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Individual Differences in Odor Imaging Ability Reflect Differences in Olfactory and Emotional Perception

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Abstract

We asked whether the large variability in odor imaging ability is underlain by interindividual differences in the processing of smells and emotion. Olfactory imaging ability, anhedonia level, and odor perception were measured in 40 subjects, using the Vividness of Olfactory Imagery Questionnaire (VOIQ), the Physical Anhedonia Scale, and the European Test of Olfactory Capabilities. "Good" olfactory imagers, defined primarily on the basis of the VOIQ, rated pleasant smells as more familiar and had lower anhedonia scores than "bad" olfactory imagers. Based on self-reported measures, these results suggest that, like olfactory perception, the mental imagery of smells is related to emotion and that, beyond their differences in vividness, good and bad olfactory imagers differ in their experience of emotion and long-term memory of smells.

Key words: anhedonia, emotion, individual differences, mental imagery, olfaction

Introduction

Mental imagery has been well documented in the visual (Farah 1989; Kosslyn et al. 2001), auditory (Zatorre and Halpern 1993; Halpern and Zatorre 1999), and motor systems (Jeannerod 1995; Jeannerod and Frak 1999), but its existence in the olfactory domain remains controversial (Engen 1987; Lyman and McDaniel 1990; Schab 1990; Algom and Cain 1991; Schab and Cain 1991; Algom et al. 1993; Carrasco and Ridout 1993; Crowder and Schab 1995; Cain and Algom 1997; Elmes 1998; Herz 2000; Henkin and Levy 2001; Djordjevic, Zatorre, Jones-Gotman 2004; Djordjevic, Zatorre, Petrides, Jones-Gotman 2004; Djordjevic et al. 2005). Mental images are defined as mental representations created in the absence of any external stimulus (Freeman 1981), and self-reports of image vividness are often used to obtain an indication of the degree to which imagery experience resembles perceptual experience (Sheehan 1983; Richardson and Patterson 1986). In both the visual (Marks 1973; Marks and Isaac 1995) and the olfactory (Gilbert et al. 1997, 1998) domains, research has found large intersubject variation in the ability to mentally evoke sights and smells, suggesting the existence of "bad" and "good" imagers.

Like odor perception, odor imagery involves specific olfactomotor patterns for pleasant versus unpleasant smells (Bensafi et al. 2003): when asked to imagine pleasant odors, human subjects take larger sniffs than when asked to imagine unpleasant odors. Recently, Bensafi et al. (2005) observed that this hedonic-dependent pattern of olfactomotor activity during odor imaging was more prominent in good olfactory imagers suggesting that bad and good imagers may process emotional items differently—as shown in a nonolfactory modality by Fiorito and Simons (1994).

The aim of the present study was 2-fold. First, we set out to investigate whether variability in odor imaging ability may be underlain by differences in the processing of real smells between good and bad imagers. Second, we further addressed the possibility that odor imaging ability may be differentially distributed among subjects according to their ability to experience positive emotions. We approached this by measuring olfactory imaging ability using the Vividness of Olfactory Imagery Questionnaire (VOIQ) (Gilbert et al. 1997) and related this measure of individual differences in imaging ability to measures of individual performance on

1) an olfactory test and 2) a test intended to access a wide variety of positive sensory experiences.

Material and methods

Subjects

Forty undergraduate students (mean age 21.43 years ± 2.24) from the Claude Bernard University of Lyon (France) participated in the experiment.

