

# Olfactory Objects

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DOI: 10.2478/disp-2014-0003

BIBLID [0873-626X (2014) 38; pp. 45-66]

## Abstract

The philosophy of perception has been mostly focused on vision, to the detriment of other modalities like audition or olfaction. In this paper I focus on olfaction and olfactory experience, and raise the following questions: is olfaction a perceptual-representational modality? If so, what does it represent? My goal in the paper is, firstly, to provide an affirmative answer to the first question, and secondly, to argue that olfaction represents odors in the form of olfactory objects, to which olfactory qualities are attributed. In order to do this I develop an empirically adequate notion of olfactory object that is sensitive to the peculiarities of olfaction, and defend it against various objections.

## Keywords

Olfaction, olfactory experience, representationalism, subjectivism

## 1 Introduction

We hold our olfactory experiences in great esteem. We spend a considerable amount of time and money perfuming our clothes, our homes, and ourselves. We find great pleasure in the kind of olfactory experiences we have when we hold a glass of fine wine against our noses, or feel the aroma of freshly brewed coffee in the morning. A certain smell can bring powerful memories from the past and create long-lasting emotional associations, while an unpleasant smell can make us feel immediately uneasy, with an overwhelming urge to get away from the malodorous source of the smell.

And yet, in spite of the great importance assigned to olfactory experience in everyday life, many questions in the philosophy of olfaction remain unanswered. In particular, is olfaction a perceptual-representational modality? Or should we understand olfactory experiences in the model of *sensations*, i.e., as non-perceptual, non-



representational sensory states with no intentional objects of their own? Moreover, if olfaction is a perceptual-representational modality, what does it represent? Does it represent odors in the form of olfactory *objects*, to which qualities like ‘musky’, ‘rosy’ or ‘minty’ are attributed? Or does olfaction merely represent the instantiation of free-floating olfactory qualities like ‘rosy’ or ‘fruity’, that are not attributed to any odor in particular?<sup>1</sup>

These questions remain hotly debated topics in the philosophy of olfaction. Regarding the first, many philosophers remain unconvinced that olfaction is a perceptual-representational modality, to be treated in the same model as vision (Peacocke 1983, Perkins 1983, Chalmers 1996). According to a popular argument in favor of this view, the phenomenology of olfaction calls for a theoretical treatment in the model of *sensations*, rather than perceptions directed at something external to the subject.

Moreover, even if we grant, for the sake of argument, that olfaction is a perceptual-representational modality, it is still not clear what it would mean for it to represent odors as olfactory objects. One popular argument against this view is based on the observation that we cannot, on the basis of olfaction, spatially discriminate odors from one another (Matthen 2005, Clark 2000, Batty 2010). Odors do not have definite sizes, and do not occupy determinate locations in the space around us. But as many philosophers have argued, genuine object representation presupposes a capacity for spatial differentiation and tracking (Shoemaker 1996, Campbell 2007, Siegel 2006a). Therefore, the poor spatial character of olfaction suggests that odors are not represented in olfaction in the form of olfactory objects. If

<sup>1</sup> These two views are not meant to exhaust all possible options. Another possibility would be to hold that olfaction represents *sources* of odors, objects that typically give off smells such as roses, basil leaves or wet dogs. There are, however, notorious difficulties with this view. For once, it would make all our experiences of rosy smells that are not caused by the presence of roses falsidical, but this seems wrong. When we smell a bottle of rose oil, there is nothing wrong with our noses, and we are not under any kind of olfactory illusion: we accurately smell a rosy odor in the air, as we should. As no one, as far as I know, has seriously defended the view that olfaction represents sources of odors, I will not consider it in this paper (see Lycan 1996, Batty 2010, Perkins 1983 and Richardson 2013 for further arguments against this view).



olfaction has a representational content at all, this content must have an objectless structure (Batty 2010). This argument remains one of the biggest challenges to the claim that olfaction represents odors as olfactory objects.

In this paper I will provide an answer to this argument, and elucidate the sense in which odors are represented in olfaction as olfactory objects. First of all, the criteria for object representation sketched above presuppose a highly visuocentric notion of ‘objecthood’, based on the kinds of solid, opaque, three-dimensional material objects we encounter in visual experience. But that is hardly relevant for a sense modality like olfaction. If olfaction represents olfactory objects, it is surely not because these objects are presented to us in experience as spatially discriminated entities. Rather, I’ll suggest that the relevant criterion for individuating olfactory objects is *chemical structure*. Our olfactory system is naturally tuned to recovering certain chemical structures amidst all the chemical compounds that arrive simultaneously at the nose, thus representing each of these recovered structures *as* an odor, which is an olfactory object. Moreover, I shall argue that there are two good reasons to postulate olfactory objects:

First of all, the object-attribute structure of olfactory contents capture very well certain experiences of smelling, where we focus on a certain smell and come to notice some of its subtler tones. Objectless contents, as I will argue, do not adequately capture these experiences. Secondly, olfactory objects serve to mark an important psychological ability attributed to the olfactory system, whereby it is able to discount idiosyncratic variations in chemical stimulation in order to focus on the more stable chemical properties of the distal odor itself, which is represented *as* an olfactory object that stays constant even as proximal stimulation changes. This makes the notion of olfactory object very useful in theorizing about olfaction and olfactory experience.

