

# A Puzzle About Aftertaste

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## ABSTRACT

When we cook, by meticulously following a recipe, or adding a personal twist to it, we sometimes care not only to (re-)produce a taste that we can enjoy, but also to give our food a certain aftertaste. This is not surprising, given that we ordinarily take aftertaste to be an important part of the gustatory experience as a whole, one which we seek out, and through which we evaluate what we eat and drink—at least in many cases. What is surprising is that aftertastes, from a psychological point of view, seem to be analogous to afterimages, and thus have little or no epistemic import. In this paper we tackle this puzzle, and argue that we are right in treating aftertastes seriously. The moral is that both from a metaphysical and an epistemic point of view aftertastes should be categorized differently from afterimages.

**KEYWORDS:** Aftertaste; afterimages; epistemic reliability, temporal experience, gustatory experience

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## 1. INTRODUCTION

Imagine yourself on a warm summer evening on a terrace, enjoying a perfectly cooled artisanal Riesling. Its crisp tartness develops slowly into a satisfyingly complex citrus aroma that stays with you for moments after you have swallowed it. The stock that has been lovingly simmering for hours on the stove is unctuously savoury due to its rich umami aftertaste. I love this chocolate because it has such an elegant, slightly bitter aftertaste. The milk, tasting good at first, develops a thoroughly unpleasant sour aftertaste which unmistakably tells me that it has gone bad. Foods and drinks do

not only have flavours and tastes, they also have aftertastes. And we take aftertastes experiences seriously: we often identify or evaluate our food and drink by their aftertastes, and we detect important properties of theirs through aftertastes. Even recipes can be framed as to track a certain aftertaste. This can be explicit, as in the case of recipes of herbal liquors or infusions, or more indirectly, as in the case of the stock in our opening example.

But what are aftertastes? A first answer comes from considering the temporal features of what happens when we experience flavour. Gustatory experiences unfold over time. As Cain Todd (2018: 278) puts it, ‘the perception of flavour is distinctive amongst our sensory experiences (...) in being experienced essentially temporally.’<sup>1</sup> Every gustatory experience is a temporally extended experience with successive phases. The ‘primary taste’ occurs immediately when the food is put into the mouth.<sup>2</sup> It lasts until the food is swallowed. The ‘aftertaste’ occurs after the food is swallowed.<sup>3</sup>

In psychology, aftertastes are seen as belonging to the same category as afterimages. Vision scientist Richard Gregory, for example, defines an afterimage as ‘an image seen immediately after the intense stimulation of the eye by light has ceased.’ (1987: 13), whereas psychologists Neely and Borg characterize aftertaste as ‘the stimulus intensity perceived in the moments immediately following removal of the stimulus (to differentiate with adaptation, in which the stimulus is constantly present).’ (1999: 21). Similarly, the *Oxford Dictionary of Psychology* explains aftertastes as ‘a sensation of taste or flavour that lingers after a sapid (tastable) food or drink has been in the mouth.’

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<sup>1</sup> What we need to assume with respect to the existence of flavour is minimal, even an anti-realist can accept that healthy human beings resemble each other in their psycho-physical properties at least insofar the gustatory perception of certain chemical features will result in something that justifies us talking about a common taste (flavour) and a common taste experience.

<sup>2</sup> Here and in what follows we will use “food” as an umbrella term for any solid or liquid nutrients that we taste and ingest while having a gustatory experience. We prefer to be a bit sloppy in the usage of an ordinary term, rather than adopting the more pompous “victualia”.

<sup>3</sup> *Nota bene*: “taste” vs. “flavour”. Usually the literature distinguishes between taste experiences, mono-sensorial experiences that we have by virtue of our taste receptor cells, and flavour, multi sensorial experiences that combine taste, touch, smell and retro-smell perceptions. Since we want to stay with the established term ‘aftertaste’ we will speak about ‘aftertaste’ and ‘primary taste’ although, strictly speaking, we are talking about ‘primary flavour experiences’ and ‘after flavour experiences’. In other words, we do not intend aftertaste to be understood as restricted to taste perceptions.

No surprise then that the same work of reference groups afterimages and aftertastes into the same category of ‘aftersensations’. Here is the *Oxford Dictionary of Psychology*’s definition.

AFTERSENSATION: Any sensation persisting after the cessation of the stimulus, especially an afterimage or an aftertaste.<sup>4</sup>

Philosophers have, at least to our knowledge, hitherto completely ignored the phenomenon of aftertaste. Afterimages, on the other hand, have been subject to a great many heated debates. One reason for this disparity may ground in a general interest bias towards visual experience. Another, admittedly more speculative reason, could be that philosophers have simply followed psychologists in grouping aftertastes in the same category as afterimages and have since not deemed them unique enough to motivate any interesting reflection. We will, hopefully, remedy this pitiful situation with this article.

The debates about afterimages mainly turn on the question whether or not afterimages reveal the existence of visual sensations, although how that is understood exactly depends on the understanding of the term ‘visual sensation’ and is ‘a theme with many variations’ (cf. Phillips, 2012: 421). One such more recent variation is the debate about pure representationalism and the idea that the phenomenal character of experience is exhaustively characterized by its representational content. One side sees the occurrence of afterimages as evidence that the view is false, the other tries to deflate that point.<sup>5</sup> ‘Sensationalists’ argue that afterimages are intrinsic, non-perceptual features of visual experience of which we are directly aware, and thus a strong counter-example to

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<sup>4</sup> (Colman, 2000: 42). And here is the definition of the more general term “aftereffect”, to which both afterimages and aftertastes are deemed to belong: “Any phenomenon occurring some time after its cause, especially (in psychology) a delayed sensory or perceptual experience.” (ibid.) While in what follows we argue against the idea of putting together aftertaste and afterimage in the category of aftersensations, we grant that “aftereffect” is general enough to encompass both.