Imagery questionnaires

The Vividness of Visual Imagery Questionnaire (VVIQ) (Marks 1973) and VOIQ (Gilbert et al. 1997) were used to estimate respectively visual and olfactory mental imaging ability. The questionnaires require respondents to mentally evoke a series of 16 objects and activities (given visual or olfactory cues, respectively) and to estimate the vividness of each of the evoked images on a 5-point scale (from 1 "perfectly vivid" to 5 "no image at all"). Thus, possible scores on the VVIQ and on the VOIQ range from 16 to 80 (low scores indicating good imaging ability). In the VVIQ, respondents are asked to think of a series of objects and activities and to rate the clarity and the vividness of the resulting image on a 5-point scale (from 1 "perfectly clear and vivid as normal vision" to 5 "no image at all"). In the VOIQ, subjects are asked to think of objects and activities that have an odorous element and to rate the realism and vividness of the imagined odor on a 5-point scale (from 1 "perfectly realistic and vivid as the actual odor to 5 "no odor at all"). For example, the first scene description in the VVIQ is "In answering items 1 to 4, think of some relative or friend whom you frequently see (but who is not with you at present) and consider carefully the picture that comes before your mind's eye: 1) The exact contour of face, head, shoulders and body; 2) Characteristic poses of head, attitudes of body etc; 3) The precise carriage, length of step, etc. in walking; 4) The different colours worn in some familiar clothes." The first scene description in the VOIQ is "Think of a time when you really need to take a bath or shower—your clothes are smelly and you need to wash your hair. The 4 items based on this scene are: 1) The smell of your shirt or blouse when you remove it; 2) The fragrance of the soap or shampoo you use to wash; 3) The smell of the fresh clothes you put on; 4) The odour of an aftershave, perfume or cologne you use afterwards." Both questionnaires show significant internal reliability and have been well validated in previous studies in their respective olfactory and visual domains (Marks 1973, 1989a, 1989b; Marks and Isaac 1995; Gilbert et al. 1997, 1998).

Anhedonia questionnaire

The anhedonia (inability to experience pleasure) level of each subject was assessed on the Physical Anhedonia Scale (Chapman et al. 1976), a 61-item true/false inventory intended to access a wide variety of positive physical experiences. This questionnaire shows significant reliability and has been well validated in previous nonolfactory studies (Chapman et al. 1976; Loas et al. 1996; Dubal et al. 2000). Possible scores range from 0 to 61 (a low score corresponding to a low level of anhedonia). Anhedonia is measured by assertions about stimuli and situations that are socially recognized as positive. Anhedonic subjects tend to disagree with assertions such as "I always want to walk in puddles of water," and to agree with assertions such as "I don't understand what people find in music"; thus, the anhedonia scale measures disagreement with the positive semantic encoding of sensory experience and how much subjects distance themselves from positive emotional stimuli.

Test of olfactory capabilities

Subjects' olfactory performance was estimated on the European Test of Olfactory Capabilities (ETOC) (Thomas-Danguin et al. 2003). Briefly, the ETOC is based on 16 blocks of 4 flasks. Only one flask per block contains an odorant. For each block, participants are asked, first, to detect the flask containing the odor and, second, to identify the detected smell. Identification is assessed by a multiple-choice procedure in which participants have to select the correct descriptor from 4 proposed. The odorous solutions (volume 5 ml) are dissolved in mineral oil and poured into a 15-ml flask (1.7 cm in diameter at the opening, 5.8 cm high). Each flask contains a synthetic absorbent (polypropylene) to optimize odor diffusion. After completing the identification task, subjects sniff each odorized vial and rate compound intensity, pleasantness, and familiarity on a 9-point scale (from 1 "not at all intense, pleasant, or familiar" to 9 "extremely intense, pleasant, or familiar"). The detection score ranges from 0 to 16 and is an indicator of sensitivity; the identification score also ranges from 0 to 16, but only odors that have been correctly detected are taken into account, thus reducing the probability of fortuitous correct identification. Previous studies showed that ETOC performance was sensitive to age; the test has been validated in several countries (Thomas-Danguin et al. 2003; Koskinen et al. 2004).

Procedure

After giving informed consent, subjects filled out a demographic questionnaire and completed both the VOIQ (Gilbert et al. 1997) and the VVIQ (Marks 1973), administered in a paper format. No reference was made in the instructions for either test as to whether the subjects should have their eyes open or closed during mental imagery tasks. Afterward, participants were to complete the anhedonia scale (Chapman et al. 1976) and the response sheet of the ETOC (Thomas-Danguin et al. 2003). After the olfactory detection and identification tasks, the experimenter presented each odorant vial again and subjects rated compound intensity, pleasantness, and familiarity on a 9-point scale (from 1 "not at all intense, pleasant, or familiar" to 9 "extremely intense, pleasant, or familiar"). The 16 odors used were vanilla, cloves, apple, eucalyptus, cinnamon, fuel oil, pine, garlic, cutgrass, anise, orange, fish, rose, thyme, lemon, and mint.

