary database is modal. I take this psychological claim to explain the widespread claim that we perceive some modality (Section 2): saying that perceptual architecture is partly modally structured specifies how we can perceive some modal facts even though the stimulus array, as McGinn [1996: 546] rightly says, is exhausted by the actual. Though reachability and graspability are not part of the stimulus array, we perceive objects as reachable and graspable because perceptual architecture is partly modally structured.

Although I have been talking in terms of vision, other sense modalities also make similar modal assumptions about the world. The brain area dedicated to peripersonal space representation is the ventral premotor cortex (vPMC) or area F4, part of the frontoparietal network (Graziano *et al.* [1997]). Since this network brings together multisensory neurons in that the neurons respond to tactile, visual, and auditory stimuli presented close to the body (Graziano *et al.* [1999]), at least tactile and auditory systems also have similar perceptual modal principles. If my phone rings, the sound can tell me how far or near the phone is. Though not backed by empirical studies (but see Barwich [2020]), a case can be made for olfaction: whatever your ontology of smell is, you can smell whether a smell source is within reach.

We can extrapolate to nonhuman animals. Bats can echolocate whether some stalactites are reachable. With their temperature-sensing systems, rattlesnakes can tell from the generated "thermal image" whether a prey is within striking reach. Put simply, perception in general, not just visual perception or human perception, makes this modal assumption about the world. In what follows, I will switch to talking in terms of perceptual systems to reflect the multimodality of the perceptual modal assumption 'objects presented within peripersonal space are reachable and graspable'.

Michael Omoge [2022] demonstrates one utility of this perceptual modal assumption. He argues that it is the first representational state to be triggered in the mental sequence that leads to action, *i.e.*, it is the immediate mental antecedent of action. Relying on empirical evidence that optic ataxia impairs peripersonal space (Bartolo *et al.* [2018]), he

argues that the assumption is the first representational state to both ontogenetically and phylogenetically evolve, and so it is evolutionarily, developmentally, and causally prior to other mental antecedents of action. Simply, without the perceptual modal assumption, reaching and grasping become impaired.

In addition, Omoge also argues that the assumption explains why intentions are not needed before agents are affected by the reach- and grasp-fostering features of objects: "[a] viewer is being affected by grasp-related properties of an object, which he/she has no intention of. grasping" (Ellis and Tucker [2000: 466, fn 3]). We have seen that area F4 is the brain area dedicated to peripersonal space representation, and it has been reported that once objects are within peripersonal space, even when they are stationary, F4 neurons fire (Graziano *et al.* [1997]). If so, then when you see your coffee mug, such that you (or, rather, your visual system) represent it as being within peripersonal space, F4 neurons fire, activating the perceptual assumption 'objects presented within peripersonal space are reachable and graspable'. In this way, at stimulus onset, you see the mug as reachable and graspable immediately—*à la* its colors, shape, size, and location—even when you have no intentions to reach, grasp, and pick it up. Simply, the mere fact that an object is presented within peripersonal space is sufficient for representing its reachability and graspability properties.[3]

Consequently, Omoge concludes that the perceptual modal assumption 'objects presented within peripersonal space are reachable and graspable' is central to understanding the role of perceptual systems in action performance, specifically, and in our cognitive framework, generally.

Here, I want to demonstrate another utility of this perceptual modal assumption. I want to show that it is integral to how perception helps us understand the world. Specifically, I will argue that it enables perceptual systems to output modal beliefs such that given our naturalistic reliabilist framework for perceptual justification (Section 3), the output modal beliefs come out basic. First, how does it enable perceptual systems to output modal belief?

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[3] If so, then one corollary here is that like color, shape, size, location, and weight *qua* featural properties, reachability and graspability *qua* modal properties seem to qualify as "low-level" properties, *i.e.*, they are phenomenologically manifest in perceptual experience. I will defend this view in future works. If I am successful, the contribution would be significant because, so far, all modal properties are typically assumed to be archetypically "high-level" properties (see, *e.g.*, Masrour [2011]). Such a contribution would show that reachability and graspability differ from all other modal properties in this regard. They are low-level even though other modal properties are high-level.