<sup>5</sup> ‘Sensationalists’ who think that afterimages are non-worldly purely sensational non-perceptual features of experience, include [Boghossian and Velleman 1989], [Block 1996], and [Kind 2008].  
On the other side, we have...

pure representationalism. ‘Purists’ about perceptual experience attempt to deny this in various ways.<sup>6</sup>

The most interesting aspect to us, however, lies in the fact that both sides deny afterimages any (or at least any valuable) epistemic import. For sensationalists, afterimages are ‘mere sensations’ which, by their very nature cannot give us information about the external world. For purists, afterimages present us with public objects, but even if they disagree among themselves on what they present us with exactly (material objects, or light phenomena), they all concur on them being illusory, and hence void of epistemic value. This general view of aftersensations as epistemically insignificant experiences creates a puzzle when applied to aftertaste, which can be summarized in three individually plausible, but jointly incompatible claims.

- A. Aftertastes and afterimages are in the same psychological category of aftersensations
- B. Aftersensations are of no or little epistemic value
- C. Aftertastes are epistemically reliable, hence they often have epistemic value

In what follows, we will focus on this previously unnoticed puzzle. In Section 2 we present the received view according to which aftertastes are aftersensations, and aftersensations lack systematic epistemic significance. In Section 3 we defend the commonsensical view that aftertastes have epistemically significance, and we point out several differences between afterimages and aftertastes. In Section 4, we explore a way to solve the puzzle based on denying that *all* aftersensations lack epistemic value, by providing an explanation of the phenomenology of aftertaste that accounts for their apparent epistemic reliability. Ultimately, we reject the solution since it overgeneralizes. In

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<sup>6</sup> The terms ‘sensationalists’ and ‘purists’ are taken from [Phillips 2012]. Although sensationalists are anti-representationalist in the sense that do not accept that the phenomenal character of our perceptual experience is exhausted by the representational content, not all purists are representationalists. Phillips himself defends a direct realist version of purism (see also footnote 14).

section 5, we offer an explanation of the epistemic significance of aftertaste that motivates a more radical re-conceptualisation of them. In section 6, we conclude with some final thoughts.

## 2. THE EPISTEMIC UNRELIABILITY OF AFTERSENSATIONS

As we have already pointed out, the received view in psychology and philosophy is that aftertastes bear enough similarities with afterimages to be considered of the same basic category of aftersensation. If aftersensations are epistemically unreliable and aftertastes are epistemically reliable, though, either aftertastes are an exception to the unreliability of aftersensations, or are not aftersensations after all. Either way, the received view should be revised deeply.

To understand in what sense aftersensations are epistemically unreliable, let us begin by contrasting aftersensations with *primary perceptual experiences*, by which we mean experiences like the one you have when looking at your screen or tasting an overly spicy sauce. What is it for a primary perceptual experience to be epistemically reliable? ‘Epistemically reliable’ is meant here in the minimal and hopefully relatively innocent sense that, when epistemically reliable, then perceptual experiences are truth conducive, if only in the minimal sense that they do not deceive us gravely. Of course ‘not gravely’, is once more a phrase that is pleading for sharper delineation, but for current purposes let us just say the following. When I have an epistemically reliable visual experience as of a cup on my desk, then there is a cup on my desk — unless I have been badly deceived either by my visual system (e.g., I am hallucinating because of a drug) or by the external conditions (e.g., the light hits the surface of the desk in such a way that it looks like there is a cup over there). We can usually trust the reliability of the information delivered to us by our senses because it is simply the function of our perceptual organs to provide us with information about the environment we are in.<sup>7</sup>

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<sup>7</sup> While we are fully aware of the dangers that lurk in opening the Pandora box entailing the phrase ‘epistemic reliability’ (see [Goldman and Beddor, 2015] for an overview), we are confident enough that our minimal definition will convey the intuitive understanding required for our purposes.

Standard cases of primary perceptual experience are characterized by certain conditions conducive, or at least not obstructive, to this process. These conditions include for example that you are awake and not dreaming, you are a healthy enough human being with eyes and a nose and so on, functioning the way they should, that there is nothing in your surroundings that hinders you in having these experiences and so forth. They are also characterized by a straightforward causal process which relates your experience to whatever in the world it is an experience about.