Study variables

The study variable for the imagery questionnaires was the subject's score, ranging from 16 to 80 (high scores indicating poor imaging ability), on the VVIQ and on the VOIQ. As indicated above, the anhedonia scores ranged from 0 to 61 (a low score corresponding to a low level of anhedonia). Regarding olfactory capability, the detection and identification scores on the ETOC ranged from 0 (bad sensitivity and bad odor identification) to 16 (good sensitivity and good odor identification). Only odors that had been correctly detected were considered for identification scoring. Intensity, pleasantness, and familiarity scores ranged from 1 to 9. Familiarity scoring was performed only on those odors that had been both detected and identified correctly.

Results

Relationship between olfactory and visual imaging ability

To examine how VOIQ scores correlated with VVIQ scores, a simple regression analysis was performed between VOIQ and VVIQ scores. Analysis revealed that the 2 scores correlated significantly and positively ($F(1,39) = 5.910$, $P < 0.02$) (Figure 1a). In other words, participants with good visual imaging ability also showed good olfactory imaging ability.

Relationship between imaging ability and anhedonia

To investigate how VVIQ and VOIQ scores correlated with anhedonia scores, simple regression analyses were performed between VVIQ and anhedonia scores and between VOIQ and anhedonia scores. Analysis revealed that VOIQ (Figure 1b) ($F(1,39) = 4.852$, $P < 0.04$) but not VVIQ scores (Figure 1c) ($F(1,39) = 0.002$, not significant [NS]) correlated significantly and positively with anhedonia scores. In other words, good olfactory imagers had low and bad olfactory imagers high anhedonia scores. No such relationship was observed for visual imagery data.

Olfactory imaging and odor detection and identification

To investigate whether olfactory imaging ability correlated with odor detection and odor identification performance, we undertook 2 simple regression analyses with VOIQ score as the dependent variable and respectively odor detection and odor identification scores as the independent variables. The analysis did not reveal any significant relationship between VOIQ score and odor detection ($F(1,39) = 1.863$,

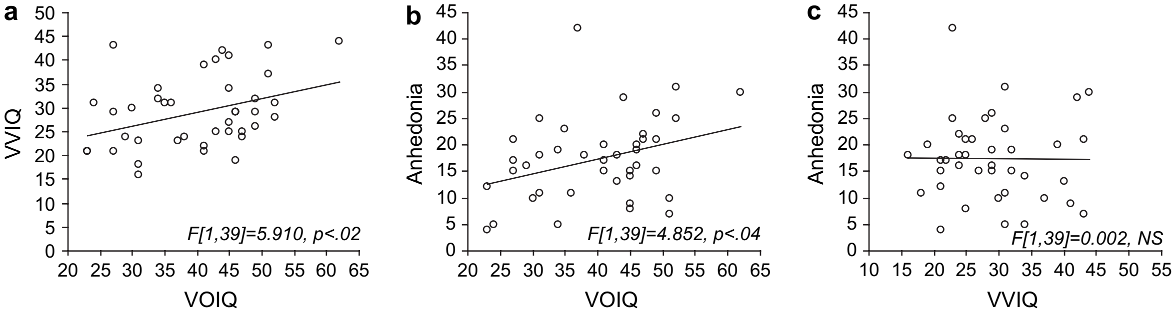

Figure 1 **(a)** VVIQ score as a function of VOIQ score. Subjects with good olfactory imaging ability also had good visual imaging ability. **(b)** Anhedonia level as a function of VOIQ scores. Subjects with poor olfactory imaging ability (high VOIQ score) also had a high level of anhedonia. **(c)** Anhedonia level as a function of VVIQ score. No relationship was observed between anhedonia level and VVIQ score.

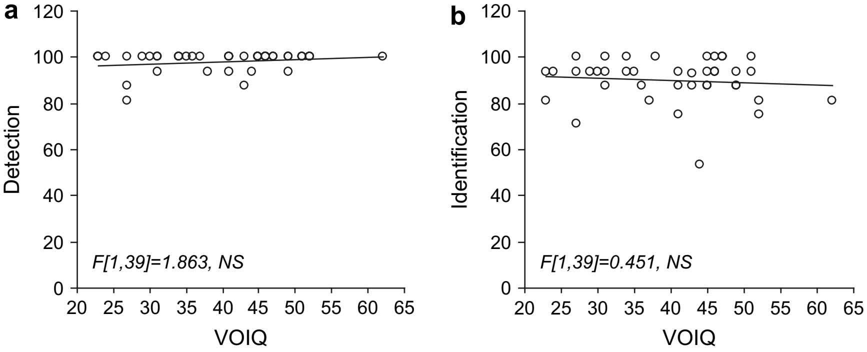

Figure 2 **(a)** VOIQ score as a function of olfactory detection score. No significant relationship was observed between the 2 scores. **(b)** VOIQ score as a function of olfactory identification score. No significant relationship was observed between the 2 scores.