5 Perceptual modal belief

The task of addressing how the perceptual modal assumption 'objects presented within peripersonal space are reachable and graspable' enables perceptual systems to output modal beliefs can be divided into two subtasks: whether (i) perceptual systems use the principle to run computations and (ii) the principle's computational role is content-constraining.

5.1 Perceptual modal assumption and perceptual computations

Whether or not the perceptual modal assumption is used to run perceptual computations depends on how perceptual systems *encode* it. Since systems can encode "explicitly" or "implicitly" (Lyons [2014, 2016]), the question becomes: do perceptual systems explicitly or implicitly encode the perceptual modal assumption?

In explicit encoding, systems explicitly represent information and inferences, *i.e.*, they are explicit in the occurrent, tokened representations of the systems. For example, if a system needs to token the connection between 'Temi is Yoruba' and 'Yorubas are Nigerians' to infer 'Temi is Nigerian', then the system will explicitly represent the inference, the inputs, and the output. The trio will feature as the occurrent tokened representations of the systems. The semantic network theory of long-term memory storage (Collins and Quillian [1969]) works via explicit encoding. According to Lyons [2014], perceptual assumptions are not encoded explicitly but implicitly.

In implicit encoding, systems can represent information and/or inference without tokening them. Instead of tokening the connections between the inputs as in explicit encoding, the connections are "weighted" against the inputs. Where weights capture the underlying idea that (i) inputs have numerical values, which can be activated and/or influenced, and (ii) inferences embody further non-syntactically structured information, which enables them to influence the numerical values of inputs. Thus, in implicit encoding, the system that outputs 'Temi is Nigerian' from the concatenation of 'Temi is Yoruba' and 'Yorubas are Nigerians' would have some further non-syntactically structured information ingrained into its architecture about ethnicity, such that instead of explicitly tokening the connection between the inputs as in explicit encoding, the connection is weighted in terms of ethnicity against the values of the inputs. In this way, weights enter the computational process without being explicitly represented by the system. The connectionist network theory of long-term memory storage (Smolensky [1988]) works via implicit encoding.

Consequently, Lyons says:

> How the network processes the information—what inputs are mapped to what outputs—is determined by the pattern of weighted connections among the units. The weight matrix (the pattern of excitatory and inhibitory connections and their degrees of connectivity) thus embodies the system's relatively stable knowledge of or assumptions about the domain. A connectionist implementation of a visual system, for example, would encode the assumptions we've been discussing (*e.g.*, that things are lit from above, [...]) in the weights [2016: 253].

If so, then weights are the body of information stored in the proprietary database of the network, and since the perceptual modal assumption 'objects presented within peripersonal space are reachable and graspable' is stored there too (Section 4), it is encoded as a weight. In short, perceptual systems implicitly encode the perceptual modal assumption.

In addition, since, as we saw, weights are syntactically unstructured, *i.e.*, they are not fine-grained, and so cannot be separated into distinct isolable units, assumptions are too:

> The information encoded in the weights is fully distributed, in the sense that for any given piece of information [...] there's no proper subset of connections that encodes it; and for any weight or set of weights, there's no principled allocation of some percentage of that weight to one assumption and some percentage of it to another assumption. Nor is there discreteness of causal efficacy: the whole body of knowledge is causally responsible for every processing event. [Lyons 2016: 253–4]

If so, then it follows that the perceptual modal assumption is inseparable from other perceptual assumptions. It is, therefore, not the case that the perceptual modal assumption is selected for this computation but unselected for that computation. Rather, together with other assumptions, it is causally responsible for each computation perceptual systems run.