The structure of the paper is as follows. I will start by introducing a view I will call **subjectivism**, which argues, on the basis of phenomenological observations, that olfaction is not a perceptual-representational modality (Chalmers 1996, Perkins 1983). I will then borrow an argument from Louise Richardson (2013) in order to show that phenomenological considerations alone do not support a subjectivist conclusion. As an alternative, in section 3 I will discuss



**representationalist** views, according to which olfactory states are genuinely perceptual, representational states with semantic properties of their own. Representationalism can come in two forms: object-based views (Lycan 1996/2000, Tye 2002), which postulate odors in the form of olfactory objects in the contents of olfaction, and objectless views (Batty 2010), which take the contents of olfactory states to have an existentially quantified, objectless structure.

My final conclusion will be that object-based representationalism is true of olfaction, although the arguments adduced in its favor by Lycan and Tye will be shown to be less than satisfactory. But before defending this view I will consider in section 4 one powerful objection against it, raised by Tyler Burge (2010): according to Burge, there is no explanatory gain in positing perceptual representations of odors. We should only posit perceptual representations if there is need to distinguish what is proximally registered by the organism's sensory systems from what is supposedly represented in the organism's perceptual state. But since we have no need to draw this distinction in olfaction, we should not take olfaction to be a perceptual-representational modality.

But this objection can be met. In the last and final section of the paper, I will appeal to empirical data in order to argue that we *do* need to posit perceptual representations of odors in olfaction. Most odors we experience are complex mixtures of many different odorants, and are usually delivered to our noses along many other odorants and compounds. In order for us to have an experience *as of* a particular odor, the olfactory system needs to extract a very complex blend against a background of irrelevant odorants, and represent it as the same odor despite idiosyncratic variations in chemical stimulation. Thus, contrary to what Burge supposes, we do need to distinguish proximal registration of odorants from perceptual representations of odors. We do need, after all, olfactory objects: an odor representation that stays constant even as proximal stimulation changes.

## 2 Subjectivism

Many philosophers have argued that it would be wrong to take olfaction as a perceptual-representational modality. According to what we may call **subjectivism**, the most accurate way to characterize



olfactory states would be in terms of unstructured sensations of odor qualities like ‘musky’, ‘rosy’ or ‘minty’, that may call up memories or cause certain emotional states, but that do not represent anything. Olfactory experience in this view does not attribute qualities to anything other than itself. These qualities are properties of experience, something internal to the subject (hence the term ‘subjectivism’).

The main argument in favor of subjectivism is phenomenological. According to the subjectivist, olfactory experience does not reveal that the qualities we smell are qualities of something external to us. Rather, we experience these qualities as qualitative modifications of our own consciousness, something that happens within us. Take, for example, an experience of a rosy smell; if we abstract away from our visual and/or tactile experience of a rose, and from our background knowledge that this kind of olfactory quality is typically caused by the presence of roses, the smell itself does not seem to be a stable property of an external object that would continue to exist unperceived. As Chalmers puts it, ‘smell has little in the way of apparent structure and often floats free of any apparent object, remaining a primitive presence in our sensory manifold’ (Chalmers 1996: 8).<sup>2</sup>

Moreland Perkins agrees (1983). On the basis of similar phenomenological observations, Perkins argues that what we become aware of in olfaction is not a sensible quality of an external object like an odor or its source. Rather, we become aware of a qualitative feature of our own experience, of its distinctive phenomenal character. ‘*It smells rosy*’, in this picture, should be glossed as: ‘*my experience has a rosy-like olfactory character*’. Therefore, Perkins concludes that it would be wrong to adopt a realist perspective *vis-à-vis* olfactory qualities: they aren’t properties of things in the world, they are dispositions in us to have experiences of certain distinctive kinds (Perkins 1983, ch. 3).

It is hard to deny that subjectivism has some initial appeal. Historically, olfaction has always been considered to be a more subjective sense modality, more naturally associated with unmediated affective

<sup>2</sup> Peacocke (1983) also suggests something along similar lines, when he writes: ‘a sensation of smell, by contrast [with visual perception], may have no representational content of any sort, though of course the sensation will be of a distinctive kind’ (Peacocke 1983: 5).



responses and memory associations than with perceptual knowledge about the external world, as vision has always been.<sup>3</sup> This affective and mnemonic dimension suggests a picture of olfaction as a sort of ‘inner’ window onto the self, a direct link to our most primitive and unmediated affective responses, rather than a form of epistemic ‘openness’ to the external world.