NS) or between VOIQ score and odor identification (*F*(1,39) = 0.451, NS). In other words, good and bad olfactory imagers did not differ in their odor detection (Figure 2a) or odor identification abilities (Figure 2b).

Olfactory imaging and odor intensity rating

To investigate whether olfactory imaging ability correlated with odor intensity ratings, we undertook simple regression analyses with VOIQ score as the dependent and odor intensity rating as the independent variable. The analysis did not reveal any significant relationship between VOIQ score and odor intensity rating (*F*(1,39) = 0.113, NS). In other words, good and bad olfactory imagers did not differ in their odor intensity ratings (Figure 3a).

Olfactory imaging and odor pleasantness rating

To investigate whether olfactory imaging ability correlated with odor pleasantness ratings, we undertook simple regression analyses with VOIQ score as the dependent and odor pleasantness rating as the independent variable. The analysis did not reveal any significant relationship between VOIQ score and odor pleasantness rating (*F*(1,39) = 0.370, NS). In other words, good and bad olfactory imagers did not differ in their odor pleasantness ratings (Figure 3b).

Olfactory imaging and odor familiarity rating

To investigate whether olfactory imaging ability correlated with odor familiarity ratings, we undertook 2 simple regression analyses with VOIQ score as the dependent and odor familiarity rating as the independent variable. The analysis revealed a significant negative relationship between odor familiarity ratings and VOIQ score (*F*(1,39) = 8.098, $P < 0.01$) (Figure 3c).

As bad and good olfactory imagers differ in the sensorimotor strategies they used to imagine pleasant and unpleasant odors (Bensafi et al. 2005), we further addressed the possibility that the relationship between odor familiarity and olfactory mental imaging ability may depend on odor hedonics. Thus, the same statistical analysis (simple regression) was applied for of each of the 16 odors. Analysis revealed a significant negative relationship between the familiarity ratings for the smells of vanilla (*F*(1,38) = 5.738, $P < 0.03$), apple (*F*(1,23) = 5.185, $P < 0.04$), pine (*F*(1,34) = 5.575, $P < 0.03$), orange (*F*(1,39) = 4.293, $P < 0.05$), and lemon (*F*(1,35) = 5.990, $P < 0.02$) on the one hand and VOIQ score on the other hand (Figure 4). No significant relationships were found between VOIQ score and the pleasantness ratings of the other odors (cloves *F*(1,36) = 0.515, NS; eucalyptus *F*(1,38) = 0.965, NS; cinnamon *F*(1,36) = 0.946, NS; fuel oil *F*(1,37) = 0.120, NS; garlic *F*(1,31) = 0.025, NS; cut-grass *F*(1,37) = 1.595, NS; anise *F*(1,35) = 1.798, NS; fish *F*(1,38) = 0.827, NS; rose *F*(1,38) = 0.901, NS; thyme *F*(1,30) = 1.225, NS; mint *F*(1,25) = 3.364, NS).

To examine whether smells for which a significant relationship was found between imaging ability and familiarity rating (vanilla, apple, pine, orange, and lemon) differed in terms of pleasantness from those for which no such significant relationship was found (cloves, eucalyptus, cinnamon, fuel oil, garlic, cut-grass, anise, fish, rose, thyme, and mint), we compared the mean pleasantness ratings of the 2 categories of smells, using a one-way analysis of variance (ANOVA). The ANOVA revealed a significant difference between the mean pleasantness ratings of the 2 types of smell (*F*(1,39) = 127.428, $P < 0.0001$): vanilla, apple, pine, orange, and lemon were on average perceived as more pleasant than cloves, eucalyptus, cinnamon, fuel oil, garlic, cut-grass, anise, fish, rose, thyme, and mint (Figure 5). In other words, good imagers estimated the pleasant smells of vanilla, apple, pine, lemon, and orange as more familiar than did poor imagers.