5.2 Perceptual modal assumption and modal belief formation

Even though perceptual systems use the perceptual modal computation to run computations, it does not thereby follow that the assumption constrains the contents of any perceptual outputs such that the outputs have modal contents, *i.e.*, it does not follow that such usage leads to the generation of perceptual modal beliefs. The point here is that information can be causally efficacious but fails to be content-constraining. Think of it this way. Though weights are fully distributed throughout the computational landscape, only some weights "light up" for any given computation (Lyons [2014]): the contents of the lighted-up weights

bubble up to the surface, constraining the contents of the generated outputs, while the contents of others remain in the background, lacking such constraining power.

Consider the ethnicity example again. If some non-ethnicity-related weights, *e.g.*, that occluded objects are not fragments of the foregrounded figures, light up during the concatenation of 'Temi is Yoruba' and 'Yorubas are Nigerians', then this occlusion-weight would also constrain the content of the output, giving us something like 'Temi is an occluded Nigerian'. This output is not just useless upstream for other cognitive systems—whether or not Temi is occluded behind some object is irrelevant to her ethnicity—but also evinces explicit, not implicit, encoding—"occlusion" could only have appeared in the output without appearing in any of the inputs if and only if the system now tokens the occlusion-weight. Thus, we can say that for any given computation, even if all weights are causally efficacious, only some are content-constraining. Causal efficacy is a psychological matter; content-constraining is a cognitive one.

The relevant question, then, is whether the perceptual modal assumption is content-constraining for some perceptual computations. We have seen that the reason we see objects within our peripersonal space as reachable and graspable even though we have no intention to reach and grasp them is that the perceptual modal assumption is activated by the firing of the F4 neurons whenever objects are presented within peripersonal space (Section 4). Another way of putting this is just that the assumption lights up whenever objects are presented within peripersonal space.

On those occasions when the perceptual modal assumption lights up, your perceptual system believes that 'the objects presented within your peripersonal space are reachable and graspable' even though you do not. When you do have the intention to reach and grasp the objects, then, in addition to your perceptual systems believing so, you also do believe. If so, then the perceptual modal assumption constrains the content of reachability and graspability beliefs, such that without the assumption playing its computational role, neither perceptual systems nor agents can form reachability and graspability beliefs. Put simply, the perceptual modal assumption plays a computational role in modal belief formation.

This switch from talking generally about modal beliefs to talking specifically about reachability and graspability beliefs is intentional. The fact that the perceptual modal assumption is encoded in terms of reachability and graspability dictates that the assumption can only constrain the contents of reachability and graspability beliefs. I will continue to talk in this term, returning to modal beliefs in Section 6.3 when I extend my analyses to other modal beliefs.

Having seen how perceptual systems can output reachability and graspability beliefs,

let us move on to how the beliefs come out as basic and the implications of their basicality for the prospects of naturalized modal epistemology.

6 Perceptual modal justification

Inferential opacity, as we saw (Section 3), captures the modular features of a perceptual system that guarantee its doxastic outputs are basic: (i) being an input system (*i.e.*, if it takes only sensory data as inputs), (ii) arising from the interplay of innateness and perceptual learning (*i.e.*, not entirely innate), and (iii) having only cognitively spontaneous outputs (*i.e.*, being psychologically, not epistemically, inferential). If these conditions hold for reachability and graspability beliefs, we would have demonstrated the basicality of reachability and graspability beliefs. Do they? Yes, they do.

One reason the perceptual modal assumption 'objects presented within peripersonal space are reachable and graspable' can play its computational role in the formation of reachability and graspability beliefs is that it is a psychological claim about perceptual systems, not a metaphysical claim about the world (Section 4). If so, then perceptual systems still only take sensory inputs when they output reachability and graspability beliefs. Were the perceptual modal assumption a metaphysical claim about the world, agents would have to believe it, such that the involved systems cease to be input systems.

Another reason the perceptual modal assumption can play its computational role in the formation of reachability and graspability beliefs is that it is clamped in perceptual databases after a period of sustained learning, from weeks 15 to 36, to be precise (Section 4). If so, then perceptual systems remain not entirely innately specified when they output reachability and graspability beliefs. A learning period is involved. Like the face recognition system, perceptual systems only come to have the perceptual modal assumption through experience.