Contrast this with aftersensations. Unlike primary perceptual experiences, aftersensations are not considered to be epistemically reliable sources of information about the world. We will come back to the fact that in general aftersensations do not *seem* to be reliable in the next section, here we consider the reasons why they may indeed not *be* reliable. The root of the epistemic inequality lies, *ceteris paribus*, in the different causal processes involved in the generation of primary perceptual experiences and aftersensations. For primary perceptual experiences that causal process that can be schematically illustrated as one that leads, in two steps, to a *primary percept*, as follows:

#### THE CAUSAL PATH TO PRIMARY PERCEPTS

Distal stimulus (DS) → proximal stimulus (PS)

PS + internal processing (IP) → primary percept (PP)

The distal stimulus can be considered the “topic” of my experience, i.e. the physical object that my experience is of or about. The distal stimulus directly causes the proximal stimulus, i.e. whatever excites the perceptual organs (photons, chemical molecules, etc.). The proximal stimulus, together with some internal processing, then directly causes the primary percept. The distal stimulus is constitutively responsible for the quality of the proximal stimulus. In other words, the proximal stimulus retains some crucial information of the object perceived. Similarly, proximal stimulus is constitutively responsible for (the quality of) the primary percept. Thus the primary percept inherits

core features from the proximal stimulus, and indirectly from the distal stimulus, the physical object I am having an experience of. Given the right background conditions, we have what we may call good cases of primary percepts. A good case is roughly one where the system is in its normal conditions, and the causal chain is ‘untampered’ by external interfering factors which guarantees that information about the perceived object is preserved and which, in turn, makes the primary percept epistemically reliable.

Let us contrast this with aftersensations.<sup>8</sup> Here, the causal chain looks as follows:

#### THE CAUSAL PATH TO AFTERSENSATIONS

DS → PS

PS + IP → PP

PP + internal processing (IP') → aftersensation (AS)

The aftersensation is directly caused by the primary percept and a second, further internal processing (IP'), and indirectly caused by the distal stimulus and the proximal stimulus. Where and why do we lose the epistemic reliability when we move from primary percept to aftersensations? The relevant difference might lie within the natures and roles of internal processes IP and IP'.

IP is merely facilitating or realizing the qualitative outcome that is (to the largest extent) determined by the proximal stimulus. In contrast, IP' is together with the primary percept *constitutively responsible* for (the quality of) the aftersensation. IP' is an emancipated contributor in producing the aftersensation powerful enough to determine the character of the aftersensation. IP on the other hand, plays a merely supportive role. In consequence, the character of the aftersensation may differ so much from the object it is an afterimage of that it ceases to be an accurate representation of it. This would certainly fit in the case of afterimages. Try, for example,

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<sup>8</sup> The fact that we talk about primary *percept* and *aftersensations* merely reflect that the term “afterpercept” is not very common in the literature, and we prefer to follow usage.

to fix your gaze on a vividly coloured image. When you then look at a white screen, you will observe a persistent after-image with colours complementary to those of the original image. The colours of the afterimage are complementary due to adaptation of the retina cells. The image is persistent due to the processing that occurs at the level of the retina cells. All these are internal processes that contribute to the qualities of the ensuing aftersensation which differ drastically from the original image. Here is another way to put it. Primary percepts are direct experiences of the world.<sup>9</sup> Aftersensations, on the other hand, are experiences only indirectly connected to the world since by AFTERSENSATION, they occur once the proximal stimulation has ceased. In a sense, when they happen, the contribution of the world to our experience does not matter anymore. It might seem the same with aftertaste. At least in certain circumstances, the quality of which we are aware in an aftertaste experience differs radically from the quality of which we are aware in the corresponding primary taste experience. For instance, a gentian liqueur may have an intense camomile aftertaste that was not at all present in the primary taste phase of the gustatory experience, or a carelessly prepared avocado soup can quickly turn the eater's experience from one of a smooth buttery flavour to one of pungent bitterness after swallowing

Notice that the epistemic insignificance of aftersensation does not mean that they cannot tell us anything interesting about how our perceptual systems work. To the contrary, psychologists study them precisely because they are byproducts of perception, and thus their study is useful to retrieve information about the physiological, cognitive and neural mechanisms underlying perception. But as byproducts do not share the epistemic profile of primary perceptual processes.

### **3. THE EPISTEMIC RELIABILITY OF AFTERTASTES**

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<sup>9</sup> Note that the epistemic superiority of primary percepts with regards to aftersensations even holds in cases where we have experiences of stars that are so far away that they have ceased to exist during the time it took the light reflected from them to reach us. In such cases the light we are perceiving from the star, the proximal cause of our experience, maintains the core information about the distal cause. Since the proximal cause is the only constitutively responsible factor in producing the visual experience of the star, the fact that the star has ceased to exist does not decrease the epistemic reliability of the experience, at least not *per se*.



The previous causal considerations speak in favour of the thesis that aftersensations are epistemically unreliable. The very phenomenology of certain aftersensations suggests the same. Afterimages are a case at issue. If I close my eyes now, or quickly turn to look at the wall, say, I have an afterimage of the screen I have been looking at. Yet I am not inclined to regard this image as a perceptual encounter with my surroundings. In other words, afterimages lack what others have called ‘phenomenal objectivity’ (Masrour, 2013: 116): they seem to present us neither with features that are independent of our own mind, nor with ways the objects of the world appear to us.

