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Sharing an olfactory experience: The impact of oral communication

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ABSTRACT

The way odors are verbally coded in many languages is not very efficient for successful intersubjective communication. Nevertheless, some types of verbalization seem to facilitate the sharing of an olfactory experience. The experiment reported here was aimed at gaining a better understanding of how successful oral communication in the domain of olfaction works. It was hypothesized that oral description of odors enhances the recognition of olfactory stimuli that match the description. The experimental situation involved two participants, one of whom (sender) smelled and orally described an odorant to the other person (receiver) who had to recognize it. Qualitative analyses (verbal) from the communication phase and quantitative analyses (recognition rate) from the recognition phase were made. The line of study of the participants (18 chemistry students and 18 humanities students) and the type-of-odorant used had no effect on the recognition rate. On the other hand, as the number of trials increased, a slight but still statistically significant interaction between participant sex and odor-recognition rate was observed. The qualitative analysis showed that the oral communication revolved mainly around five types of description - known source, odor intensity, hedonistic valence, odorant property, and odorant effect – and that the use of too many of these descriptors reduces performance. Descriptions were based on associations and fuzzy categories, they were related to the body, occasionally contained references to other senses (sight, touch, and taste), and could exhibit considerable self-confidence, even on trials that ended in a recognition failure. These findings support the idea that one and the same scent-bearing substance can be subject to highly diverse cognitive processing.

1. Introduction

According to a number of psycholinguistic studies, odor perception is an individual phenomenon, highly encapsulated in the subjectivity of autobiographical memory (Chu & Downes, 2000). It seems, in Western societies at least, that odors – unlike colors – were not constructed collectively via negotiation of a shared meaning during verbal interaction (Dubois & Rouby, 1997). According to Schaal (2004), it is as if "the acquisition of chemical sensory knowledge were the random outcome of personal experiences". Does this mean that this object escapes all intersubjectivity? The literature on this topic refutes this claim. First, because the olfactory system is highly phylogenetically programmed (Kratz, Dugas, & Ngai, 2002), some olfactory perceptions can be shared by all humans. Secondly, numerous publications have demonstrated the existence of differences in olfactory perception across groups (Candau, 2004; Chrea et al., 2004; Classen, 1993, 1997; Classen, Howes, & Synnott, 1994) and even across countries (Gilbert & Wysocki, 1987), sometimes with slight variation (Chrea, Valentin, Sulmont-Rossé, Hoang Nuguyen, & Abdi, 2005). Not only odor-related processes such as hedonistic evaluation, naming, and memory storage (Candau, 2001) but also olfactory tolerance thresholds are determined socially, culturally, and historically (Corbin, 1986), notably in the food-related odor register. Accordingly, different ways of sharing olfactory experience are beyond doubt.

However, much more still than in the general field of shared cognition – finding out "how two minds shape each other mutually through reciprocal interactions" (Frith & Wolpert, 2004) – the true nature of olfactory cognition remains mysterious. The overly

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general explanations given in many theories that bring "social frameworks" or "cultural influences" to bear do not provide a concrete understanding of exactly how and to what extent individuals are able (or unable) to share an olfactory experience: is it by way of identical reactions to the same stimuli, reliance upon a shared terminology, similar meanings assigned to descriptors, and so forth? We contend that by studying the verbal coding of olfactory experience, we will be able to improve our understanding of how such experiences are shared. This assumption is not trivial, given the characteristics of this verbal coding.