Yet another reason the perceptual modal assumption can play its computational role in the formation of reachability and graspability beliefs is that it lights up whenever objects are presented within peripersonal space, even when agents do not intend to reach and grasp the objects (Sections 4 and 5.2). If so, then the generated outputs, *i.e.*, reachability and graspability beliefs, remain cognitively spontaneous. They do not result from any introspectable train of reasoning process.

In short, the modular features that secure perceptual justification subsist in perceptual modal justification, such that demonstrating the perceptuality of reachability and graspability beliefs indeed doubles as demonstrating their basicality. If my toddler or my dog,

in virtue of their perceptual systems, is justified in believing that 'their mother/owner is standing in front of them', then so too are they justified in believing that 'they can reach and grasp the objects on their playmat'. Perceptual modal justification is just perceptual justification for modal beliefs.

Let us now consider the implication of perceptual modal justification in specific cases.

6.1 Subpersonal perceptual modal justification

In Section 3, I categorized perceptual systems, small children, and animals in the same category, *i.e.*, as capable of having only subpersonal beliefs. Clearly, the perceptual modal assumption 'objects presented within peripersonal space are reachable and graspable' is a subpersonal belief of perceptual systems. *Mutatis mutandis* for my toddler son and my dog, when they believe that 'they can reach and grasp the objects on their playmat'. Neither perceptual systems, small children, nor animals have the concepts 'reach', 'grasp', 'peripersonal space', or 'playmat'.

This suggests that once we countenance beliefs for small children and animals, subpersonal reachability and graspability beliefs are one uncontroversial type of basic belief they have. It follows then that one way of attributing beliefs to small children and animals without hyper-intellectualizing perception opens up for perceptual epistemologists. And not hyper-intellectualizing perception, as Tyler Burge [2003] makes clear, is virtuous for any perceptual epistemological work.

In addition, it follows that we must include subpersonal reachability and graspability beliefs in the list of basic beliefs, and incrementing this list, as Nico Silins [2013] explains, is contentious:

> A traditional foundationalist will say that only putatively infallible beliefs about the internal world, about your current states of mind, are basic perceptual beliefs [...] However, the basic perceptual beliefs allowed by the moderate foundationalist standardly concern only such matters as the colors, shapes, and locations of external things [...] If experiences have high-level contents, it is tempting to think that the basic beliefs can include beliefs concerning causation, kinds, or the mental states of others. The beliefs allowed by generous foundationalism are a much more promising basis for the rest of our justified beliefs about the external world (although they could still turn out to be too narrow). [Silins 2013: 14–5]

Indeed, this list is still too narrow. To see this, let us categorize the beliefs on the list into subpersonal and person-level. Beliefs about the internal world

(see, *e.g.*, DeCasper and Fifer [1980]), colors (see, *e.g.*, Teller [1998]), shape (see, *e.g.*, Kestenbaum *et al.* [1987]), size (see, *e.g.*, Slater *et al.* [1990]), and others' mental states (see, *e.g.*, Onishi and Baillargeon [2005]) are subpersonal because they develop either earlier or concurrently with subpersonal reachability and graspability beliefs, *i.e.*, between weeks 15 and 36. Beliefs about causation and kind are person-level because they develop much later when children have already begun to acquire concepts.

Thus, even if you are a traditional foundationalist, you cannot accept beliefs about the internal world, colors, shape, size, and others' mental states as basic without accepting subpersonal reachability and graspability beliefs as basic: developmentally, they are all formed at about the same period. In short, subpersonal reachability and graspability beliefs are some of the first basic beliefs humans and nonhuman animals form.

Moderate/generous foundationalists are also implicated: they cannot accept beliefs about causation and kind but reject subpersonal reachability and graspability beliefs as basic. Foundationalist constraint mandates that we admit earlier basic beliefs before later ones, and subpersonal reachability and graspability beliefs, we have just seen, precede beliefs about causation and kind developmentally. They have begun forming the foundation of our cognitive framework long before beliefs about causation and kind came aboard.