Why do we not regard afterimages as having objective import? People have made various features of afterimages responsible. Whereas ordinary experiences are usually of a familiar, stable world, afterimages are ‘typically feeble and fleeting’ (Phillips, 2012: 442). Afterimages do not seem to possess spatial locations independently from us and do not meet certain expectations implicit in ordinary perceptual experience, like for example the expectation that objects look bigger the closer we get (cf. Masrour 2013). And Ned Block adds that ‘afterimages (...) don’t look as if they are really objects or as if they are really red. They look...illusory’. (Block, 1996: 32)

All these features do plausibly reduce the phenomenal objectivity of afterimages. Those doubts about the phenomenal objectivity of afterimages is generally taken in support of the view that there is no objectivity in the information afterimages provide us full stop. *Aftertastes* have *some* phenomenal features that point in the direction of a reduced phenomenal objectivity. For example, one might think that there is some sense in which *aftertastes* do not seem to possess spatial locations independently from us. *Tastes* are bound to their bearers; the taste of the truffle is where the truffle is, a point that is made blatantly obvious by the fact that we have to literally touch it with our tongue to perceive its taste. And even flavour, which includes smell, is at least dependent on the presence of some chemical molecules.<sup>10</sup> Instead, the *aftertaste* is supposed to occur (roughly) in the mouth of the taster, once all of the food is removed. Remember that *aftertaste* occurs ‘after

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<sup>10</sup> We do not want to make a stance as to whether odours are clouds of molecules. Our view is compatible also with a view like for example Richardson’s, where odours are ‘parcels of stuff’ ([2018: 12]) supervening on molecules.

the stimuli have been ‘removed’ (Neely and Borg, 1999) and ‘after the cessation of the stimulus’ (*Oxford Dictionary of Psychology*, op. cit.). It is in that sense one might argue that the spatial location of aftertaste seems not entirely independent of the taster. And one might even argue that there is some implicit expectation about gustatory perception to the effect that our taste sensation disappears or at least fades away, but certainly doesn’t change after the food has been swallowed.

However, for the most part the phenomenology of aftertaste seems to be radically different from that of afterimages. This is witnessed in the way we treat aftertaste in ordinary social interactions: we value a wine for its aftertaste, we prefer a chocolate over another for the aftertaste it leaves in our mouth, and more generally we attribute properties to foods and drinks on the ground of aftertaste experiences. Contrariwise, we attribute shapes and colours on the ground of visual experiences, but we do *not* attribute those properties to objects on the ground of afterimage experiences—unless the circumstances are highly deceptive. For instance, in certain artificially reproduced circumstances an afterimage can be so vivid that we can mistake the experience we are having for an ordinary visual experience (cf. Phillips 2012).

Still, it is a fact that we do not rely as much on afterimages as we do on aftertastes when we want to gather information about our environment. One part of the explanation could be that aftertastes are just more persistent, they last longer and tend not to be as fleeting as afterimages. Indeed, we ordinarily experience much more afterimages than we realise, but since afterimages are usually very brief, we tend not to notice them; therefore it is not surprising that they do not carry much information. It is enough to hold your sight fixed for a few seconds on an object, and when you move it, a short-lived afterimage will be easily created, for instance if your gaze moves to a white wall right after. But this cannot be the entire explanation.

Firstly, it is possible to induce very persistent afterimages, hence the ephemerality of afterimages is not a constitutive feature of them. A flash right in our eyes produces a persistent afterimage, and the pictures and instructions that we find in psychology handbooks all lead to vivid experiences (if not, something went wrong and you have to repeat the “experiment”).

Secondly, afterimages entertain a different counterfactual relation with their source, that is the distal stimulus at the origin of their causal chain, than aftertastes. Experiencing a mouth watering stew would be less informative in terms of the stew's flavour, if the experience did not include the delicious umami aftertaste. We would say to know less of the stew if, for instance, through some artificial inducement, our experience was suppressed before developing the aftertaste. A visual experience of a cup without afterimage, on the other hand, could hardly be described as informatively diminished. No information would be lost if the experience was phenomenologically suppressed in the right moment. The epistemic import of an afterimage is at best redundant (as in the case of a brief retention of an object's image right after we have moved our sight away from it), potentially misleading (for instance about the position and the colour of the distal stimulus, as shown in many handbook experiments), and at hindrance for further visual inspection of the object (if the afterimage is persistent). In other words, even if we speak in terms both of an afterimage *of the screen* and an aftertaste *of the stew*, the "of" plays a different role in each case. An afterimage of the screen does not seem to reveal anything *new* about the screen but that it has produced an afterimage experience—or if it does so, it does in a misleading way (by representing a position and a colour that the screen doesn't have). Contrariwise, the stew's umami aftertaste tells us something new about the stew, something we did not have access to before we had the aftertaste experience: the stew that *was* in my mouth, *now* tastes umami (and this happens also when the aftertaste quality is very similar to the quality of the primary taste—in that case we will say of the stew that it *still* tastes umami in the aftertaste).

Those considerations about the phenomenological difference between afterimages and aftertastes leads us to think that there is a presumption of epistemic reliability concerning the latter. Such a presumption should be taken seriously, unless we have independent reason to believe that we are systematically mistaken.

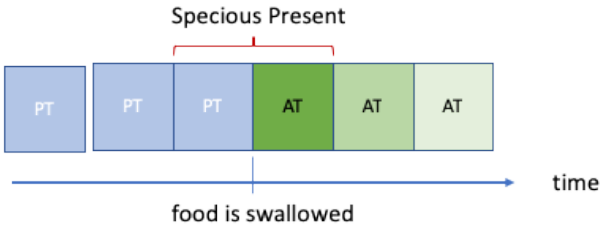
#### **4. AGAINST THE RECEIVED VIEW: AFTERTASTES ARE EXCEPTIONS**

In section two we saw that the physiological processes leading to an aftersensation *constitutively* involve a second internal processing IP' which occurs after the experience of the primary percept, and this fact is taken to be responsible for the general "epistemic remoteness" of aftersensations. However, the presence of IP' does not motivate *per se* a complete segregation of the aftersensation from the world. Nor does the lack of phenomenal objectivity. The complaint, for example, that 'after-images are not seen as material objects any more than, say, a ringing in one's ear is heard as a real noise' (Boghossian and Velleman, 1989: 86-7), is clearly without base when we are to judge whether the experience in question is perceptual or not. As Ian Phillips points out about afterimages, we can very well be perceptually presented with non material objects, rainbows, shadows, reflections and the like, which are real at least in the sense of publicly accessible. This should be even more obvious for other sense modalities, for example in olfaction.

