Philos Stud (2014) 171:233–250
DOI 10.1007/s11098-013-0265-9

Sniff, smell, and stuff

Vivian Mizrahi

Published online: 18 December 2013

Abstract Most philosophers consider olfactory experiences to be very poor in comparison to other sense modalities. And because olfactory experiences seem to lack the spatial content necessary to object perception, philosophers tend to maintain that smell is purely sensational or abstract. I argue in this paper that the apparent poverty and spatial indeterminateness of odor experiences does not reflect the "subjective" or "abstract" nature of smell, but only that smell is not directed to particular things. According to the view defended in this paper, odors are properties of stuffs. This view, motivated by several arguments grounded in the phenomenology of olfactory experience, explains in particular why odors appear to be located both in the air around our nose and in the objects from which they emanate. It also explains the power of smell in the task of discriminating chemical compounds.

Keywords Perception · Perceptual experience · Odors · Smell · Olfactory experience

1 Introduction

Following Brentano, most philosophers agree that our perceptions are intentional in the sense that they are directed toward things different from themselves. Thus, when I see a table, my perception of the table has at least two components: the act of

V. Mizrahi (✉)
Thumos Group, Geneva University, Geneva, Switzerland
e-mail: vivian@mizrahi.ch
URL: http://www.unige.ch/lettres/philo/thumos/Thumos/Home.html; http://www.mizrahi.ch/philo

Present Address:
V. Mizrahi
5 chemin d'Amoz, 1257 Charrot, Switzerland

seeing and its intentional object, the table. Although most philosophical theories of perception agree about the intentionality of perception, there are significant divergences regarding the ontological nature of its intentional object. It has been argued, for example, that a scrupulous analysis of perception shows that ordinary objects, like tables, are only indirectly perceived. According to indirect theories of perception, when looking at a table it is not the table that we directly see, but some perceptual intermediary. Depending on the particular version of indirect realism defended, perceptual intermediaries have been identified with various entities: ideas, sense data, contents, appearances, etc. This paper does not address the general question of the ontological status of the objects of perception, but deliberately and dogmatically considers the objects of perception to be public extramental entities. This investigation regarding odors starts therefore from a direct or "naïve" approach to perception, which holds that perceptual experiences are not mediated by internal or mind-dependent entities.

I will use the term "odor" to refer to the intentional object of olfaction independently of any metaphysical theory.[1] "Smell" is a synonym of "odor" in most occurrences. But I will try to minimize its use, since "smell," also used as a verb, can express the perceptive act through which odors are perceived.

One of the main virtues of direct realism is to validate the trust we generally have in our senses. Although not infallible, our perceptual experiences are at the root of our empirical knowledge. And it seems that the assumption of unmediated access to the external world advocated by the direct realist does justice to the common or "naïve" belief that, most of the time, things are as they appear in perception.

The direct realist assumption that we are directly aware of the world around us is often combined with the view that perception involves being acquainted with medium-sized three-dimensional material objects, like tables, apples, or birds. It is therefore often assumed that a direct account of perception has to be given in terms of material objects.[2]

If visual experience involves some form of acquaintance with material objects, what about the other sense modalities? Do audition, touch, taste, and smell also imply an immediate or direct awareness of material objects? Recent philosophical approaches to nonvisual modalities have considerably enriched our understanding of perception by investigating modalities and topics rarely studied from philosophical perspectives. And many recent works have suggested that a careful scrutiny of nonvisual modalities provides compelling reasons to open the realm of perceptual objects to a large spectrum of ontological categories in addition to those of material objects and their properties. Audition in particular has been the target of numerous papers discussing the nature of

[1] Unfortunately, the term "odor" has been used to refer to a particular theory that identifies the object of olfaction as gaseous emanations, clouds of molecules, or vaporous entities. As the rest of the paper should make clear, the use of "odor" here does not represent an endorsement of this particular theory.

[2] The idea that visual perception involves a direct acquaintance with material objects doesn't exclude the seeing of other kinds of entities. As stressed by O'Callaghan: "This doesn't rule out that you're ever visually aware of other material things, such as parts of material objects, or events in which material objects participate, or that you're ever visually aware of qualities or properties of material objects, or relations among them. But being visually aware of each of those sorts of things standardly also involves being visually aware of material objects" (O'Callaghan 2011, p. 145).

sounds and proposing that the intentional objects of audition are events rather than objects.[3] The present paper pursues a similar goal by examining the nature of olfaction. It holds that the intentional objects of olfactory perceptions, the odors, are best conceived as properties of stuffs rather as properties of individual material objects. The distinction between stuffs and things is complex and highly controversial, but it can be roughly understood as the distinction prevailing between objects and their constituting matter. Statues, tables, and trees are paradigmatic examples of objects, whereas copper, water, and wood are paradigmatic examples of stuffs. Objects and stuffs differ in many respects. For example, unlike individual things, stuffs persist despite division and transformation. If a statue made of bronze is melted to obtain two bronze cups, the statue disappears whereas the bronze persists.

I will argue that olfactory perception involves being acquainted with stuffs rather than particular objects and that the notion of stuff is essential for understanding the idiosyncratic characteristics of olfaction. The argument will proceed as follows. In the first part, I will give a short inventory of olfactory experiences. In the second part, I will show how most philosophical accounts fail to do justice to the phenomenology of olfactory experiences. In the last part, I will argue that olfactory experiences present compelling evidence that odors are properties of stuffs.