Clearly, coding of odors poses a genuine cognitive challenge, for a number of reasons. First of all, the French language, like many of others, does not have a precise, unchanging vocabulary for odors as it does for colors (lack of "basic terms": Berlin & Kay, 1969). Secondly, our olfactory perceptions, just like our other sensory perceptions, fall along a continuum that is not easy to describe in a language made up of discrete units. Moreover, the categorization system of odors is a fuzzy one, at least as far as its linguistic description is concerned. Not only is the distinction between category and exemplar poorly defined – we often find the same name being proposed for "type" and "token" responses (David, 1997) – but we also frequently see the meaning of the term "odor" overlapping with that of the scent-bearing object. The odor, which is the cognitive representation of the odorant, is usually confounded with the odorant itself, which adds to the imprecision of the description. What we call the "odor of a rose", for instance, is in fact the effect of the odoriferous mixture of chemical substances on a person who smells it. In this case, while the olfactory descriptor refers explicitly to the scent-bearing source, what really is described is the subjective quality of this substance. This is certainly true for other perceptual systems as well. Most people take the internal representation of the outside world (perception) to be the same as the outside world (stimuli). However, what is specific in olfactory perception is the very usual confusion in the internal representation between *two* different entities of the outside world: the direct origin of stimuli (the odoriferous volatile molecules emitted by the source and transported to the olfactory epithelium by the inhaled air flow) and their indirect origin (the scent-bearing source). It would be more accurate indeed to speak of "the odor of the odoriferous molecules emanating from the rose". This shift in meaning questions what the common sense sees as obvious: that words refer directly to the things they name. This idea underlies Dubois and Rouby's remark that "whether or not and how these two entities (material and mental) overlap remains one of the important questions (if not *the* question) for olfactory research" (Dubois & Rouby, 2002). In the end, given the instability of the natural language of odors, speakers trying to communicate their subjective representations of scent-bearing molecules "make do with what's available" (Dubois & Rouby, 2002), even professional perfumers and flavorists, despite their efforts to optimize this kind of communication. Although written up by trained specialists, the descriptions found in specialized publications or in catalogues of chemical products are highly inconsistent. In a recent study, Pintore et al. (2006) compared the odorous characteristics of various common compounds found in two major databases deemed to be the authorities in the field (Arctander, 1960, 1969; PMP, 2001), each containing about 2600 compounds. Based on a comparison of the 923 compounds present in both databases, the authors noted that 40% were described by totally different olfactory profiles, 58% shared at least one descriptor, and a mere 2% were described in exactly the same way.

In spite of these characteristics of the verbal coding of odors, all of which appear to be obstacles to successful intersubjective communication, it is nevertheless generally acknowledged, both in daily life and in experimental settings, that there exists a "process of fitting to the perceptual representation" at the individual level, and also an intersubjective negotiation for "sharing subjective experiences" (David, 1997). It is the elaboration of these shared cognitive representations that we will study here via the experiment described below. Our hypothesis is that oral description of odors enhances the recognition of olfactory stimuli that match the description. The aim of the work is to gain a better understanding of linguistic factors that contribute to the success of an oral communication in the domain of olfaction. This goal is pursued on the basis of the analysis of recorded dialogues between sending and receiving participants. In these dialogues, we try to identify the types of verbalizations which facilitate the recognition and hence the sharing of a sensory experience.

2. Methods

2.1. Participants

Thirty-six volunteer participants (11 men and 25 women, mean age 24) were recruited at the University of Nice-Sophia Antipolis, France. Subjects gave written informed consent. The experiment was not intrusive and was considered by the ethic committee on human experimentation as not requiring formal approval. Sex was not taken into account in the experimental design, however it was considered a posteriori to check whether some individual differences due to sex may explain the identification rate.

Subjects were divided into two groups according to their line of study (18 chemistry majors, 18 humanities majors). The rationale for choosing two groups was the following. The substances used in the experiment are "pure chemical substances" including representative substances of chemical families such as esters, amines, and sulfides that "chemistry" students have probably being exposed to during their laboratory work, while this possibility is very low for "humanities" students. Since it is generally considered that familiarity to an odorant is an important factor for its recognition, it was a priori sought that "chemistry" students could perform better than "humanities" students. The participants in each group were asked to choose a partner so that each member of the pair could act alternately as the sender or the receiver.

2.2. Stimuli

The experimental material was comprised of a set of 12 odorants (Table 1) selected on the basis of their spatial location in Jean-Noël Jaubert's classification (Jaubert, Tapiero, & Dore, 1995). According to this classification (generated from the responses of a panel of judges whose sensitivity to odors had been verified), the olfactory space is represented by 45 basic chemical compounds whose smell is considered prototypic of a class of odors. This space has six principal poles (amino, hesperidian, terpenic, sulphurous, pyrogenic, and sweet), that allow positioning of the 45 compounds relative to each other. The olfactory space is multidimensional, but in exchange for certain distortions, it can be represented as a two-dimensional map (called the field of odors) onto which the refer-

Table 1
Odorants used for the experiment.

	Far (Series F)		Close (Series C)
1	Citral (5%)	7	Cyclopentanone (10%)
2	Isobutyl amine (1%)	8	γ-Undecalactone (1%)
3	Coumarin (5%)	9	Benzyl acetate (5%)
4	α-Pinene (10%)	10	4-(4-Hydroxyphenyl)-2-butanone (5%)
5	2-Acetyl pyrazine (0.5%)	11	Methyl anthranylate (1%)
6	Dimethyl disulfide (0.01%)	12	Ethyl phenylacetate (1%)

Test solutions were prepared from pure chemicals diluted to 10% in alcohol and then diluted in water to the concentrations (percentages) given in the Table.