Of course it is true that aftersensations often *misrepresent* many features of the distal stimulus (its position, whether it is moving and in which direction, its colour, the dimension, etc.), but the mistakes are systematic and can be reproduced in different subjects, by exposing them to analogous conditions. Hence the link with the stimulus is in some sense stable, IP' notwithstanding, and their being generally illusory is after all a matter of degree. Although most aftersensations are in general on the "illusion" end of the spectrum, aftertastes may be exceptional in being mostly on the "veridical" side.

A phenomenal feature that seems to support the veridicality of aftertastes is the role of the "specious present" in their temporal structure. As we pointed out at the outset, gustatory experiences are temporally extended experiences, which have phases. More precisely, they are *phenomenally unified* experiences, that is experiences whose phases pass one into another in a continuous manner. From a subjective point of view, they are experiences of the food that we ingest. Unless something triggers unusual attentive activity (more on this below), the primary taste phase (PT) 'moves into', as it were, the aftertaste phase (AT).

An obvious way to spell out the structure of this phenomenal diachronic unity is in terms of the specious present. A specious present is an interval  $t_0-t_n$  during which anything that is experienced is both experienced as occurring over  $t_0-t_n$  and apprehended all at once. We can say that what is represented in the specious present is *phenomenally present*, even if not all of its parts are presented as temporally present.<sup>11</sup> A gustatory experience is phenomenally unified in virtue of being constituted by a series of (possibly overlapping) specious presents.<sup>12</sup> Crucially, at least one specious present contains both primary taste phases and aftertaste phases.



**FIGURE.1** Primary taste and aftertaste in the specious present

Although the swallowing of the food is the dividing moment, the experience is phenomenally unified, and this explains why we tend to consider all its parts as reliably providing information about the food. In the primary taste phase of the experience we are presented directly with the food. The activity of the receptors (both the taste bud and the smell receptors cells)<sup>13</sup> together with the internal processing present to us how the food that *is in our mouth* tastes *now*. In the aftertaste phase the experience is less directly linked to the (gustabile), but from the subjective point of view it is an evolution of the previous phases, rather than a new sensation that is only accidentally linked to the primal taste. Hence, even if the receptors are not directly involved in interactions with the

<sup>11</sup> Cf. (Valberg 1992).

<sup>12</sup> What we have in mind here is Dainton’s model of specious present experiences in particular, although (Dainton 2000) does not use a representational framework.

<sup>13</sup> As (Richardson 2013) points out, the fact that receptors that are usually dedicated to smell have an important role in the gustatory experience does not make the experience of taste an *olfactory* experience. As we will see in Section 5, if we are right, the so-called retro-smell may play a crucial role in explaining the epistemic import of aftertaste.

food when we have the aftertaste experience, we can say that their activity, together with IP', the secondary internal processing, present us with how the food that *was in our mouth* tastes *now*.

If this description captures the phenomenology correctly, then aftertastes are not experiences of *pure gustabilia*, as for the sensationalist afterimages are experiences of pure visibilia. In an aftertaste phase the food or drink itself appears to us in a certain way, which may be (and usually is) different from the way it appeared to us in the primary taste phase. This is why it is perfectly natural to say that the stew (say) tasted bland at first, but then revealed its blasting umami side, even when we are only talking about experiencing one single mouthful, rather than a number of spoonfuls.

Notice that for the experience to appear epistemically as one, temporally extended, complex experience of the very same food item, it is crucial that the transition from the primary taste phase to the aftertaste phase is part of the overall phenomenology, if not in full focus of attention. We have to be phenomenally aware of the food changing from tasting such-and-such to tasting thus-and-thus (or keeping on having that such-and-such taste). If for some reason we do not attend *at all* to this transition, then it is not clear that the aftertaste experience would still qualify as an awareness of the way the food that I had in my mouth tastes now. In that case, the aftertaste may even appear, akin to an afterimage, "not real", as pure sensation. Imagine yourself happily diminishing an enticing little sandwich when suddenly the piercing, demanding squeak of a hungry guinea pig distracts you and captures all your attention. After you regain your attention for what you were doing, you might "find yourself" with a weird taste in your mouth. It is slightly sour and almost minty, but very different from the taste you experienced when you were chewing the sandwich. Where does it come from? You can of course *infer* that it is an aftertaste of the sandwich? filling by excluding other sources (I am not sick. I have not ingested taste-altering drugs. I am not hallucinating), and you can confirm this hypothesis by enjoying (or undergoing, at any rate) another aftertaste experience with the next bite. But without awareness of the continuity, something (the "after" in "aftertaste" one is tempted to say) is missing.