2 A world of odors

Unlike colors, and to a lesser extent sounds, odors and olfaction have received little attention from philosophers. In philosophy, odors are sometimes mentioned to illustrate the distinction between primary and secondary qualities (Locke 1690) or to exemplify the category of "sense-data" (Russell 1912) or "qualia" (Campbell 2004; Jackson 1982), but they are rarely considered for their own interest. Thomas Reid's work is a notable exception; an entire chapter of his *Inquiry into the Human Mind on the Principles of Common Sense* ([1764] 2000) is dedicated to smell. It is remarkable that Reid's discussion of the external senses starts with a long chapter devoted to olfaction. Reid's justification for this choice is that an inquiry into human understanding must proceed from the simplest to the more complex and that the same principle should be applied to the philosophical examination of the senses. Therefore, Reid starts his discussion of the senses with olfaction not because it is "the noblest, or the most useful"[4] sense, but because it is, according to him, the simplest. Reid's view regarding the simplicity of smell appears to have roots in antiquity. Aristotle, for example, considers smell to be both poor and inaccurate:

> Smell and its object are much less easy to determine than what we have hitherto discussed; the distinguishing characteristic of the object of smell is less obvious than those of sound or colour. The ground of this is that our power of smell is less discriminating and in general inferior to that of many species of animals; men have a poor sense of smell and our apprehension of its

[3] See Casati and Dokic (2005).

[4] chap. II, section II.

> proper objects is inseparably bound up with and so confused by pleasure and pain, which shows that in us the organ is inaccurate.[5]

The goal of this section is to rehabilitate the sense of olfaction in view of such allegations by showing with a few examples and facts that our sense of olfaction is both extremely discriminating and highly sensitive. The first step will be to clarify the function of olfactory perception and to get a better appreciation of what our nose tells us about our environment. What better way to demonstrate the importance and impact of olfaction in our daily lives than envisaging what it would be like to be deprived of it? Consider the testimony of Anita Chang, who lost her sense of smell after an car accident:

> I spent a good part of Saturday morning over my bathroom sink, hand-washing clothes—scrubbing my cheery red sweaters and wringing out my Victoria's Secret bras. The clothes may or may not have been dirty. They might well have still smelled sunshine fresh. I wouldn't know. […]
>
> It's like living behind a film of Saran Wrap. I'm in a world where, if my eyes were closed, I wouldn't know the difference between walking into a bakery and stepping into a gas-station bathroom.
>
> After the accident, my parents immediately installed a natural-gas detector in my apartment. I have a gas stove; if it leaked, I would have no idea. I have to make sure my smoke alarm works, because I would sleep right through a fire.
>
> That's the obvious stuff. Other things I've had to figure out day by day.
>
> Milk is tricky. How do you tell if it's spoiled if you can't smell it? Out of habit, I still stick my nose into the crusty top of the bottle, trying to sniff out sourness. I hold it to the light. I shake the bottle, watching the milk slosh against the sides while I look for chunkiness. Usually, I end up pouring out the milk, just to be safe. Same with leftovers. […]
>
> Imagine the holidays without your sense of smell. On Thanksgiving, my brother cooked a huge spread and I missed out on the smells. Turkey skin sizzling to a perfect crispiness? Nothing. Jalapeno cornbread browning in the oven? Nothing. The savory yumminess of stuffing on the stove? Nope. […]
>
> I'll tell you a secret. Not having my sense of smell has made kissing quite dull. What's the point when you can't smell aftershave/sweat/beer on a hunky boy? The excitement, the intimacy of knowing a person's smell is gone. (Chang 2005)

As Chang points out, smell pervades all aspects and all stages of our lives. It helps us to fulfill our biological needs by locating and selecting food. It protects us from harmful substances like decayed meats or burning materials. It shapes our social interactions by helping us recognize our kin[6] and select a potential mate.[7] But smell

[5] Aristotle, *On the Soul*, translated by J.A. Smith, II.9.

[6] Porter (1999).

[7] Several studies show that humans and mice can smell genetic variations in a potential mate, suggesting that olfactory detection of body odor operates as a mechanism of avoiding inbreeding.

is not just a matter of survival; it is also a matter of aesthetics. Like painting for sight or music for hearing, perfume incarnates the art of smell. You can certainly find pleasant odors around you, but perfumes cannot be reduced to pleasurable encounters. Perfumes are complex creations that involve grace, balance, proportion, and inventiveness. They are evanescent and unique constructions that can be explored and compared in an infinite number of ways. Consider for example Tania Sanchez's review of "Lolita Lempicka":

> With most of the many fragrances based on Thierry Mugler's Angel, the first thing you think on smelling them is "Hello, Angel." Not this time. Perfumer Annick Ménardo found the sole variation that stands on its own. In Angel, a loud fruity-floral accord of jasmine, mango, and black currant, like cleavage set to trumpets, is backed up by a somewhat louche and curiously masculine sweet woody section centered on patchouli. Together they sing a husky-voiced come-on. Lolita Lempicka, the first and best of the post-Angel crowd, keeps the sweet woody stuff but skips the pushup bra; instead, it plays out a fresh anisic melody that begins in salty licorice and modulates through several leafy changes as refreshing as lime soda pop, playing Doris Day to Angel's Peggy Lee. The fragrance is snappy and smart, an ideal accompaniment for flirtatious banter delivered by prim girls in glasses.[8]

Despite the lack of serious estimates of how many odors the human nose can detect,[9] the capacity of the human olfactory system to detect and discriminate among odorant molecules in infinitesimal quantities is inarguably excellent. And even if human beings have great difficulty verbalizing their olfactory experiences or identifying specific odors, there seems to be little reason to conclude that human olfaction is poor or confused.

The aim of this paper is not to describe the richly populated world of odors or to discuss possible odor categories or dimensions. It will therefore not try to explain why roses smell the way they do or answer questions about presumable differences or similarities between odors. The goal of this paper is rather to show that a philosophical approach to olfaction that identifies odors with properties of stuffs captures the general features of olfactory experiences and explains what distinguishes olfaction from the other sense modalities.