Discussion

The present study sought to relate olfactory imaging ability to the perception of real smells. Good olfactory imagers, defined as such primarily on the basis of the VOIQ, exhibited good visual imaging abilities and had lower anhedonia scores. Good and bad olfactory imagers differed in their

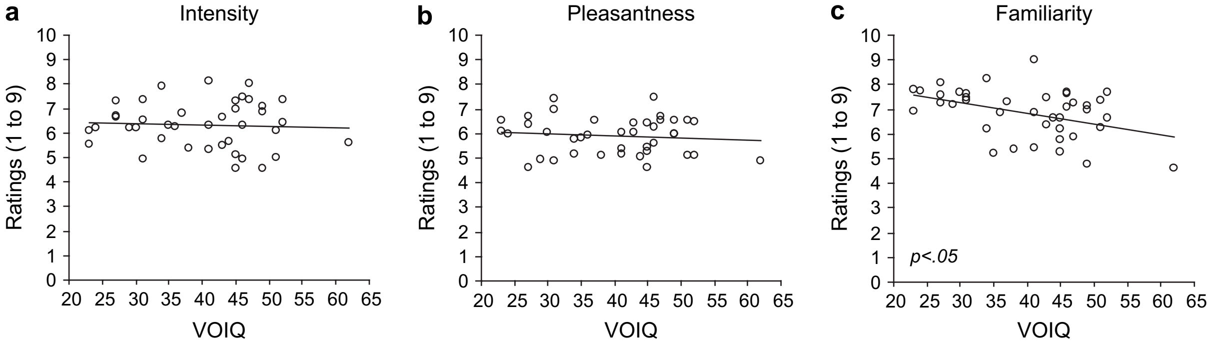

Figure 3 VOIQ score as a function of odor intensity **(a)**, odor pleasantness **(b)**, and odor familiarity **(c)** ratings. Subjects showing good olfactory imaging (i.e., low VOIQ scores) rated odors as more familiar than did those showing poor olfactory imaging ability (i.e., high VOIQ scores) (c); but the 2 groups of olfactory imagers did not differ in their odor intensity (a) and pleasantness (b) ratings.