This view seems to be supported by empirical evidence. Studies with anosmic patients, i.e., people who have completely lost their sense of smell, reveals how crucial olfaction is in making us feel ‘at home’ in the world, providing an affective background against which conscious experience takes place (Van Toller 2000). After losing their sense of smell these patients feel lost, unmotivated, and eventually exhibit signs of severe depression. It is as if their experiences had no ‘color’ anymore, as if they could no longer fully connect to the world they inhabited. These observations suggest a more subjectivist picture of olfaction: one where olfactory states function as an affective background against which conscious experience takes place, rather than representing something external to the mind. Olfaction looks inwards, so to speak, not outwards.

But of course, there is nothing here a representationalist needs to disagree with. No one denies that there is an important affective, subjective dimension to olfaction, but that need not be incompatible with the claim that olfaction is a genuine perceptual-representational modality, whose function is not only to tell us of our own internal states but also to inform us about the current state of the world around us. Furthermore, it is far from clear that this subjectivist, ‘inner-looking’ picture of olfaction is something we can get out of phenomenological reflection alone. When the subjectivist claims that a smell is nothing but a ‘primitive presence in our sensory manifold’, she is in fact ignoring an important dimension of olfactory experience. As Louise Richardson (2013) correctly points out, our conscious olfactory experiences are typically accompanied by an experience of *sniffing*, a feeling of ‘taking in’ the air from the outside as we breathe. As Richardson argues, when we say we have an experience of smelling freshly brewed coffee, this is more than an

<sup>3</sup> See Le Guérer 2002 for a historical overview of olfaction in philosophy, psychology and psychoanalysis that provides support for this claim.



introspective report of a qualitative change in us. This is also a report on what things are like in our external environment, that something ‘out there’ bears this olfactory quality. For we only sense the smell of coffee when we actively bring in the air from our external environment by sniffing. The coffee-like quality that characterizes our experience is a quality of something that was lurking in the air around us, and is now coming into our bodies through our noses. If this is an experience we want to avoid, all we need to do is temporarily cut the airflow in our noses by holding our breath, thus preventing the air from coming in.

There is, in other words, an important *exteroceptive* element in the phenomenal character of conscious olfactory experience, provided by the experience of sniffing, of ‘taking in’ the air from outside. The subjectivist can only make her case by ignoring this element of conscious olfactory experience. But once we see that we cannot abstract the experience of sniffing from a complete characterization of (typically) what it’s like to smell, the phenomenological case for subjectivism is considerably weakened.

Granted, there are some answers available to the subjectivist to resist Richardson’s arguments. She could, for example, hold that the experience of sniffing is not strictly speaking an element of *olfactory* experience, but a *tactile* sensation, caused by airflow in the nasal cavities. Although one could hold such a view, I agree with Richardson that it would involve some substantial commitments concerning the individuation of sensory modalities, which are highly controversial (2013: 412-14). So if the subjectivist can make her case only on the basis of these controversial commitments, her case is also weakened.

But regardless of our final verdict on the issue, my aim in this section was merely to cast some doubt on the sort of phenomenological observations the subjectivist appeals to in order to make her case. As far as phenomenology is concerned, there are other data we may appeal to in order to mount a case against subjectivism, as Richardson has shown us. Therefore, it is far from clear that this question will be settled on phenomenological grounds alone. But as we shall soon see, there are other good, independent reasons for representationalism, which concerns the role of olfactory representations in accounting for certain facts about olfactory experience and olfactory processing. These will be spelled out in more detail in sections 3 and 5 of the paper respectively.



### 3 Representationalism

While the arguments in favor of subjectivism remain controversial, the most plausible theoretical alternative is **representationalism**. According to the representationalist, olfactory states are genuinely perceptual, representational states with semantic properties of their own, which function to tell us something about our external environment. Olfactory experience, in this picture, does not merely tell us that qualities are instantiated; it tells us that these qualities are instantiated *out there*, in the world, an experience that may be true or false, accurate or inaccurate according to how things really are out there.

But if we move towards representationalism, one question that immediately arises concerns what it is exactly that olfaction represents. According to **object-based** representationalism, olfaction represents odors in the form of olfactory objects, which bear the olfactory qualities we experience. One supporter of an object-based view is Michael Tye (2002). Although Tye's primary concerns are not with a philosophical theory of olfaction, he does provide some brief remarks in that direction, which suggests a phenomenological argument in favor of object-based representationalism. 'When we introspect our experiences of hearing, smelling, and tasting,' Tye tells us, 'the qualities of which we are directly aware are qualities we experience as being qualities of sounds, odors, and tastes' (Tye 2002: 142). Although he does not develop this point in more detail, we can propose an argument in favor of object-based representationalism roughly along these lines:

When we have a certain olfactory experience of a coffee-like quality, we feel this quality to be instantiated by something in our external environment, as we actively bring in the air from outside into our bodies by sniffing. But the things out there that carry the chemicals responsible for the olfactory qualities we smell are odors. Therefore, if experience represents olfactory qualities in 'the air outside us', it represents them as qualities *of* particular odors. This also seems to be Lycan's argument in favor of object-based representationalism, when he writes:

Consider what an *odor* is, in the public sense of the term. It is a vaporous emanation, a diffusing collection of molecules typically given off



from a definite physical source. It is itself a determinate physical thing that makes physical contact with the smell receptors in one's olfactory epithelium and sets them to firing. Moreover, there is nothing arcane about this. We are publicly and commonsensically aware of odors; they are public physical entities available for sensing by anyone who, fortunately or unfortunately, happens by. (...) Now *odor* is a candidate for the representatum (...) perhaps, then, smells represent odors (Lycan 1996: 146).