But, as I will show shortly, if generous foundationalists accept beliefs about causation and kind, which are formed much later, as basic, then the fact that person-level reachability and graspability beliefs are formed much later will not rule them out from being basic. For now, we are content knowing that the list, as Silins rightly suggests, is still too narrow, and including subpersonal and person-level reachability and graspability beliefs will go a long way to completing it.

6.2 Person-level perceptual modal justification

While animals can only form subpersonal basic reachability and graspability beliefs, small children go on to acquire the concepts needed to specify belief content later in life, *i.e.*, they go on to form person-level beliefs. For instance, my wife believes that 'she can reach and grasp the computer screen, but not the window', and this modal belief is attributed to her not merely because it is the doxastic output of her perceptual systems, as in my toddler son's case, but also because she tokens it. It is *her* belief. But if so, will it not be based on the subpersonal perceptual modal assumption 'objects presented within peripersonal space are reachable and graspable?' If yes, then will such basing not render it nonbasic? No.

Though person-level reachability and graspability beliefs are based on the subpersonal

perceptual modal assumption, I deny that they thereby become nonbasic. A belief becomes nonbasic if and only if the belief on which it is based is person-level: "[a] belief/assumption can be part of someone's justifying evidence for some belief only if that belief/assumption both is [...] a person-level belief" (Lyons [2016: 259]). Since my wife is not trained in perceptual psychology, the perceptual modal assumption never becomes person-level for her, so her person-level reachability and graspability beliefs, though based on the assumption, remain basic for her. The objector confuses psychological inference with epistemic inference: the basing relation for my wife's person-level reachability and graspability beliefs is psychological, whereas the objector needs it to be epistemic.

Given this justificatory redundancy of subpersonal beliefs for the untutored, Lyons says:

> But if a belief/assumption's being unjustified doesn't detract from the justification of beliefs that causally depend on it, then the assumption isn't serving as evidence for those beliefs. [2016: 249]

Harmen Ghijsen [2021] reads Lyons as saying that subpersonal beliefs lack justificatory status, complaining that Lyons applies the same justification conditions to subpersonal and person-level beliefs. For him, since subpersonal beliefs "have incorporated information from innumerable other occasions [they] could remain justified in the face of the agent's personal-level contrary reasons" (Ghijsen [2021: S1764]). Subpersonal beliefs are justified because they were acquired reliably, probably, evolutionarily.

Though I do not think Lyons should be read in this way—it is one thing for an assumption to not serve as evidence for the beliefs that are causally dependent on it and quite another for the assumption to lack justificatory status—I agree that subpersonal assumptions/beliefs are themselves justified, and this is true of the (subpersonal) perceptual modal assumption as well. As we have seen (Section 4), the perceptual modal assumption is reliably acquired, going through the required evolutionary developmental phase between weeks 15 and 36. Thus, my view is compatible with Ghijsen's addition such that person-level perceptual modal justification is secured, at least for the ordinary agent not trained in perceptual psychology. What about those so trained?

When so trained, agents become aware of the epistemic status of their subpersonal beliefs, such that the beliefs become person-level for them. Given my expertise in perceptual psychology, I know that the perceptual modal assumption constrains the content of my person-level beliefs. Unlike my wife, the basing relation for my person-level reachability

and graspability beliefs is epistemic. Does this not render my person-level reachability and graspability beliefs nonbasic? Again, no.

Even though I am aware of the epistemic status of the perceptual modal assumption, I do not arrive at my person-level reachability and graspability beliefs through some introspectable train of reasoning: I do not token the perceptual modal assumption. The beliefs remain cognitively spontaneous. Given the neural basis of the perceptual modal assumption, which is that the presentation of objects within peripersonal space is sufficient to make F4 neurons fire, thereby activating the assumption (Section 4), it is patently false and, in fact, unnatural if each time I form person-level reachability and graspability beliefs, I token the perceptual modal assumption. Put simply, the belief 'I can reach the computer screen but not the window' is cognitively spontaneous in that I can just see that I can reach the computer screen but not the window, so the belief remains basic. This is how I form such beliefs typically.