Rather than exploring the intrinsic characteristics of olfactory experiences, philosophers tend to compare them to the other sense modalities, generally vision. The result is that olfaction and odors are often negatively described:

(1) Smell is informationnally very poor (Lycan 2000, p. 277; Batty 2010b, p. 103).
(2) Smell lacks intramodal robustness; i.e., there is no olfactory perspective (Lycan 2000, p. 277).
(3) Smell is aspatial (Lycan 2000, p. 278) or spatially undifferentiated (Batty 2010a, p. 524, 2010b, p. 111).

[8] Turin and Sanchez (2008, p. 228).

[9] Gilbert (2008, p. 4).

(4) Olfactory experience presents an undifferentiated smudge of properties. It seems disengaged from any particular object (Batty 2010a, pp. 518, 527, 2010b, pp. 111, 112).
(5) Olfactory experiences are nonrepresentational (Reid 1764, chap. II, section II; Peacocke 1983, p. 5)

I will argue that most characterizations of olfaction like (1)–(5) rest on the assumption that the intentional objects of olfaction are individual things. I will show that, once odors are described in terms of stuffs, (1)–(5) can be reinterpreted as follows:

(1) Smell is informationnally poor with respect to individual things, but informationnally rich with respect to stuffs.
(2) There are no olfactory perspectives, because stuffs (the objects of smell) are not, like individual things, spatially oriented.
(3) Odors lack the spatial contours usually attributed to visual qualities, because odors are not restricted to an object's spatial boundaries.
(4) Stuffs are directly perceived by smell, whereas particular objects are only indirectly perceived by smell.
(5) Olfactory experiences are representational, but they do not represent individual objects.

3 Current views on odors and smell

As noted by many philosophers, smell seems to differ in many respects from the other sense modalities. First of all, smell seems very poor in relation to spatial information. Olfactory experiences seem to lack all the spatial organization we gain through other sense modalities. Compare for example the richness of my visual experience of a piece of cheese on my kitchen table with the olfactory experience I have when I enter the kitchen. When I look at a piece of cheese, I am able to perceive its location in the room and its relative position to my body and to the other objects in the room. My visual experience also contains information about the object's size, shape, orientation, etc. Olfactory experiences, on the other hand, appear to be rather poor with respect to their spatial content. As stressed by Matthen,[10] odors are diffused and vaguely located around the perceiver. Olfactory perceptions neither represent the relative position of objects as do vision or touch, nor their direction as does audition.

The apparent informational poverty and spatial indeterminateness of odor experiences have led many philosophers to conclude that olfactory experiences are purely sensational rather than world-directed as are vision or touch. Consider Lycan's comparison between smell and audition:

> Hearing, too, comes to us spatially organized, even phenomenally speaking […]. By contrast, smell is aspatial. Phenomenologically, an odor is just with us, happening right in the center of our minds. (Lycan 2000, p. 278)

[10] Matthen (2005, p. 284).

Lycan denies that olfactory experiences are spatial and maintains therefore that "phenomenally speaking, a smell is just a modification of our consciousness, a qualitative condition or event in us."[11] According to this view, the absence of spatial features in olfactory experiences renders them purely sensational, and they therefore lack the world-directed properties exhibited by vision and audition.[12]

The paucity of spatial information involved in olfactory experiences also constitutes a major objection to the claim that smell is directed to particular objects. Unlike vision, for example, smell alone has no way of telling us how many pizzas there are in the oven or the number of roses there are in a bouquet standing right under our noses. In effect, spatial experience appears to be crucial for perceiving objects. In order to perceive something as an individual object, one must be able to distinguish it from its surroundings and from other objects. Individuating objects in this way depends therefore on experiencing them as spatially extended and bounded entities. The fact that olfactory experiences do not present odors at distinct locations makes the view that smell is directed to objects rather questionable.

Recent papers on olfaction have contested the view that the apparent spatial indeterminateness of olfactory experiences should lead to the conclusion that smell is not world-directed. According to Batty (2011), for example, the world-directedness of olfactory experiences is remarkably different from that of visual experiences. Unlike visual experiences, which present particular objects as being located at particular places, olfactory experiences do not present olfactory properties at determinate locations. They just appear to be located in the subject's olfactory field. Although there seem to be few phenomenological reasons to ascribe olfactory properties to particular objects, Batty suggests that we should not conclude that olfactory experiences fail to attribute properties to objects. In fact, she argues that olfactory experiences are essentially abstract in the sense that they don't aim at a particular object, but rather represent "that there is something or other here with certain properties."[13] To illustrate her abstract account of olfactory experiences, Batty considers Drestke's limiting cases,[14] such as visual experiences of staring at a white ceiling while lying in bed or of looking up at a cloudless blue sky. In these cases, we cannot differentiate one particular object as white or blue, even though we clearly see something white or blue. In the same way, Batty suggests, when we smell citrus in the garden, we don't experience one particular object as lemony, we just experience something as lemony.

[11] Lycan (2000, p. 281).

[12] To be more accurate, I should stress that Lycan (1996, chap. 7) argues that smells represent "clouds of molecules diffusing in the air" and also ordinary objects in an indirect level of representation. But his approach differs from the one advocated here in the sense that Lycan's notion of content is teleological. However, he insists that at the phenomenological level smell is just a *quale* which does not itself present anything else than "a modification of consciousness, a qualitative condition or event in us" (Lycan 2000, p. 281).

[13] Batty (2011, p. 172).

[14] Dretske holds that a subject S sees an object D if and only if D is "visually differentiated from its immediate environment by S" (1969, p. 20), except for the "limiting cases" in which the object seen "has no environment" (1969, p. 26). In those cases, the differentiation clause "becomes inoperative when nothing appears to S that is not part of D" (1969, p. 27).