Now, as a metaphysical characterization of odors, the passage above is acceptable. However, it can hardly count as an argument for object-based representationalism. To be sure, no one would deny that odors are *in fact* the things we come in contact with in olfaction, as vaporous emanations that bring to our noses the volatile chemicals responsible for the smells we experience. But it does not follow from this claim that olfaction represents odors as bearers of the olfactory qualities we smell. It is one thing to say, with Richardson (2013), that olfactory qualities are presented as instantiated by something in the air outside us, and quite another to say they are presented as attributes of particular odors. The latter is a more substantial claim, which needs to be argued for. But Tye's and Lycan's observations do not seem to take us far enough.

Philosophers like Austen Clark (2000), Mohan Matthen (2005) and Clare Batty (2010), for example, have argued that if odors were presented in olfaction as olfactory objects, they should be presented as individual entities spatially differentiated from one another; and that we should be able, on the basis of olfactory experience, to pick out and perceptually track one of these objects as opposed to another. As Shoemaker puts it,

Sense perception affords 'identification information' about the object of perception. When one perceives one is able to pick out one object from others, distinguishing it from the others by information provided by the perception, about both its relational and its nonrelational properties. The provision of such information is involved in the 'tracking' of the object over time, and its reidentification from one time to another. (Shoemaker 1996: 253)

But olfactory properties are not presented to us like that. If I smell something smoky, and then come to smell something minty, olfactory experience does not tell me if there is a single odor that is both smoky and minty (as the odor of a mint-flavored cigar that has been lit in the room), or if there is one smoky odor and one minty odor (as



the odor of a mint-scented air freshener which has been sprayed in the room after a cigar has been lit) (Clark 2000: 79). For *where* would the minty odor be, as opposed to the smoky one? And how can I perceptually track one odor rather than the other? These questions are meaningless in olfactory experience. All I get from experience are free-floating olfactory qualities: ‘minty’, ‘smoky’, and so on (Matthen 2005: 284). Differently from vision and even audition, olfaction has a very poor spatial character, and it does not seem to provide us with ‘identification information’ about odors, as Shoemaker would put it. Therefore, according to this line of thought, objectless contents seem unavoidable if we want to be true to the phenomenal character of olfaction.

In this spirit Batty proposes her ‘abstract content view’ (or ‘objectless’ view), where the content of olfactory states are expressed with an existentially quantified structure that tells us that olfactory qualities are instantiated at some undifferentiated spatial location *all around the subject* (Batty 2010). This structure seeks to capture the phenomenological observation that olfactory qualities are always presented together in the air around us, and not as properties of one particular odor or another. In this picture, an experience of minty and smoky olfactory qualities would have a representational content like:

OLF EXP:  $\exists x (x \text{ is minty} \ \& \ x \text{ is smoky} \ \& \ x \text{ is at } L_0)^+$

This general structure, with only one quantifier and one undifferentiated location ‘all around the subject’ ( $L_0$ ), is supposed to capture all the richness of experience through the possibility of adding as many represented qualities as we like inside the parenthesis. At the same time, the phenomenological observation that these qualities are experienced as spatially undifferentiated is respected by keeping  $L_0$  as the only location referred to in the content of this experience, comprising the entirety of the olfactory field. This experience will be veridical if there is really something out there that smells minty and smoky, and false otherwise — in case the subject is victim of the kind of olfactory hallucination seen in clinical cases of *phantosmia*, where patients have recurrent olfactory experiences in the absence

<sup>+</sup> From Batty 2010: 530.



of external stimulation (Cowart & Rawson 2005).