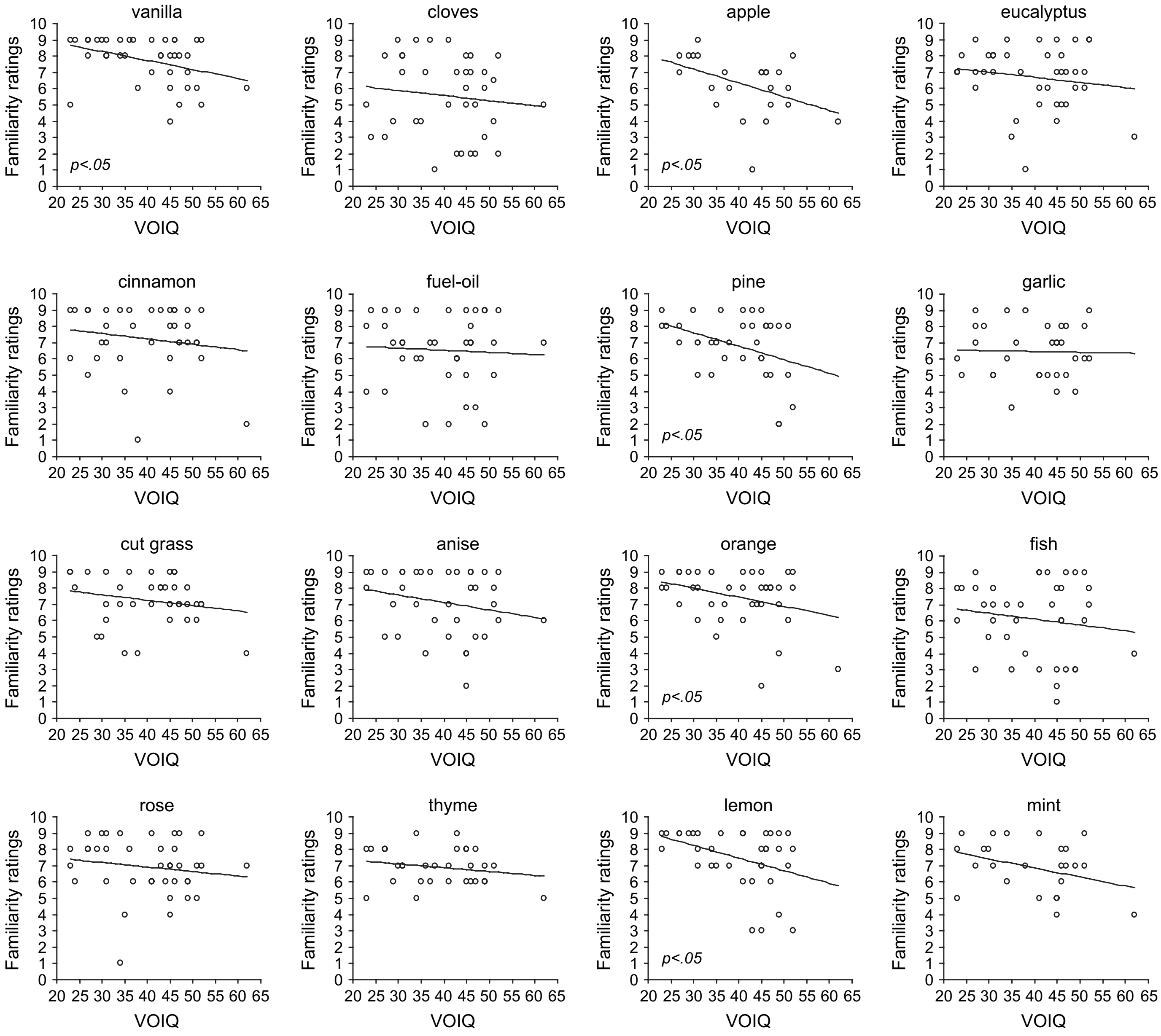

Figure 4 VOIQ score as a function of familiarity ratings for each of the 16 odors used in the present experiment. Subjects showing good olfactory imaging (i.e., low VOIQ scores) rated the smell of vanilla, apple, pine, orange, and lemon as more familiar than those with poor olfactory imaging ability (i.e., high VOIQ scores). Good and bad olfactory imagers did not significantly differ in their familiarity ratings on the other odors (cloves, eucalyptus, cinnamon, fuel oil, garlic, cut-grass, anise, fish, rose, thyme, or mint).

behavior in response to pleasant olfactory stimuli, the former rating pleasant smells as more familiar. No relationship was found between olfactory imaging ability and odor detection and identification or intensity and pleasantness rating.

That VOIQ and VVIQ scores showed a significant positive correlation suggests that visual and odor imagery may interact, sharing a common cognitive basis, in line with the findings of Gilbert et al. for their nonexpert subjects. From the behavioral and neural points of view, recent investigations indicate that the generation of an olfactory representation is facilitated by simultaneously presenting visual and olfactory aspects of an environmental object (Gottfried and Dolan 2003), suggesting an interaction between the visual and olfactory attributes of a mental representation. This in turn suggests that good olfactory imagers should have an advantage in generating odor images, thanks to their imaging ability in another sensory modality.

Anhedonia is typically marked by a decrease in the perceived pleasantness of positive sensory stimuli (Fiorito and Simons 1994). Although bad olfactory imagers exhibited a higher level of anhedonia than good olfactory imagers, their pleasantness ratings for olfactory stimuli were not lower.

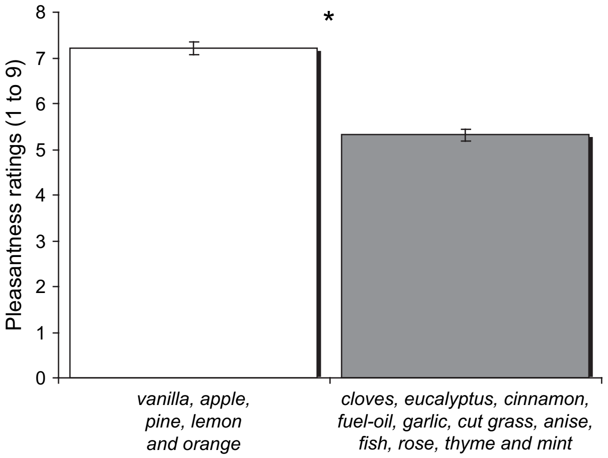

Figure 5 Pleasantness ratings of the odors of vanilla, apple, pine, orange, and lemon (white bar) and of cloves, eucalyptus, cinnamon, fuel oil, garlic, cut-grass, anise, fish, rose, thyme, and mint (gray bar). The odors represented by the white bar were significantly (*) more pleasant than those represented by the gray bar.