Another strategy for resisting the conclusion that olfactory experiences are purely sensational is given by Richardson (2013). According to her view, the visuocentric model of perception has wrongly assumed that an exteroceptive experience[15] should involve distance and direction. In fact, what olfactory experiences show is that neither distance nor direction are necessary for something to be perceived as external and spatially distinct from the perceiver. According to Richardson, the exteroceptivity of smell is assured by the act of sniffing. When a smelling experience occurs, odors are brought into the nose by sniffing. The fact that odors are revealed in experience by "being brought in from without" explains why odors are perceived as being external to the perceiver's body and why they seem to be in the vicinity of the perceiver's nose. Richardson is certainly correct in stressing that olfactory experience involves bringing something into the nose from outside by sniffing, but it is far from clear how something brought into the nose from outside ends up being represented as being outside the nose. Suppose for example that you inadvertently inhale a mosquito. It is likely that the feeling you have when this happens is not of something located around you, but rather of something being stuck in your nose. Because sniffing involves bringing in something from outside, it can explain why smell is not interoceptive like bodily sensations such as pains or itches, but it does not really help us understand why odors are perceived as being in the subject's vicinity and not in the subject's nose.

Although I do believe, like Batty and Richardson, that olfaction is neither subjective nor interoceptive, I hold the belief for different reasons. I agree with Batty that olfactory experiences do not seem to present ordinary objects. When we enter a room, we cannot tell by smell only how many apples there are or if a vanilla odor corresponds to a scented candle or a homemade cake. So if ordinary things are not presented in olfactory experiences, what kind of information about reality does smell convey? According to Batty, smell represents olfactory properties without representing something having these properties. She explains that

> smells are attributed to objects but in no way that allows us to pick out the individual objects that instantiate them. According to what I call the *abstract view of olfactory content*, although potentially rich in terms of the properties it represents as present in your environment (as rich as the situation we are in and our discriminatory abilities allow), olfactory experience only ever predicates properties to just one object—and not in any way that enables us to pick that object out. That is to say, olfactory experience predicates properties to "something we know not what" at the undifferentiated location of "here". On the abstract view, then, olfactory experience represents that there is something or other here with certain properties. (Batty 2011, p. 170)

Although she advocates for a representational approach to olfaction, Batty seems to embrace the traditional view that considers smell to be deprived of the richness found in vision. According to her abstract view, smell is like vision minus its rich

[15] As Richardson rightly points out, in resisting the idea that odors are external to the body, philosophers have often supposed that smell is nonexteroceptive.

spatial content. This is shown by the fact that she equates olfactory experiences with the extremely poor visual experience of looking statically at a white ceiling or a blue sky. But those cases, as she rightly stresses, are *limiting* visual cases. Dretske's limiting visual experiences result from the subject being placed in an environment deprived of almost all visual data. Rather than showing that visual experiences can have abstract content, as suggested by Batty, Dretske's limiting visual experiences really show that in some extreme situations visual experiences can be highly underdeterminate. My experience of looking statically at a white ceiling, for example, fails to provide the spatial features necessary to localize and identify the white expanse in front of me. But unless olfactory experiences are reduced or indeterminate in this way, the analogy with Dretske's limiting experiences fails to illuminate the nature of olfactory perception.

I agree with Batty that smells, unlike visual properties, don't appear at particular locations. Unlike colors or shapes, smells seem to be vaguely located around the perceiver. But, at the same time, as she rightly points out, the olfactory system constitutes an informational system that guides our behavior effectively. For example, when it comes to choosing the right food, olfaction is vital. It seems, therefore, that the problem with olfaction is not that odors don't have definite locations like the colored expanses in Dretske's limiting experiences, but that they are *at the same time* attributed to particular objects like hot apple pies or rotten eggs. Smelling does not appear to be confined to indistinct locations after all. And as is stressed by ordinary talk, odors can also be attributed to things: flowers have a delicate scent and skunks stink. It seems therefore that the intentional object of olfaction can be referred to in two different ways. We can say, for example, that either

(i) I smell the cheese in the kitchen, or
(ii) I smell the odor of cheese filling the kitchen or I smell a cheesy odor around me.

Although (i) and (ii) are not strictly incompatible, they have very different implications regarding the localization of odors provided by olfaction. In (i), the odor appears to be located where the piece of cheese is to be found, whereas in (ii) the odor appears in the air surrounding the perceiver. How should this ambivalence be interpreted? Should we favor (i) at the expense of (ii), the converse, or accept both (i) and (ii)?

Because Batty is interested primarily in showing that olfaction is representational even when olfactory experiences do not present smells at distinct locations, she doesn't give full consideration situations in which odors are attributed to particular objects, as in (i).

As for Richardson, she clearly denies the truth of (i) by asserting that our relation with odor sources is cognitive rather than perceptual. She explains that, in contrast to our relation to visual objects, we are almost insensitive to the comings and goings of odor sources in our environment. We can, for example, still smell the cheese in the kitchen long after it has been eaten. She also observes that locating odor sources depends on other sense modalities as well as on other cognitive resources. She gives the following example:

> […] had I not the ability to recognise this odour as that characteristically produced by roses, and were I not also able to see the roses in the room, my olfactory experience would be no guide at all to the presence of roses in my vicinity. I could just as easily conclude that there was something else rose-scented about, such as air-freshener or a perfume-wearing friend. (Batty 2011, p. 404)

Therefore, according to Richardson, I cannot smell the piece of cheese on the table, but only identify it as being the source of the odor I can smell in the kitchen. But if Richardson is right, the consequences are far from trivial. As just stressed, it would be literally wrong to say that we can smell the subtle bouquet of a wine or the refreshing smell of eucalyptus, because we literally can smell only the odor those objects emit, not the objects themselves. However, this view seems to conflict with the phenomenology of certain ordinary situations. If you wonder whether the milk in your fridge is spoiled, you will most likely place the bottle of milk under your nose and sniff it. And if you cannot identify by sight alone which spice is in a jar, sniffing it will probably help you to find out. Contrary to Richardson's view, it seems that odor sources are not necessarily identified through other sense modalities or cognitive resources, but that in many cases smell alone has the last word about their real nature and identity.