But is it true that these contents can really capture ‘all the richness of experience’? It doesn’t seem so. To see why, imagine for example that you are quietly working in your office, when a delicious smell comes into the room. You sniff profoundly, and come to recognize it as grilled eggplant. According to Batty, the content of your experience would be captured by a structure like:

OLF EXP 1:  $\exists x (x \text{ is eggplanty} \ \& \ x \text{ is at } L_0)$

But suppose that for some reason you become interested in this smell. You want to know more about it. You focus your attention on it, and start to notice some of its subtler notes and tones. There is a sweet tone to it, and perhaps also something earthy. You have adopted a different perspective in relation to the smell, where you consciously try to sense its subtler qualities and tones.<sup>5</sup> But how can we capture this experience in Batty’s view? With the theoretical tools at our disposal, the only option would be to add these further qualities to ‘the air around us’, leaving us with a content like:

OLF EXP:  $\exists x (x \text{ is eggplanty} \ \& \ x \text{ is sweet} \ \& \ x \text{ is earthy} \ \& \ x \text{ is at } L_0)$

But this does not seem right. As formulated, this content fails to capture the sense in which the sweet and earthy qualities you smell are qualities *of the eggplant odor*, which you notice when you focus your attention on the smell in this manner. They are not just qualities in the air, presented to you alongside the eggplant quality; rather, they are subtler tones *of the eggplant smell*.

To make this point clearer, imagine that as you are noticing the subtler tones of the eggplant smell you notice another smell in the air, which you recognize as sweet potato pie being baked in the oven. According to Batty the contents of your experience would be something like:

OLF EXP:  $\exists x (x \text{ is eggplanty} \ \& \ x \text{ is sweet} \ \& \ x \text{ is earthy} \ \& \ x \text{ is sweet-potato-y} \ \& \ x \text{ is at } L_0)$

<sup>5</sup> This change of perspective is something very familiar to wine tasters and perfumers, who need to break a smell apart and notice some subtler tones that inexperienced smellers have more trouble noticing (Lawless 1997).



But now imagine that you focus your attention on the smell of sweet potato pie, and come to notice some of *its* subtler qualities, which are also presented to you as sweet and earthy tones. If we follow Batty the contents of this experience would be exactly the same as the content of the previous experience, when you focused on the qualities and subtler tones of the eggplant smell. But these are different experiences, with different phenomenal characters. Focusing on an eggplant smell and noticing its sweet and earthy tones, while there is also a smell of sweet potato pie in the room is different from focusing on the smell of sweet potato pie and noticing its sweet and earthy tones, while there is also a smell of grilled eggplant in the room. Batty's theoretical apparatus seems unable to distinguish between these two experiences.

In order to acknowledge the difference between these two cases we need something else in addition to existentially quantified properties and reference to an undifferentiated location  $L_0$ . What we need is an odor, an *olfactory object*, that could bear the different qualities one comes to notice when one focus one's attention on it. Once we allow olfactory objects in the contents of olfactory experience, the experience of focusing on the eggplant smell and noticing its sweet and earthy tones could be captured in terms of a structure like:

OLF EXP: ([grilled eggplant]<sub>sweet, earthy</sub>)

The linguistic material inside the brackets stands for a repeatable type, that marks a psychological ability attributed to the olfactory system: to recover from all the chemical compounds that arrive at the nose, the familiar chemical structure of the odor recognized as a 'grilled eggplant' odor. This is so regardless of the linguistic material we choose to put between the brackets. As Howes 2002 has shown, the linguistic labels people attach to odors are highly idiosyncratic, so how we choose to express this content in linguistic form is not important. The olfactory object between brackets is posited in order to mark an ability of the olfactory system, to segregate a certain chemical structure from a background of chemical noise. In the example above the olfactory object was classified as a 'grilled eggplant' odor, but it could easily have a different linguistic label ('grandma's summer eggplant'), or no label at all (you recognize it as an odor you have experienced before, but you are incapable of applying a linguistic label to it).



When your olfactory system represents this odor, you are in a position to focus your attention on it, and notice some of its subtler tones. This odor may also bring up childhood memories of summer barbecues by the lake, which give you a feeling of peace and relaxation. If you then come to notice a smell of sweet potato pie alongside the eggplant smell, according to the picture I am suggesting we would now have a different olfactory object, which we could incorporate into the content of your experience in the following manner:

OLF EXP: ([grilled eggplant]<sub>sweet, earthy</sub> & [sweet potato pie])

If you now focus on the smell of sweet potato pie and notice its sweet and earthy subtler tones, the contents of your experience would be something like:

OLF EXP: ([grilled eggplant] & [sweet potato pie]<sub>sweet, earthy</sub>)

The difference between the two experiences can now be easily captured, in terms of a difference in the olfactory object to which these subtler qualities are attributed in experience: ‘grilled eggplant’ in one case, ‘sweet potato pie’ in the other. This move is not available if we adopt Batty’s theoretical apparatus, where all qualities are predicated of the same undifferentiated space ‘all around the subject’. These kinds of experiences motivate a view of olfactory contents structured in object-attribute form. When we focus on a smell in order to find out about its subtler qualities, we are not simply focusing on ‘the air all around us’; we are focusing on one odor among other in the room, which is represented in experience as an olfactory object.

There is, however, an obvious problem with this proposal: haven’t we seen before that the phenomenal character of olfaction speaks against odors being represented as olfactory objects, since we cannot not spatially distinguish one odor from another? Indeed we have, but this phenomenological observation simply begs the question against a modality with poor spatial character like olfaction. This argument presupposes a notion of ‘objecthood’ that is highly visuocentric, based on the kinds of solid, opaque material objects we encounter in visual experience, with edges and boundaries delimiting a specific spatial position or a traceable spatial trajectory. But it is clear that if odors are supposed to be represented in olfaction as



olfactory objects, it will not be because they are presented in experience as spatially discriminated entities.