There are two problems for this solution to the puzzle. The first problem is that an appeal to the phenomenologically unifying role of the specious present structure of gustatory experiences can only explain why we take aftertaste experiences as reliable indicator of qualities of the food, rather than as a purely sensorial epilog or “coda” to the way food has appeared to us in primary taste. But, as we have pointed out already, there are good reasons to think that aftertaste *is* actually reliable, it does reveal to us properties of food (such as its dangerousness in the case of certain unpleasant aftertastes) that are independent from its being experienced, and an appeal to the phenomenology is at best a very partial explanation of this. If something seems epistemically reliable that may be a *prima facie* evidence that it is reliable, but it cannot be the end of the story.

Now, maybe we could be content with this account nonetheless. The “exceptionality” of aftertastes as aftersensation could entirely reside in their having an appearance of epistemic reliability—regardless of the fact that there may also be independent reasons to take them as actually reliable with respect to certain objective properties of the food. After all, afterimages do not seem to share this phenomenal trait, or at least not to the same extent. Maybe Philipps or some other purists are right and afterimages are not pure sensations either, but there are still many more “phenomenal defeaters” in the case of afterimages, features that make us subjectively doubt the epistemic reliability of afterimages, than in the case of aftertaste. Moreover, there is no doubt that afterimages are for the most part illusory, and unless in very unfavourable circumstances we do not tend to take them as otherwise.

Unfortunately this will not do. If we are content with explaining the phenomenal difference between aftertastes (experienced as representations of public features or objects out there) on the one side, and afterimages on the other side (at least not obviously experienced as public features or objects), then an appeal to the specious present is of no use, because it overgeneralises. There is no reason why the transition from primary visual percept (let’s call it, the *primary image*) to an afterimage could not also occur within one phenomenally unified specious present episode. To the contrary, it does so occur normally. If aftertastes seem epistemically reliable due to the phenomenal

diachronic unity of our temporally extended experiences, then the same should hold true, at least to some degree, for afterimages. Of course we might appeal here to the plethora of phenomenal defeaters we find for afterimage but not aftertaste experiences—the ephemerality, the lack of kinetic independence, the lack of size constancy and so forth (cf. Phillips 2012). Still, if phenomenal diachronic unity was the core reason for the epistemic reliability of aftertaste, even if just subjectively, one would expect the same criterion to carry more weight for the subjective reliability of afterimages too.

But it clearly does not. We do not have any tendency at all to construe an afterimage as a way the distal stimulus *that was seen* is experienced *now*. An afterimage of a flash in our eyes is not a way the flash that almost blinded us looks now. An afterimage of the US flag in complementary colours that I see on a white page is not the way the picture of the flag initially perceived (in its usual colours) looks *now*. Even when we clearly recognize the similarity with the original image (it has the same shape and flutters a bit on the right), afterimages simply do not seem to present us with further, initially somehow “hidden” properties of the original object perceived. And notice that purists do not have to deny this. Even if afterimages are illusory presentations of material objects, they do not need to be presentations of the very same “object source” (that is the external stimulus that originates the corresponding primary image).<sup>14</sup>

## **5. AGAINST THE RECEIVED VIEW: AFTERTASTES ARE NOT AFTERSENSATIONS**

If aftertaste experiences are different from afterimage experiences because they seem and are (more) epistemically reliable, then maybe the difference between the two is deeper, and we should not put them in the same basic category. Afterimages are aftersensations, they are experiential ‘spandrels’ with little epistemic significance, whereas aftertastes are experiences that,

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<sup>14</sup> This is even clearer for Philipps’ version of purism, in which afterimages present light phenomena, and not concrete objects as often the “object source” are.



even if they too depend on a primary percept (in the way illustrated by THE CAUSAL PATH TO AFTERSENSATIONS in section two), reliably add information about source objects.

It is hard to deny that there are situations in which aftertastes reliably signal objectively obtaining state of affairs, independently of how objective that signalling seems to us. An unpleasant aftertaste in milk is usually a sign of its dangerousness for our health, and even if (some of us) may appreciate a bitter aftertaste in craft beer and coffee, bitterness as it is revealed in aftertaste (and sometimes only in aftertaste) can be a sign of a poisonous element. But for an experience being a dependable signal of some mind-independent state of affairs is for it to be reliable; hence — given that revising the idea that aftersensations in general are not reliable seems explanatorily costly, as we have seen — the more radical solution is the only way to go. Aftertastes are not aftersensations, they simply have a feature in common with aftersensations (they, too, appear after the stimulus has ceased).

Now, aftersensations are not always epistemically idle. Although when by misfortune (or sheer stupidity) one takes them to veridically represent the object of one's primary experience, and in result misjudges many of that object's properties, we can think of unusual scenarios in which the information we get from an afterimage is useful, and it is so in virtue of its connection with the object source. For instance, imagine someone who has the misfortune to be kidnapped.

Locked in a bare room they have but a few moments to orientate themselves and memorize the layout of their confinement. Before all too long, they are blindfolded and, to add insult to injury, injected with some substance that is supposed to erase their entire short-term memory. It fails. Instead, it only erases from memory their most recent perceptual experiences. It seems to us that it would be worse for that person if the drug had worked properly— and not only for the obvious reason that it would have caused greater damage to them. For suppose that our poor kidnapping victim has no (perceptual) memory of the room they have just seen but still a vibrant afterimage of the visual experience; they may, from that afterimage, understand the shape and the relative

position of the window and even of the glaring metal door and use that information to navigate their escape.