This means that person-level reachability and graspability beliefs, although formed much later than their subpersonal counterparts, are *always* basic for those untrained in perceptual psychology (which is most people) and *typically* basic for those so trained. It is, therefore, unreflective for either the moderate or generous foundationalist to reject their basicality.

That said, atypically, things become complicated. It may happen that you press me for the evidence I have for my person-level reachability and graspability beliefs. When this happens, and since I am trained in perceptual psychology, I may supply facts about the perceptual modal assumption as my evidence, saying that I believe that 'I can reach the computer screen but not the window' because the computer screen but not the window is within my peripersonal space. Once I do this, my person-level reachability and graspability beliefs become nonperceptual, although not necessarily nonbasic—recall that perceptuality is only sufficient, not necessary, for basicality.

As we saw (Section 3), once a system takes person-level beliefs as inputs, it ceases to be a perceptual system, but it may yet be a primal system. To remind ourselves, a primal system must continue to have nondoxastic interlevel representations as consciously accessible to agents and/or involve only psychological inferences, even though they may not be input systems. When I gave facts about the perceptual modal assumption as my evidence to your demand, I was describing the psychological, not epistemic, processes that went on in my head when I formed the person-level reachability and graspability belief. This means that, at that point, I believed that 'I believe I can reach the computer screen but not the window because the computer screen but not the window is within my peripersonal

space'. This belief is introspective, but, as we saw (Section 3), the introspection system is primal though nonperceptual, such that introspective beliefs are basic even though they are nonperceptual. Thus, the introspective belief I formed when I gave facts about the perceptual modal assumption as my evidence is still basic even though nonperceptual.

However, since modal justification is our concern, it may be asked whether this introspective belief is modal. If we take introspection to be the cognitive system that produces our intuitions, and if modal intuitionism, according to which modal intuitions have epistemic imports (see, *e.g.*, Bealer [2002]), is correct, then the introspective belief is modal. If this highly condensed argument works, then, in addition to a person-level perceptual modal justification account, our naturalized reliabilist framework also paves the way for a person-level introspective modal justification account.

Relatedly, I should point out that, in addition to this introspective modal justification account, there is also a memorial one. Though there are different types of memory, epistemologists are often concerned with episodic (*i.e.*, autobiographical) and semantic (*i.e.*, general facts) memories, and both are primal (Lyons [2009]). Though both episodic and semantic memories take beliefs as inputs (so, they are not input systems), the input beliefs are never tokened, so the involved inference remains psychological.

Consider an example with episodic memory. Last week, as I typed, I tried and succeeded in reaching the computer screen but not the window, so I formed the perceptual belief 'I am reaching the computer screen, but not the window'. My memory takes this belief as input, storing it as a mental representation. Today, I retrieved the representation, telling you that 'I can reach the computer screen but not the window'. This is a memorial modal belief, and intuitively, it is basic. This is because even though my memory takes the earlier perceptual belief as input, it does not base the output memorial modal belief on it. First, the earlier perceptual belief is now extinct, and a belief cannot influence the justification of another belief if the first belief is no longer occurrent and tokened:

> Basing is thus necessarily synchronic, even though dynamic, and because diachronically persistent mental states are possible, basing is nontransitive. So in a standard case of memory, the output beliefs are not based on the input beliefs. [Lyons 2009: 141]

Second, the output modal belief is based on the stored representation, whose psychological profile is nonidentical with the input perceptual belief.

Though much more can be said about these sorts of introspective and memorial accounts of modal justification, what is important for now is that their details will differ from those

of the perceptual account I have been describing. If so, then we can revel in the knowledge that specifying the details of person-level perceptual modal justification opens up avenues for future research into naturalizing modal justification.

6.3 Extended perceptual modal justification

So far, I have only talked about reachability and graspability beliefs, but it is obvious that modal beliefs outstrip them. We also form beliefs about climbability, edibility, throwability, and so on. Typically, these beliefs are person-level. Unlike reachability and graspability, perception does not have any assumption stored in its proprietary database, which enables it to output beliefs about edibility, for instance, and this, in turn, is because children do not go through any sustained learning period before seeing objects as edible, throwable, or climbable.