Significant relationships between anhedonia and odor hedonic judgment have been found in certain clinical cases. Schizophrenic patients, for example, showed relatively impaired processing of the hedonic and semantic features of smells (Hudry et al. 2002). Neurologically, schizophrenia is characterized by a deficit in the activation of the insula, the orbitofrontal cortex, and the limbic areas including the piriform cortex (Plailly et al. 2006). This neurological deficit may explain how a basic process such as hedonic judgment of smells is impaired in that population. The present study, however, tested healthy subjects whose anhedonia scores, although varying widely, remained nonpathological; this may explain why no difference in odor hedonic rating emerged between high and low anhedonia scorers. It does not, however, account for the relationship found between imaging ability and anhedonia. One explanation for this may be that, in contrast to basic hedonic judgment (which does not necessarily require the activation of contextual information), imaging ability and anhedonia were estimated on subjective questionnaires that involve access to memories and cognitive representations.

Another point of interest in the present study was that the mental representation of a pleasant odor was judged more familiar by good than bad imagers. Thus, the difference between these groups seemed to depend not so much on the sensory processing as on the memory representation of odors. Differences in familiarity point to long-term memory differences between the 2 groups, independently of linguistic codes. Several authors have stressed that familiarity (the "feeling of knowing") of odors may be dissociated from explicit recollection ("remembering") (Lehrner et al. 1999; Larsson et al. 2005). If these processes are dissociable, it is possible that subjects are able to retrieve linguistic and/or autobiographic information about odors despite having no more than a weak feeling of familiarity. An alternative interpretation, however, could be that the feeling of familiarity involves lower level processing (implicit memory driven by a perceptual process) than does retrieval of verbal and/or autobiographical information (involving explicit memory) and that these separate processes are additive (Mandler 1980). In that case, one would expect that bad and good olfactory imagers would differ in terms of both odor familiarity and odor identification. The present study, however, found differences only in terms of familiarity. This could be due to a ceiling effect induced by the forced-choice paradigm used here to prompt identification: providing 4 verbal alternatives induces semantic priming that may have made the identification task too easy, failing to disclose long-term memory differences between good and bad imagers. Assessing odor identification without any semantic cueing might reveal such differences. Whatever the case, the differences observed here concerned only the memory representation of pleasant odors and may be the reflection of a more subtle difference than expected in the experience of pleasure in subjects with high anhedonia scores.

That good olfactory imagers 1) also exhibited good visual imaging ability, 2) were less impaired in experiencing positive emotions, and 3) estimated odors as more familiar than bad olfactory imagers taken together suggests that these 3 factors (imagery, anhedonia and familiarity) are not independent and modality-specific but interact centrally in memory. Odor familiarity rating addresses how much experience subjects think they have with a given odor. If good olfactory imagers are defined as individuals who access their memory easily, then they should more easily access memories involving odors and thus rate odors as being more familiar. In addition, in the present study, bad olfactory imagers showed a higher level of anhedonia than good olfactory imagers. This particularity may lead bad olfactory imagers to expect any odor to be rather unpleasant, so that they will sample odors differently to good olfactory imagers. As there is no reason to suppose that bad imagers are going to encounter such odors less often, the difference may lie in the depth of processing of pleasant odors. One possibility would involve sniffing: sniffing longer might enable deeper access to the mnemonic information needed subsequently to estimate familiarity. Indeed, in a previous report we showed that, just as during actual sensory perception, good olfactory imagers sniffed longer while imaging pleasant odors, whereas bad olfactory imagers failed to produce such an integrated pattern of affective response during pleasant-odor imaging (Bensafi et al. 2005). Combined with the present finding of decreased familiarity of pleasant odors in bad imagers, this suggests that this affective response pattern is not properly retrieved from memory in bad imagers. From a physiological point of view, bad imagers, who exhibit a high level of anhedonia, may not deploy the appropriate sensorimotor response when generating emotional odor imagery. This would be in line with the finding that anhedonic subjects show a physiological response deficit when imaging emotional events (Fiorito and Simons 1994).