Like Batty and Richardson, I will defend the view that smell is exteroceptive and world-directed. But I will argue that only an account of the nature of odor in terms of stuffs can capture the characteristics of olfactory experiences. I will maintain that if odors are only vaguely located around the observer, it's not because olfactory experiences are abstract or indeterminate in any particular way, but because odors are not properties of particular and discrete objects, but properties of stuffs. But what are stuffs? And how does the notion of "stuff" capture the specificity of olfaction and odors? The following sections address these questions.

4 The notion of stuff

The category of stuff has occasioned many interesting and controversial questions. One way to understand this notion is to contrast it with the category of individual objects. Stuffs are typically referred to by "mass nouns" like "water," "wood," and "oatmeal," whereas individual objects are referred to by "count nouns" like "chair," "molecule," or "lake." Individual objects can be counted; stuff can't. The relation between objects and stuffs can be understood as one of constitution. This kind of relation obtains when an object is made of a certain portion of stuff. A chair can be made of wood and a fork can be made of iron, for example.

Objects have characteristic shapes and sizes, but stuffs don't.[16] A lake and a glass of water have distinct sizes and shapes. Water, on the contrary, can be found in both lakes and glasses, as well as in rivers and tears. Stuffs are independent from their

[16] Because stuffs have neither shape nor size, the chemist can store stuffs by keeping samples and pulverize stuffs before conducting experiments.

shape, but their structure, on the other hand, is crucial. As noticed by Soentgen, "every portion of a stuff displays, or at least can display, structures that are typical for the stuff. Every portion of stuff has, at least potentially, a structured inner organization."[17] The inner structure of a stuff is revealed, for example, by its disposition to drip, bend, or to be torn or smashed to pieces.

Unlike individual objects, a stuff can be divided without losing its essential properties. By cutting a cake in several slices, I destroy the cake, but "create" cake slices instead. Unlike the cake, the identity of the yummy stuff from which the cake is made does not change when it is cut. Fortunately, the stuff of the original cake and the stuff of the slices obtained after cutting it is the same. The homeomerosity[18] of stuff is also the reason the chemist can study stuffs by doing experiments on tiny samples only. If any portion of a stuff has the same properties as any other portion, what we know about one portion can be generalized to all the other portions of the same stuff.

Chemistry is the science of matter, or "stuff." Whereas physics focuses on the behavior of discrete objects or things, chemistry explores their inner nature. As clearly expressed by Lewowicz and Lombardi (2013) in a recent paper: "the ontological category that underlies the discourse and the practice of macro-chemistry is the category of stuff. Our effort has been directed to stress the deep breakdown between the ontology of macro-chemistry, inhabited by stuffs, and the ontology that prevailed in Western philosophy and physics, populated by individuals and properties." However, our knowledge of stuff doesn't start with chemistry. We deal with stuffs every day and have no trouble distinguishing among them. Take a bowl of sugar and a bowl of salt in a kitchen. They look perfectly alike, but most people know that tasting them is a very direct way to tell them apart. If chemistry is the science of stuff, it is not surprising that smell and taste are referred to as the chemical senses. But our everyday knowledge of stuffs doesn't rest on their gustative or olfactory properties only. By touching, for example, we know which stuff is hard, soft, sticky, moist, liquid, granular, etc., and most sounds we hear reveal the inner structure of a resonating object.

Unlike portions of stuff that exist in space and time, stuffs are not spatiotemporally located. We can point to a portion of water in a glass, for example, but water as a stuff cannot be identified in spatiotemporal terms. We can distinguish a particular stuff from another through certain characteristics like solubility, hardness, rigidity, viscosity, thermodynamic properties, taste, or smell, but stuffs are not individuated by their spatiotemporal properties. The conclusion argued for here—that olfaction targets stuffs rather than objects—should therefore be distinguished from alternative theories that identify odors with individual objects or aggregates like molecules or clouds of molecules.

[17] Soentgen (2008, p. 80).

[18] Something is said to be homeomerous if it remains invariant across any arbitrary partition. If X is iron, a portion of X is iron. However, most stuffs are only "relatively homeomerous" because there is for most stuffs a limitation to their homeomerosity.

5 Odors as stuff properties

I have argued so far that olfaction is not informationnally poor even though it fails to identify individual objects in our environment. The next step is to show that only a characterization of odors as stuff properties adequately captures the phenomenology of olfaction. To reach this goal, I will consider in turn the following characteristics of olfactory experiences:

(1) Pervasiveness: the same odor is experienced as being in many places at the same time.
(2) Object recognition: although smell does not track particular objects, odors can single out particular objects.
(3) Chemical identification: By keeping track of stuffs, smell can identify chemical transformations.
(4) Mereological simplicity: odors do not appear to have either spatial or temporal parts.