Lacking such a learning period means that intentions and goals are needed, which in turn means that the role of "working memory" is sustained in the formation of edibility beliefs. Where working memory is a capacity that allows the retention of a limited amount of information in the service of complex cognition and action (Baddeley [1986]). Since no learning is involved in seeing objects as edible, the pattern of movement involved in eating an apple is not stored in any perceptual database, and so the edibility features of objects are *combined* with the agent's goal in working memory before the combined data are sent to the motor system to be transformed into motor actions. Unless you are hungry, you do not perceptually judge the apples on the table as edible or an apple tree as climbable. The apples' edibility and the tree's climbability are not immediately seen.

This sustained influence of working memory in the formation of beliefs about edibility and its ilk means that the relevant outputting systems are not perceptual or even primal. Working memory is standardly rendered as utilizing different components, *e.g.*, a central executive, a visuospatial scratchpad, an articulatory loop, phonological stores, and so on (Baddeley [1986]). These components, as Lyons [2001] argues, are dissociable, *i.e.*, they can work independently of one another, and so they lack the kind of internal cohesiveness required of a cognitive system. If so, then surely, when they interact with perceptual systems, the resulting processing mechanism will also lack the same internal cohesiveness. It follows that perceptual or primal systems do not produce beliefs about edibility and its ilk, so they are neither perceptual nor basic.

You may recall that a specific food nearly killed you such that you believe that 'it is inedible for you', but since that information is neither semantic in that someone else may

eat it and be fine, nor (purely) episodic in that you are not just remembering the event for the sake of it but in view of (not) performing the same action, the relevant storeroom is working memory, not semantic or episodic memory. It is a piece of information employed in the service of complex cognition and action. Thus, your belief 'I can't eat this food' is nonperceptual and nonbasic. This, then, explains why Lyons is right to be suspicious of the perceptuality of edibility beliefs:

> Perceptual beliefs include beliefs like 'there's a dog in front of me', 'there's a stapler on the table', 'it's raining', 'Martha's here', and such [...] These, anyway, are the beliefs I will take to be perceptual beliefs; I'm avoiding contentious examples like [...] 'there's something edible on the table'. [2011: 291]

Though I am unsure if Lyons is thinking along the lines of my argument here, it suffices to know that his suspicion is spot on. That said, he should not generalize the suspicion: edibility beliefs, as I said at the beginning of this section, are only typically nonperceptual and nonbasic.

Typically, most of us do not go through any sustained learning period to see objects as edible, climbable, throwable, and so on. Atypically, however, some people do. A professional apple picker who works on an apple farm has gone through such a learning period: they have learned to become sensitized to the relevant edibility features of apples. So, too, has a professional rock climber become sensitized to the climbability features of rocks. If so, then the role of working memory in seeing apples as edible or rocks as climbable will be dropped for them, and the involved sensitization pattern will be hardwired into their perceptual architecture, just as it was in the case of reachability and graspability. In short, perceptual learning will occur, and, as we have seen (Section 3), cognitive systems can arise from the interplay of innateness and learning. Thus, the system that outputs experts' beliefs about edibility, climbability, throwability, and so on is perceptual, rendering the beliefs perceptual and basic. Although the system is nonperceptual for novices, rendering their beliefs nonperceptual and nonbasic.

In short, we can extend perceptual modal justification beyond reachability and graspability beliefs to include beliefs about edibility, climbability, throwability, and so on, clarifying when perceptual modal justification holds or fails.

6.4 Defeaters

Since my construal of perceptual justification is *prima facie* (Section 2), I must discuss defeaters. Given the reliabilist spirit of my perceptual modal justification account (Section 3), worthy candidates of defeaters are those the account inherits from the many objections to reliabilism.