Rather, what is relevant in the case of olfaction is *chemical structure*. Odors, in this picture, are type-individuated by their chemical structure, and it is the function of the olfactory system to recover these structures out of all the chemical compounds that arrive simultaneously at the nose. The output of this process is a (token) representation of an odor — an olfactory object — that characterizes the content of your olfactory experience. It is this odor what you recognize as an odor you have experienced before, and that you may come to recognize again in the future. For even if you encounter this odor again under very different conditions of chemical stimulation, i.e., mixed with other chemical compounds, as long as your olfactory system is functioning correctly it should normally be able to recover that same chemical structure and represent it as the same odor, which you may experience as a *grilled eggplant* odor again. That the odor is not presented to you as occupying a certain spatial location has no bearing on its status as an olfactory object.

There is, however, a more serious objection that can be raised against this view. As Tyler Burge has argued at length (2010), we should only posit *perceptual representations* if they have a non-trivial explanatory role to play in accounting for the organism's sensory state. If there is no need to distinguish information that is proximally registered in the organism's sensory systems from what is supposedly represented in the organism's perceptual state, talk of perceptual representations is explanatorily idle. In this case, we can fully account for the organism's sensory state in terms of low-level mechanisms of sensory registration. Let's call this **Burge's constraint** on genuine perceptual representations.<sup>6</sup>

Now, if the view sketched above is correct and olfaction indeed represents odors as olfactory objects, then we should naturally expect our analysis of odor representation to conform to Burge's constraint. But it is far from clear that it does. As we shall see in the next section, it seems that all we need to mention in order to account

<sup>6</sup> This constraint can also be found (although in slightly different formulations) in both Smith (2002) and Siegel (2006b). But since I will focus on Burge's version of it I will call it 'Burge's constraint'.



for the content of olfactory states are mechanisms of odorant detection at the olfactory bulb, which directly cause the organism to have a distinctive experience that corresponds to the odorant detected. Nothing is gained by saying these odors are *perceptually represented* by the olfactory system.

But this objection can be met. After explaining and motivating Burge's constraint in section 4 of the paper, in section 5 I will appeal to recent empirical studies that provide evidence for *olfactory constancies*, where the olfactory system is able to discount idiosyncratic variations in proximal stimulation in order to focus on the more stable chemical properties that characterize the represented odor. This suggests that odor representations do meet Burge's constraint after all, and that olfaction is a perceptual-representational modality.

#### 4 Burge's Constraint

Let's start by examining the case of the salmon discussed by Burge (2010). It is known that at about four years of age, the salmon returns to the stream where it originally molted, sometimes following an olfactory trail through the ocean over thousands and thousands of miles. It does so by detecting certain odor plumes in the water at certain intensities, which causes it to respond in a certain way: it orients itself in the direction of the sensed smell, and holds its course until the intensity starts dropping. At this point, it will start to zigzag again until the level of intensity detected rises, and so on. Should we take the salmon to *perceptually represent* these odor plumes? Here's Burge:

As the salmon case illustrates, the tasks solved by the homing capacity can be immensely complex. Yet such systems of sensory registration are not perceptual. The sensory contribution to behavior is fully explained by appeal to registration of proximal stimulation on the animal's surface. There are no operations for forming representation as of a specific environmental source of information. No spatial relationships are represented. Only the type of intensity of the proximal stimulus are sensed. Spatial location is determined by repeated sampling techniques. For the salmon, the direction and ultimately the location of the original molting site are ascertained by following up serially on the intensity of relevant proximal stimulation on one or another side of the animal's body (Burge 2010: 425-6).

In this passage Burge is pointing to a general constraint governing



the theoretical notion of ‘perceptual representation’: we should appeal to perceptual representations in psychological explanations only if we need them in order to distinguish what is perceptually represented from proximal stimulation registered in the organism’s sensory system. More precisely, an organism is credited with perceptual representations of *X* only if, by discounting proximal features that are merely perspectival, its perceptual system is able to focus on the more stable properties of the distal *X*, so that the organism might take on different perspectives on *X* and still represent it *as X*. In other words, only if *O*’s perceptual system is capable of applying *perceptual constancies* to proximal stimuli, maintaining the representation of *X* constant despite shifts in perceptual perspectives. This condition on genuine perceptual representations is what I call **Burge’s constraint**.