In Fiorito and Simons' study, heart rate and skin conductance recording showed reduced autonomic reactivity during imaging as compared with actual (auditory) perception of emotional scenes; the fall in skin conductance was present in control subjects but more dramatic in anhedonics; the fall in heart rate was also found in both groups, but controls showed the same valence effects (i.e., greater acceleration with negative emotional content) whether during perception or imagery, whereas anhedonics were unable to maintain a differential heart rate response, which did not differ from baseline during imaging. The authors interpret these differences in terms of the structure of emotions in long-term memory. Lang (1984) observed that heart rate seems to be the most reliable means of distinguishing between good and poor imagers. He proposed that emotional memorial representations rely on image mode processing, associating visceral outflow; it is thus possible that anhedonics have a poorly integrated emotional prototype in memory, making retrieval problematic. In major depressive disorder—a clinical population characterized by anhedonia—positive affect processing is found to dysfunction, and cerebral imaging studies show hypoactivation of striatal regions subserving reward paired with hyperactivation of dorsal prefrontal cortical areas in response to happy stimuli, both effects correlating with anhedonia severity (Keedwell et al. 2005). This is consistent with enhanced recall of sad memories in depressed subjects. In schizophrenia, another anhedonic population, Crespo-Faccoro et al. (2001) demonstrated deficient processing of a pleasant odor (vanillin), associated with far lower limbic and paralimbic activation (nucleus acumbens) than in control subjects and with hyperactivation in a number of frontal areas that "appear to be hijacked for recognizing unpleasant stimuli," in compensation for the failure of the paralimbic regions. The connection between mnemonic and emotional information has recently been explored in normal subjects by Smith et al. (2006), who showed that retrieving emotionally valenced information involves enhanced connectivity from hippocampus to amygdala, both structures being crucial for the encoding of emotional events. Moreover, during emotional retrieval, an influence of the orbitofrontal cortex on these structures was seen. As the orbitofrontal cortex is involved both in the representation of affective value and in behavioral guidance, this circuit could reflect top–down influences on behavior during recall of emotional memories. This top–down influence may be less effective during imaging tasks in anhedonic subjects, failing to prompt both the memory of the odor experience and the visceromotor responses associated with encoding.

In summary, it is possible that anhedonic subjects encode odors in a different and less integrated way than their more hedonic counterparts: as exposure to pleasant and unpleasant odors elicits respectively positive and negative moods in healthy volunteers (Schiffman, Sattely-Miller, et al. 1995; Schiffman, Suggs, et al. 1995), people with anhedonic tendencies may either sniff in a different way when they meet a pleasant odor or process odors at a lower level than subjects who easily feel physical pleasure; they may, for example, shorten either their sniff or the episodic encoding of the odor, either because they do not find it very rewarding or because they more generally tend to avoid emotional stimulation. Thus, the basic difference between bad olfactory imagers with a high level of anhedonia and good olfactory imagers with a low level may involve the way mental representations of odors are integrated: odor representation may comprise at least an emotional (odor hedonics) and a motor trace (sniffing), good olfactory imagers integrating these traces properly, whereas bad olfactory imagers exhibit deficits during retrieval.

A final concern that may be raised here is that the relationship observed between odor imagery and pleasant smell familiarity may be due to external factors such as demand characteristics or "overconfidence" (McKelvie 1990, 1994), given that all the variables measured in the present study were subjective. Subjects were exposed to pleasant, neutral, and unpleasant smells. In such a design, overconfidence and/or demand characteristic effects could occur for any smell, whatever the degree of pleasantness. A significant relationship was, however, observed in the present study only between odor imaging ability and pleasant smell familiarity rating, which suggests that demand characteristic and/or overconfidence effects were not in fact occurring, and gives support to the notion that self-reported olfactory image vividness as rated on the VOIQ is a valid measure of differential olfactory mental experience.

In conclusion, the present results show that, as in olfactory perception, olfactory imagery is related to emotion and that, beyond their differences in reported vividness, good and bad olfactory imagers differ both in their experience of emotion and in their long-term memory of smells.

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