However, the lack of systematicity in the way afterimages can usefully be exploited by an embodied cognitive system is a likely signal of the fact that they play a very different role than aftertastes. To illustrate this point, it may be helpful to refer to a contrast Louise Richardson draws between experiencing odours on the one hand, and experiencing rainbows on the other. According to Richardson,

(t)he visual system is not tuned to the presence of rainbows as the olfactory system is tuned to the presence of odours. Rainbows are perceived merely as a side effect of a system devoted to the direct perception of ordinary objects. (Richardson, 2018: 22).

In our comparison, odours are likened with aftertastes and rainbows with afterimages. Employing Richardson's point further, we might say that our cognitive systems are tuned to the presence of aftertastes because aftertastes are instrumentally valuable in providing us with further information about their sources. The reason why this is so may be evolutionary (bitterness in nature may be a symptom of poisonousness, and it is advantageous that an animal has a surplus of resources to detect it). Afterimages, on the other hand, are merely 'a side effect of a system devoted to the direct perception of ordinary objects' (ibid.), in other words, an evolutionary spandrel.

The difference in the role of afterimages and of aftertastes for the subject is plausibly reflected by some physiological difference between the IP's (the internal processing constitutively responsible for the quality of the aftersensation) in the two cases. We will not go too much further at this point since we are rapidly moving into empirical terrain. However, looking at some evidence from empirical research, the hypothesis that a difference in IP'-afterimage and IP'-aftertaste

explains the epistemic disparity, seems not outlandish. Phillips for example, drawing on various empirical findings,<sup>15</sup> writes that

“There is now substantial evidence that afterimages cannot solely be accounted for as photochemical process (...). Rather, at least under certain experimental conditions, neural adaptation in the retina forms an essential process.” (Phillips 2012: 421)

Now consider the following quote by psychologists Naim, Nir, Spielman, Noble, Peri, (et al.) about aftertastes:

“In the context of aftertaste, *the combination of both receptor-dependent and receptor-independent processes* have been proposed to explain the signal transduction mechanisms for foods with distinct aftertastes, particularly those that are bitter.(...)The receptor-independent process involves the diffusion of bitter, amphiphilic chemicals like quinine across the taste receptor cell membranes, which activate both the taste receptors on the cell surface, as well as the signaling pathway proteins in the intracellular space. *Intracellular signaling may be slower than taste cell receptor activation (...). This delayed activation of intracellular signaling proteins in response to the bitter compounds*, in addition to the extracellular receptor signaling *is proposed to be related to the lingering aftertaste* associated with bitter foods.” (Naim M, Nir S, Spielman AI, Noble AC, Peri I, et al., 2002: 2-17, our emphasis).

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<sup>15</sup> Specifically, [Loomis 1972] and [Virsu and Laurinen, 1977].

In both cases, there is talk about receptor-independent processes (in the first quote these would be the processes other than the photochemical ones). For aftertaste, however, this process is described as a delay in the activation of certain signalling proteins. It seems to us that a delayed processing of a stimulus is still a processing of that stimulus. Although this process is in some sense more remotely connected to the distal stimulus than the process that generates the primary taste, it can still reliably connect with the source object. The idea here is that IP'-aftertaste are processes that are intrinsically reliable with respect to certain aspects of the stimulus—for instance its bitterness. At any rate, if IP'-afterimage do not have the same intrinsic characteristics, and are thus less able to reliably track features of the external stimulus, then they are mere “echos” — possibly distorted ones — of the original experience, and should fall in a different category than the one in which we put aftertastes.

Our second suggestion as to why aftertastes are epistemically more reliable than afterimages, and thus should not be classified as belonging to the same category, is probably in equal parts more important and more daring than our first suggestion. We propose that aftertastes are epistemically more reliable than afterimages because they are, to large extent, constituted by another genuine perceptual sense, namely the sense of ‘retronasal smell’. Smell, as psychologist Paul Rozin phrased it, ‘is not a single sense but rather a dual sense, comprising orthonasal (breathing in) and retronasal (breathing out) senses’ (in Shepherd 2012:17). Retronasal smell is nowadays recognized as the most important component for our awareness of flavour. Neuroscientist Gordon M. Shepherd for example argues that,

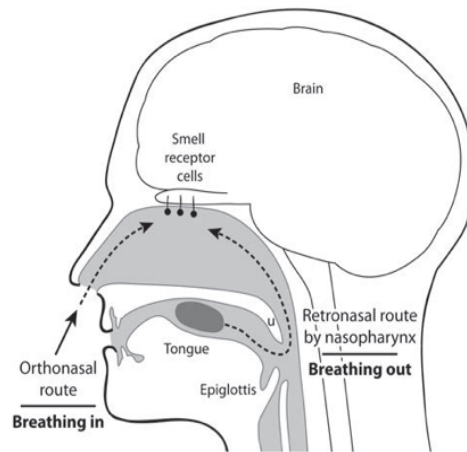
‘(a)s delivered by the retronasal route, smell dominates flavor. We often characterize our food in terms of how it “tastes,” but the sense of taste as properly defined consists of sensitivity only to sweet, salt, sour, bitter, and umami. What we call the taste of our food beyond these simple sensations should be called flavor and is mostly due to retronasal smell.’ (Shepherd 2012: 2-3)

Here is how Shepherd describes the physiological processes involved in retronasal smell:

‘The retronasal route to the smell organ begins with the food or drink that comes into the mouth. There the food is moved about by the tongue as it is chewed (masticated). (...) At the same time, the taste is sampled by the taste buds on the tongue and the back of the mouth and into the pharynx. **When the chewer exhales, air is forced from the lungs up through the open epiglottis into the nasopharynx at the back of the mouth. There the air absorbs odors from the food** that coats the walls and back of the tongue and that have volatilized from the warm, moist, masticated mass. **Because the mouth is closed, the odor- laden air is pushed into the back of the nasal chamber and out through the nostrils, sending eddy currents within the nasal chamber up to the olfactory sensory neurons to stimulate them.**’ (Shepherd 2012: 26, our intonation)

And then, particularly relevant to us,

‘(f)inally, the motor control of **swallowing takes over, and the (food) goes down to our stomachs (followed by our breathing out for a last enjoyment through retronasal smell)**. (Shepherd 2012: 186, our intonation)



**FIGURE.2** The head of a human

The arrows show the pathways in humans for sniffing smells by the orthonasal route and for sensing smells from the mouth by the retronasal route. (Shepherd 2012: 25)

While retronasal smell is crucial to the primary flavour experience, we argue here that it plays an even more decisive role for aftertastes. More precisely, we are arguing that the impingement of the olfactory system by volatile aroma molecules through retronasal smell is a (temporally) second genuine perceptual input that carries additional first-hand information about the eaten food. In other words, the quality of aftertaste is constitutively determined by *two different proximal stimuli*: indirectly, via the primary taste, by the molecules in the saliva that excite the taste buds and directly by the molecules that pass through the retro-pharynx to excite the olfactory nerves. Aftertaste, thus, seems to be a more complex phenomenon than aftersensation; its causal path is “richer”. The second input provides a distinguishing contribution to IP’ and thus to the qualitative profile of the aftertaste experience. We can schematise this idea as follows:

#### THE CAUSAL PATH TO AFTERTASTE

$$DS \rightarrow PS$$

$$PS + IP \rightarrow PP$$

$$PP + \text{secondary input from retro-smell (RS)} + IP' \rightarrow AT$$

By swallowing the food the air is pushed in the nasopharynx, and thus aftertaste inevitably includes retronasal smell. And given that retronasal smell is part of the IP' that leads to the aftertaste experience, the contribution of the second perceptual input RS is *constitutive* of the experience. Now, if retronasal smell is a means to an epistemically direct contact with the object source (the food), then it should be no surprise that the aftertaste experience is after all a *reliable* source of information about the food that is the topic of the gustatory experience as a whole. While aftersensations such as afterimages are constituted by an IP' that does not benefit of a further channel of information from the external stimulus, since it is entirely triggered by the first elaboration of the stimulus, aftertaste depends also on a second input from the food, namely the molecules that impinge on the olfactory receptors through the retronasal route.

Recall that we started this article with some definitions of aftertaste as given by prominent psychology references. These quotes define aftertastes as sensations 'persisting after the cessation of the stimulus'. This might seem problematic in the context of our proposal since we are arguing that there is a stimulus that is directly responsible for the quality of the aftertaste. Rest assured, though, it is not our intention to boldly dismiss definitions built on decades of solid empirical work. But our argument is in fact compatible with such definitions: while there is some stimulus present and involved in the generation of the aftertaste, the *taste* stimuli, the molecules that excite the *taste buds*, have indeed ceased once the food is swallowed (at least we can assume that there are cases where there may really no such stimuli left but aftertaste still occurs).

This explains also why aftertastes are, more often than not, qualitatively different from primary tastes. The perception of retronasal smell is usually mingled with taste and touch. As Shepherd (2012: 117) observes, 'retronasal smell is never sensed by itself, but always together with virtually every other sense in the mouth.' Never, except in aftertaste when all the food has been swallowed. So where flavour is a combinatory experience of taste, touch, orthonasal and retronasal,

aftertaste is a comparably impoverished experience which has as direct perceptual input merely the retronasal aspects left.

Why then, one might ask, would aftertaste be labelled as a kind of taste at all? Flavour, Shepherd writes, and we might extend this to explicitly include aftertaste, is ‘not (...) recognized by us as coming from the nose. Rather it is perceived as coming from the mouth.’ (2012: 30). And Charles Spence confirms that we are, most of the time, ignorant of how much information that we think we taste with the tongue comes in via the retronasal route. This is due to a phenomenon called ‘oral referral’: the phenomenon that food aromas are experienced as if coming from the mouth. (cf. Spence, 2017:51). If that is true for primary tastes, then there is no obvious reason why the same phenomenon should not also be responsible for experiencing *aftertastes* as tastes rather than smells. We can now see, moreover, why aftertastes might have been lumped together with afterimages into the category of aftersensations in the first place. Our experience of aftertaste as taste rather than smell has made us focus more on the fact that there are no stimuli anymore to excite the taste buds when aftertaste occurs, rather than on the other fact that there are nevertheless still olfactory stimuli present which are also responsible in creating the sensation. In the end, the problem might be one of mouth over nose bias.

## **6. CONCLUSION**

While afterimages are connected to their distal stimulus only as byproducts of the perceptual process, and have a somewhat eerie appearance, aftertastes have the mark of phenomenal objectivity and provide us with valuable information about the food that was just in our mouth. We have given an account of this difference, which has led us to reject the received view according to which aftertastes and afterimages belong to the same category of aftersensations. Epistemically, metaphysically, and physiologically, aftertastes have a distinct profile and a distinct function from afterimages. Theoretical and empirical investigation should take such differences seriously, otherwise we risk underestimating the role of aftertaste in gustatory experience.



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