To make this point clearer let’s take the case of human vision, which is an excellent candidate for a genuine perceptual system. In order to explain how we visually perceive a uniformly colored red cube, it’s not enough to mention the patterns and spectral properties of light registered in the retina, since the mere registration of these features underdetermines the color we actually perceive. In fact, in order to explain how we perceive a particular red cube *as such*, we need to mention transformational principles that take the initial patterns of light and dark registered in the retina and generate a perceptual representation of a three-dimensional, uniformly colored red cube, that is perceived as the same throughout a period of perceptual tracking, from different perspectives and under different conditions of illumination.<sup>7</sup>

But now let’s consider the case of olfaction. There seems to be a kind of ‘directness’ in olfaction that distinguishes it from the way other sensory modalities process their stimuli. Indeed, there seems to be no space for olfactory *representations* to intervene, as opposed to sensory detection of odorants. In vision, for instance, although we perceive external material objects like tables and chairs, all we receive is light reflected from these objects, which must be transformed into meaningful perceptual units according to transformational principles hard-wired into the visual system by evolutionary

<sup>7</sup> See Palmer 1999, Bruce et al. 2003.



pressures. But what we inhale in olfaction are the actual molecules that have evaporated from their sources and found their way through the air into our nasal cavity, where they are picked up by our olfactory receptors and bound to specific kinds of proteins, determined by the chemical properties and three-dimensional configuration of these molecules. This *docking* process, as it is usually called in the cognitive psychology of olfaction, excites the nerve cells, causing electric signals to be sent to the olfactory bulb in a specific spatial pattern; these patterns correspond to the specific odors we are able to detect, giving rise to the correspondent olfactory experience (Coward & Rawson 2005, Savic 2001).

If the picture sketched above is correct, there is not much room for ‘olfactory constancies’ to be applied, no sense in which olfactory processing has to discount perspectival proximal stimuli in order to focus on invariant features of the external stimuli. In fact, as what is detected by our olfactory receptors is nothing other than the external stimulus itself – the actual molecules that have evaporated from their source and came in contact with our olfactory receptors – the notion of a *perspectival* proximal stimulus, distinct from its distal source, doesn’t make sense here. Even if we consider the subject’s movement towards or away the source of the smell as a sort of ‘olfactory perspective’, the only difference in stimulation this perspective shift would bring would be a difference in *intensity*, which is easily explained by a lower concentration of molecules in the air; but there is no proximal stimulation here to be discounted for the odor to be perceived as the same. In this picture, a certain olfactory experience arises when the molecules that compose the experienced odor are detected by our olfactory receptors, and a signal sent to the olfactory bulb. It seems that we are able to explain all there is to explain about our olfactory states and experiences with this very simple processing model. There is no need to posit representations of olfactory objects, distinct from what is sensorily registered at the olfactory bulb. Odors, therefore, do not appear to meet Burge’s constraint.<sup>8</sup>

This appearance, as I will argue in the next section, is deceiving. Empirical evidence shows that the olfactory system *does* apply

<sup>8</sup> See Burge 2010: 415 for an explicit endorsement of this claim regarding the human olfactory system.



olfactory constancies to stimuli that are proximally registered at the olfactory bulb. This will give us a notion of an olfactory object — an odor — that meets Burge’s constraint on genuine perceptual representation, and that is also adequate to the phenomenology of olfaction.

## 5 Olfactory Objects

Up until the last decade or so, psychological research on olfaction has mostly focused on detection and discrimination of monomolecular artificial odorants, either presented in isolation or in very simple mixtures, under carefully controlled laboratory conditions. In a typical experiment, for example, a subject would be presented with simple chemical compounds like *n*-butanol or *b*-phenethyl, and psychologists tested for odor detection and discrimination threshold in different concentrations.<sup>9</sup> As these odorants had very simple chemical compositions and were usually presented in isolation (i.e., with little or no background chemical noise), there was no need to distinguish what was proximally detected in the olfactory bulb from the subject’s conscious olfactory experience. However, many psychologists now think that these experiences fail to capture the richness and complexity of our everyday olfactory experiences, where we need to take a much wider range of factors into account. If we want to explain a subject’s olfactory experience in real-world situations, we cannot limit ourselves to proximal stimulation alone, as there will be a wide variety of chemical compounds arriving simultaneously at our olfactory receptors. In these situations, psychologists now argue that we must look beyond the olfactory bulb to how olfactory stimuli is represented at the *piriform cortex*, an area of the brain involved in olfactory attention, multisensory integration and olfactory consciousness. And there are good reasons to take these representations to be genuinely perceptual, distinct from the kind of proximal stimulation detected and encoded at the olfactory bulb.<sup>10</sup>

First of all, real-world situations of olfactory perception seem to

<sup>9</sup> See Stevens et al. 1988 for review.

<sup>10</sup> See Stevenson & Wilson 2007, Barnes et al. 2008, Gottfried 2010, and references mentioned therein.



require some sort of *figure-ground segregation*, a process traced to the piriform cortex that seems to be genuinely perceptual in nature (in the sense specified in Burge's constraint). Looking beyond the simple monomolecular odorants used by psychologists in the laboratory, most odors we experience in real-world situations are complex mixtures of many different odorants, and are usually delivered to our noses along many other odorants and compounds. But even if all this chemical noise is simultaneously detected by our olfactory receptors, for one of these odors to be experienced *as such*, as the odor that it is, the olfactory system needs to be able to extract a very complex blend against a background of irrelevant odorants and competing olfactory objects. By successfully masking all irrelevant background noise, this process will ultimately yield an odor representation at the piriform cortex (Stevenson & Wilson 2007, Gottfried 2010).