5.1 Pervasiveness

Philosophical views regarding the spatial content of olfactory experiences are quite diverse. Lycan suggests that smell is aspatial (2000, p. 278), Smith holds that we experience smells in our nose (2002, p. 139), Richardson maintains that odors are in the vicinity of the nose (2013, p. 417), and Matthen (2005, p. 284) and Batty (2010b, p. 112) claim that odors are indeterminately located around the perceiver. I suggest that this variety of opinions about the spatiality of smell originates from the fact that the objects of smell are pervasive and unlocalized, unlike the objects of most other sense modalities. Consider vision. Our visual field is populated with three-dimensional objects with determinate shapes, sizes, and locations. When sitting at my desk, I can see my two hands on a black keyboard, a white mug on my right, and a flat monitor screen facing me. The keyboard, the mug, and the monitor have clear spatial boundaries that define their spatial location and the spatial relations they bear to me and to each other. Except in limiting cases, like watching a uniform expanse filling the visual field,[19] visual experience presents us with discrete objects at different locations. The objects of smell, by contrast, have no clear boundaries and their locations are indeterminate. When I enter a kitchen filled with an odor of roasted chicken, I notice the presence of the odor but don't perceive immediately where this odor is located or where it comes from. As I walk through the kitchen, I may continue to notice its presence and its variations of intensity. The odor can fade away while I'm leaving the kitchen, but the point in space where I can no longer smell the odor is generally hard to locate.

The evanescent and formless aspects of odor seem to indicate that odors are properties of the ambient air. But restricting odors to the air, or to the molecules that fill it, seems to disregard the role we usually ascribe to smell. Odors can catch our attention and make us act in various ways. An odor of smoke prompts the cook to

[19] See above, p. 2.

check the stove for burning food, a delicate perfume encourages the gardener to sniff the flowers around her, and a corky smell in a glass of wine persuades the sommelier to open a new bottle. If smell were directed only toward the air surrounding us, our actions based on olfactory experiences and directed to objects would be quite mysterious. Why would our appreciation of wines rely on their odors? Why would flowers invite us to put our nose in their petals? And why would the odor of smoke trigger an immediate response in our internal warning system? These example show that odor sources are genuine objects of olfactory experiences and that there seems to be no evidence that acquaintance with odor sources is only mediated by cognition. Moreover, it seems quite plausible to suppose that the human olfactory system has evolved to recover information about odor sources, like food or potential dangers, rather than atmospheric properties. But if odors are found in objects, how should we explain the detection of odors in the absence of their sources, and how should we respond to Richardson's remark that "olfactory experience is too insensitive to their [odor sources] comings and goings to count as perceiving them"[20]? My proposal is to acknowledge that odors are located both in the air and in their sources.[21] This apparently *ad hoc* solution to the pervasiveness of odors becomes more plausible once it has been acknowledged that odors are not properties of objects but properties of stuffs. As stressed earlier, a main characteristic of stuff is its homeomerosity. When a stuff is divided into several portions, the stuff of all the portions is the same. So the apparent sensitivity of smell to the air around the perceiver's nose rather as to the comings and goings of odor sources can be explained in terms of the olfactory system's sensitivity to the tiny fractions of the stuff of odor sources disseminated in the air around its source.[22] To be detected by the olfactory system, volatile odorant molecules must detach from the source and reach the inside of the nose. From an object perspective, it is dubious to consider those volatile molecules to be part of the odor source. But from a stuff perspective, the link between the volatile molecules and the source is obvious: both are made of the same stuff. If smell seems to be insensitive to the comings and goings of the odor sources, it's because smell tracks odor sources by detecting the traces of stuff dispersed in the air.[23]

[20] Richardson (2013, pp. 403–404).

[21] See n. 15.

[22] The fact that olfactory experiences are caused by portions of stuffs doesn't mean that olfactory experiences represent portions of stuffs rather than stuffs. As stressed above, unlike stuffs, portions of stuff are localized in regions of space. You can for instance move the portion of water filling your glass by moving the glass, but water *per se* cannot be moved. The fact that portions of stuffs are causally responsible for our perceptions of stuffs raises many interesting questions, but it should not force us to conclude that we don't perceive stuffs directly. In fact, I think that a closer look at olfaction shows exactly the opposite. Portions of stuffs, like clouds of odoriferous molecules, are only indirectly perceived in olfaction. What is directly perceived are the olfactory properties of their stuff discriminated by our sense of smell.

[23] Odors can be considered as a particular case of traces. Like odors, traces are often small quantities of stuff detached from their original location. At a crime scene, for example, all kinds of stuff residues can be used as trace evidence: soil, sand, paint, fibers, hairs, blood, saliva, etc. The fact that odors are traces is also manifested in the way olfactory exploration is performed. Smelling relies on repetitive sniffs that

5.2 Object recognition

As revealed by the investigation above, smell is not directed to individual objects, but to stuffs. However, the capacity to identify and recognize stuffs through smell can be exploited to identify individual objects provided these objects are constituted by a characteristic stuff.

For an olfactory experience to take place, volatile molecules must detach from a source and reach the inside of our nose by inhalation. We know that a typical odor source, such as an apple, emits hundreds of different odorants. The correlation of odors to complex mixtures of molecules explains the apparently colossal number of odors we can smell.[24] To capture the virtually inexhaustible variety of smell experiences, it's enough to remember that the modern era in perfumery began with the invention of synthetic odorants in the late 19th century[25] and that new odorant molecules are still created by chemists every day. This seemingly infinite richness accessible by the sense of smell explains how objects can be identified and recognized by their odor.

Biological objects, like plants and animals for example, release quantities of odorant molecules that are the products of the ongoing chemical reactions occurring in living organisms. Biological bodies can therefore be regarded as chemical factories that emit different volatile molecules. The number, identity, and relative amounts of these molecules differ for each individual organism, giving them a distinctive odor.

Despite the large number of basic and challenging questions remaining open about the way the olfactory system responds to the volatile compounds, it is largely agreed that a combinatorial activation of neurons is involved in olfactory perception and that the human olfactory system can detect and discriminate between thousands of chemical compounds. Several studies also show that animals and humans are able to distinguish one individual from another member of the species by their odor.[26]

Although odors are, as I have claimed, properties of stuffs, each individual organism is constituted by a distinctive stuff that is the product of the complex physical and chemical processes occurring in the organism. In the same way that biometric characteristics, like fingerprints, are used to identify individuals, chemical markers, like odors, can therefore be used to identify and trace the objects that propagate them.