For instance, the clairvoyance challenge that stirs up cases of reliability without justification (*e.g.*, BonJour [1985]), the bootstrapping problem that warns against attributing reliability without external checks (Vogel [2000]), and the cognitive penetration problem that reduces reliability (Siegel [2012]). However, since perceptual modal justification is just perceptual justification for modal beliefs, some available resolutions for these objections will apply, *mutatis mutandis*, to perceptual modal justification.

For instance, Lyons' [2009] and Graham's [2012] competent resolutions of the clairvoyance challenge apply. If you wake up tomorrow with a clairvoyant ability with which you believe that 'you can climb a certain tree', and it so happens that you can, thereby making your clairvoyant abilities reliable, you are still not *prima facie* justified in forming the modal belief. As Lyons puts it, your clairvoyance system is not a perceptual system by current standards. It does not begin from sensory transduction such that it is not an input system, and it does not arise from the interplay of innateness and learning. And even if it does not have this sort of weird etiology, perhaps you were born with it, and it just starts manifesting now that you are an adult; Graham adds that it lacks a proper evolutionary history in that you are perhaps the only human with such an ability. Since perceptual modal justification is, like perceptual justification, a function of the modular features and etiology of perceptual systems, it, therefore, subsists in this case.

Similarly, we can quickly dismiss the bootstrapping challenge, according to which reliabilism attributes reliability without external checks. As I have argued, one indispensable modular feature of perceptual systems in virtue of which they are reliable modal-belief-producing mechanisms is the perceptual modal assumption 'objects presented within peripersonal space are reachable and graspable', which we were only able to identify through external checks, *i.e.*, by listening to the relevant natural sciences, which have undertaken the needed empirical investigations on our behalf. If so, then perceptual modal justification does not stack the card in its own favor. It does not bootstrap itself from the outset.

The danger posed to a reliabilist framework of perceptual modal justification by cognitive penetration is not so swiftly dealt with, however. For instance, even if I am a novice, I may have read books about the features to look out for when deciding whether apples

are edible, such that even though my eyes are not sensitive to the edibility features of apples, the knowledge I have acquired can top-down influence my perception, inducing me into believing that 'these apples are edible'. If the books' authors are credible or I believe them to be credible, then it seems that the edibility belief, even though nonbasic, is *prima facie* justified. It may be that eating the apples is my only means of survival, such that the involved cognitive penetration has increased, not decreased, the reliability of my perceptual systems. And there is merit, too, in a non-foundationalist reliabilist account of modal justification. I lack the space here to carefully lay out the details of this account. I will pick it up in future works.

7 Concluding remarks

This paper has been about the Cartesian/Humean/Kantian modal skepticism, according to which experience does not play any justificatory role in modal justification. I have chosen a modest task: to show how this skepticism is false for everyday possibility beliefs, leaving out everyday necessity beliefs.

Notwithstanding this modesty, I think the task suffices as an entry into the field of naturalized modal justification: everyday possibility facts, as I have said (Section 2), are uncontroversially accessible such that everyday possibility beliefs are exoteric: everyone has and forms them daily. If so, then if we can show that experience plays a justificatory role in the justification of everyday possibility beliefs, then that is a big win for the justificatory role of experience in modal justification.

Moreover, addressing how experience plays a justificatory role for everyday possibility beliefs opens up a way to naturalize the justification of everyday necessity beliefs. If evolutionary psychologists, *e.g.*, Cosmides and Tooby [2006], who argue that our moral attitudes are rooted in cognitive modules, are correct, then some details about everyday possibility belief justification would apply to everyday necessity belief justification. Moral necessity facts are paradigmatic examples of everyday necessity facts, and given this sort of cognitive understanding of moral attitudes, moral necessity beliefs would be output by some cognitive systems. Such systems may turn out to be primal or even perceptual, and so a naturalistic account of everyday necessity belief justification would unfold. I will give a defense of this in future works.

In sum, not only is perceptual modal justification possible, but explicating it also opens up myriad ways of uniquely contributing to and advancing the prospects of naturalized

modal epistemology.[4]

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