Think, for example, of the kinds of olfactory experiences you may have while walking through a food market downtown; despite being constantly bombarded with several different odors at the same time, you are nevertheless able to sometimes focus on the smell of ginger beef, other times on basil chicken, or caramelized bananas, and so on. When you focus on one of these odors as opposed to the others, the odor becomes a *figure* against a *background* of masked chemical noise. Of course, this does not mean that the odor will be experienced *as in* a spatial location distinct from the one where you experience a different odor, but that is beside the point. What is segregated by the olfactory system is not the spatial location of the vaporous cloud of molecules responsible for the odor in question, but its *chemical structure*: the stable chemical properties that composes the odor the system is able to detect and represent, as opposed to others that are temporarily masked as part of background chemical noise.

The market experience is not something we can account for with proximal stimulation alone; psychologists explain figure-ground segregation in olfaction partly in terms of a process of *cortical adaptation*, whereby, after a brief period of exposure to stable odors in the environment, neurons at the piriform cortex stop responding to these odors, thus facilitating the detection and representation of a novel target odor. This odor may be then experienced against a background of chemical noise '*as if that target odor alone were present*,' as Stevenson and Wilson argue, '*despite the fact that, at the nose, a bi-*



*nary mixture of the target and background is present* (Stevenson & Wilson 2007: 1824).’ If we want to explain a subject’s experience of ‘basil chicken odor’ in the food market, we need to go beyond processes of odorant detection, which detect the whole range of odorants and compounds that simultaneously reach the nose (at the right levels of concentration). Rather, we must bring in this process of cortical adaptation, responsible for filtering background chemical noise and yielding a cortical representation of a single ‘basil chicken’ odor.

Moreover, the stimuli proximally detected in the olfactory bulb is highly inconstant, often showing enormous variations in its chemical properties depending on the temperature and humidity of the air, force and speed of the wind, nose angle, respiratory phase, and so on (Gottfried 2010, Barnes et al. 2008). Due to these variations, it may be that on certain occasion some of the odorants that compose an odor are not actually registered at the olfactory bulb. But we are still able to experience a particular odor in these circumstances *as such*, even if some of its components are missing. And we continue to experience it as the same throughout a period of exposure, even as its chemical properties change across samplings. Finally, we may also come to recognize it as an odor we have previously experienced even if it is highly unlikely that odors are ever delivered in the same chemical proportion or intensity each time.

This requires the olfactory system to apply **olfactory constancies** to proximal stimulation, in order to discount changes in chemical properties that are likely to be caused by idiosyncratic perceptual conditions, and focus on the stable chemical structure that characterize the odor itself. As evidence presented in Barnes et al. (2008) suggest, operations of *pattern completion* in the piriform cortex are able to ‘fill in’ missing or corrupted compounds, which are likely to be the result of poor perceptual conditions. Even if a few odorants that compose a certain odor happen to be missing, the olfactory system can rely on the simultaneous presence of most of its components in order to ‘infer’, as it were, that this odor is likely to be present in one’s external environment. This is clearly a *perceptual* process (in the sense of Burge’s constraint), which yields a representation that is distinct from proximal stimulation.

This gives us a notion of an olfactory object — an *odor* — that is able to meet Burge’s constraint, and structure the representational



content of olfactory states. As I have been arguing in this section, the olfactory system's main function is to perceptually differentiate chemical structures from one another (and not to spatially differentiate vaporous clouds of volatile chemicals from one another). In order to explain how it can do this, as well as how we can experience a certain odor *as* the same under very different conditions of chemical stimulation, we need to posit perceptual representations of odors *qua* olfactory objects. They mark repeatable psychological abilities of the olfactory system which can be applied at different times, in order to yield a particular (token) representation of the odor in question. These odors play various roles in psychological explanations in olfaction: they are what we primarily experience in conscious olfactory experience, what serve as the basic units of olfactory attention, what is recognized as the same odor upon subsequent perceptual encounters under different conditions of chemical stimulation, and what triggers emotional and mnemonic responses.

These represented odors and their qualities are, as I have been arguing, genuine *perceptual* representations; in order to explain an olfactory experience of a certain odor among many other odorants that are simultaneously presented to the nose, we need to bring in perceptual processes that explain how the olfactory system is able to discount idiosyncratic chemical variations in proximal stimulation in order to focus on the stable chemical properties that characterize the experienced odor. This can be done, as I have suggested, through processes of figure-ground segregation and the application of olfactory constancies, which explains how Burge's constraint can be met in olfaction after all.

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