Footnote 23 continued
deliver odor molecules from the environment to olfactory receptors. Tracking an odor therefore presupposes sampling of the environment in order to find chemical traces left by odor sources.

[24] According to Gilbert (2008), and contrarily to what is often claimed, there is no serious scientific estimation of the number of odors.

[25] For a short history of the chemical discoveries that made modern perfumery possible, see Turin and Sanchez (2008, pp. 33–40).

[26] Cf. Porter (2000).

5.3 Chemical transformations

Considering odors as properties of stuffs rather than of objects sheds some new light on the phenomenology of smell. Unlike particular objects, stuffs don't have built-in boundaries that determine their identity through time. Unlike trees, cars, or buildings, stuffs can be scattered and dispersed without losing their identity. Water that starts its journey at the top of a mountain and travels as rivers into the valley and to the ocean remains water regardless of its dispersion or streaming. Even though stuffs may be crushed, pulverized, scattered, spilled, or dispersed and yet remain the same, stuffs can also undergo substantial changes and cease to exist. When ice melts into water or when wine turns to vinegar, there is a gradual transformation from one kind of stuff into another. Systematic transformations of stuffs are studied by chemistry labs, but transformations of stuffs happen also in everyday life. We create foam by using soap or end up with ashes after lighting a fire, for example. But the place in our homes where most of these transformations take place is the kitchen. Every time you fry eggs, bake a cake, or boil vegetables, numerous chemical reactions take place and stuffs undergo radical changes. We can of course witness some of those transformations through sight, but taste and smell are far superior when it comes to noticing them. For example, odors of cheese, freshly baked cake, and hot bacon correspond to particular stuff transformations: fermentation, caramelization, and Maillard reactions.

The idea that smelling involves being acquainted with stuffs instead of objects explains the sensitivity of smell to chemical changes. Although it is not easy to give identity criteria for stuffs, it is plausible to say that a chemical reaction is the transformation of one stuff into another. If this analysis is correct, we can conclude that smell gives access to stuffs and their transformations independently of the objects they constitute. Whereas vision gives us access to the superficial properties of objects, olfactory awareness aims directly at the inner nature of things.

5.4 Mereological simplicity

According to Lycan, odors are informationnally very poor, whereas "vision is king."[27] But this affirmation seems to be contestable if the apparent poverty of olfaction is supposed to refer to its discriminatory power. As argued earlier, once it is acknowledged that smell is directed to stuffs rather than objects, smell appears to be highly sensitive and discriminative. However, Lycan's remark can be interpreted more productively if we understand the poverty of smell in terms of the organization of olfactory experiences rather than in terms of its discriminatory power. It seems in fact that the information furnished by vision about objects and their properties is somewhat more structured than the way odors are represented in olfactory experiences.

Visual objects are individuated by their colors, textures, shape, spatial properties, and their cohesion through motion. They have a structural complexity exhibited by

[27] Lycan (2000, p. 277).

the way perceptible parts are integrated in a unified perceptible object. Consider the fact that the content of our visual experiences changes as we move or as the object's location varies. As we move around a house, our perspectival relation to it changes, and as a result we see different sides and different parts of the house. Moving closer foregrounds the surfaces' textural features, whereas changing our viewing angle might disclose previously hidden sides. Visual experiences are therefore mereologically complex in the sense that different visible features are seen as different parts of the same object.

Olfactory experiences, on the other hand, seem to lack such complexity. Odors can vary in intensity, but they do not seem to have any kind of spatial complexity.[28] Unlike visual objects, odors never appear to be partly occluded. They don't have profiles or hidden aspects. They don't appear to be oriented—to have a top, a bottom, and a left and right side. It seems therefore that odors are simple and that they can be grasped in one sniff.

The mereological simplicity of odors can be linked to the distinctive uniformity of stuffs. Unlike material objects, stuffs don't have *bona fide* parts (i.e., parts that exist independently of human partitioning). Division of stuffs is necessarily arbitrary in the sense that stuffs don't exhibit any qualitative, material, or spatial discontinuity that could ground any demarcation between *bona fide* parts.

Odors are said to differ in longevity, but I think it would be misleading to say that odors have temporal parts. Perfumers use the word "note" to describe the longevity of the scents composing a fragrance. A perfume is divided into three sets of notes that create an olfactory accord. The top notes are the scents immediately perceived after a perfume has been applied. They are followed by middle notes, which produce the bridge between the top and the base notes. The base notes provide the long-term effect of a fragrance and convey its depth. Even though a perfume is said to evolve according to the longevity of its olfactory components in the air, it is questionable whether one should consider odors to be temporally extended and to have real temporal parts. Unlike sounds, odors are not "creatures of time"[29] whose identities rely on their temporal characteristics. Like our visual experiences, our olfactory experiences have a certain duration, but neither visual[30] nor olfactory objects are experienced and conceived as temporal entities. The identity of a smell is not anchored in its evolution in time. An odor can appear or disappear from our olfactory field, but it is wholly present at each moment we smell it. Odors, according to this analysis, are not intrinsically temporal entities.

[28] As suggested to me by Kevin Mulligan, distinguishing between spatial location and spatial extension could be useful for understanding the spatiality of smells. The fact that smells have no extension could account for the fact that they are located in space but lack spatial parts.

[29] O'Callaghan (2007, p. 14).

[30] In addition to individual things, like trees or teapots, visual perception can also be directed to events or processes, like car accidents or footraces. It seems that this diversity is also available in olfaction. As emphasized above, we can smell some transformations from one stuff to another. The odor of smoke, for example, corresponds to the perception of a process (combustion) rather than to the perception of a persisting stuff.

6 Conclusion

Philosophy of perception has traditionally focused on vision and visual experiences. I have suggested that olfaction differs from vision in several fundamental respects and that a new singularized approach to the philosophy of olfaction is needed. I have argued in particular that, unlike vision, the objects of smell are stuffs and their properties. This new approach to the nature of odors has several implications.

On this account, odors are not private entities like sensations. They are located in space and are publicly accessible. But unlike visual objects, they don't appear to have clear spatial boundaries. According to this approach, odors characterize individual things only because they are properties of the stuff that constitutes them. Individual things can change or even disappear, but as long as the properties of the stuff remain the same, odors survive those changes. Analyzing odors in terms of properties of stuff captures the specificity of olfaction. It explains in particular why odors appear to be both located in the air around our nose and in the objects from which they emanate. It also explains the power of smell in the task of discriminating chemical compounds.

In focusing on the phenomenological characteristics of olfactory experiences, I have emphasized the notion of stuff and proposed to consider stuffs as the primary objects of olfactory perception. Our world is filled with natural stuffs like wood, mud, snow, sand, blood, and flesh, and artificial stuffs like glass, shampoo, soap, fabrics, and yogurts. And most of our interactions within the world involve the capacity to finely discriminate among stuffs. But stuffs are not only smelled; they can be seen, touched, tasted, and probably heard. Despite their pervasive presence in our lives, stuffs have largely been neglected by philosophical approaches to perception.[31] There are therefore good reasons to bet that by turning their attention to stuffs, philosophers could discover exciting perspectives and challenges, not only in the study of smell, but also in their accounts of all the other sense modalities.

Acknowledgments Many thanks to Stuart Firestein, Kevin Mulligan, Emma Tieffenbach, Victoria Tschumi, and to two anonymous referees of this journal for their comments and suggestions.

References

Aristotle (350 B.C.E). On the Soul. Translated by J.A. Smith. http://classics.mit.edu/Aristotle/soul.html. Accessed 16 Dec 2013.

Batty, C. (2010a). A representational account of olfactory experience. *Canadian Journal of Philosophy, 40*(4), 511–538.

Batty, C. (2010b). Scents and sensibilia. *American Philosophical Quarterly, 47*(2), 103–118.

Batty, C. (2011). Smelling lessons. *Philosophical Studies, 153*, 161–174.

Campbell, N. (2004). Generalizing qualia inversion. *Erkenntnis, 60*(1), 27–34.

Casati, R., & Dokic, J. (2005). Sounds. In E. N. Zalta (ed.), *The Stanford Encyclopedia of Philosophy* (Fall 2005 edition). Available at http://plato.stanford.edu/archives/fall2005/entries/sounds/. Accessed 16 Dec 2013.

[31] One notable exception is Soentgen, who has explored the notion of stuff in phenomenology (Soentgen 2008) and written several detailed monographs about particular stuffs, like coffee, wood, cacao, aluminum, etc.

Chang, A. (2005). The scent of a woman—Lost. *Associated Press*. http://hamptonroads.com/2006/01/scent-woman-lost. Accessed 16 Dec 2013.
Dretske, F. (1969). *Seeing and knowing*. Chicago: The University of Chicago Press.
Gilbert, A. (2008). *What the nose knows: The science of scent in everyday life*. New York: Crown Publishers.
Jackson, F. (1982). Epiphenomenal Qualia. *Philosophical Quarterly, 32*, 127–136.
Lewowicz, L., & Lombardi, O. (2013). Stuff versus individuals. *Foundations of Chemistry, 15*(1), 65–77.
Locke, J. (1690). *An Essay Concerning Human Understanding*. http://www.gutenberg.org/ebooks/10615. Accessed 16 Dec 2013.
Lycan, W. (1996). *Consciousness and Experience*. Cambridge: The MIT Press, Bradford Books.
Lycan, W. (2000). The slighting of smell. In N. Bhushan & S. Rosenfeld (Eds.), *Of minds and molecules: New philosophical perspectives on chemistry* (pp. 273–290). New York: Oxford University Press.
Matthen, M. (2005). *Seeing, doing & knowing: A philosophical theory of sense perception*. Oxford: Oxford University Press.
O'Callaghan, C. (2007). *Sounds: A philosophical theory*. New York: Oxford University Press.
O'Callaghan, C. (2011). Lessons from beyond vision (sounds and audition). *Philosophical Studies, 153*(1), 143–160.
Peacocke, C. (1983). *Sense and content*. Oxford: Clarendon Press.
Porter, R. H. (1999). Olfaction and human kin recognition. *Genetica, 104*(3), 259–263.
Porter, R. H. (2000). Human reproduction and the mother-infant relationship: the role of odors. In T. V. Getchell, et al. (Eds.), *Smell and taste in health and disease* (pp. 429–442). New York: Raven.
Reid, T. ([1764] 2000). *An Inquiry into the Human Mind and the Principles of Common Sense*. Ed. Derek R. Brookes. University Park: Penn State Press.
Richardson, L. (2013). Sniffing and smelling. *Philosophical Studies, 162*(2), 401–419.
Russell, B. (1912). The Problems of Philosophy, available at http://www.gutenberg.org/ebooks/5827. Accessed 16 Dec 2013.
Smith, A. D. (2002). *The problem of perception*. Cambridge: Harvard University Press.
Soentgen, J. (2008). Stuff: A phenomenological definition. In J. van Brakel & K. Ruthenberg (Eds.), *Stuff: The nature of chemical substances* (pp. 71–91). Würzburg: Königshausen und Neumann.
Turin, L., & Sanchez, T. (2008). *Perfumes: the A–Z guide*. New York: Penguin.