

# Modeling the Subjectivity of Human Olfaction and Its Variability

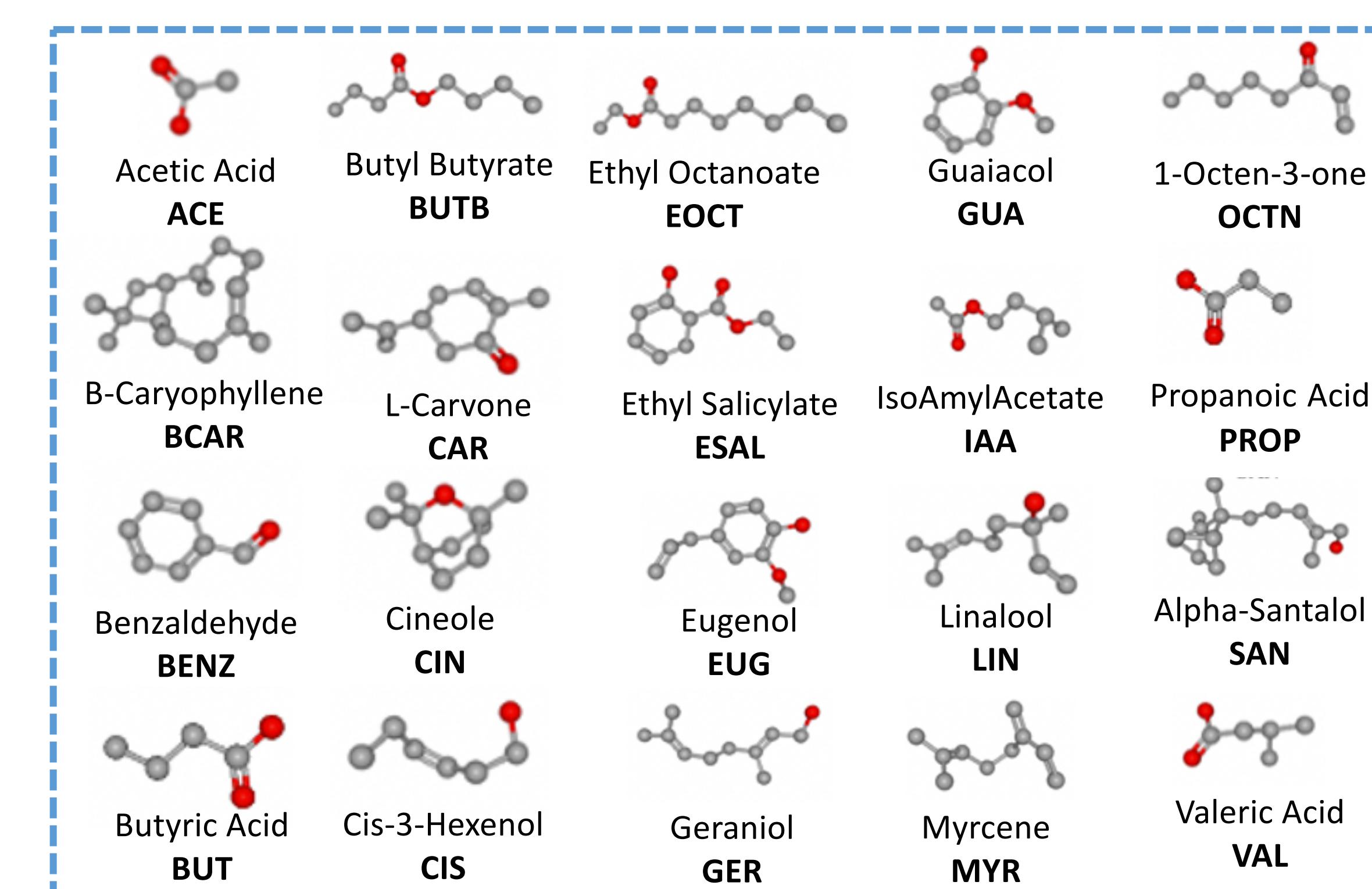
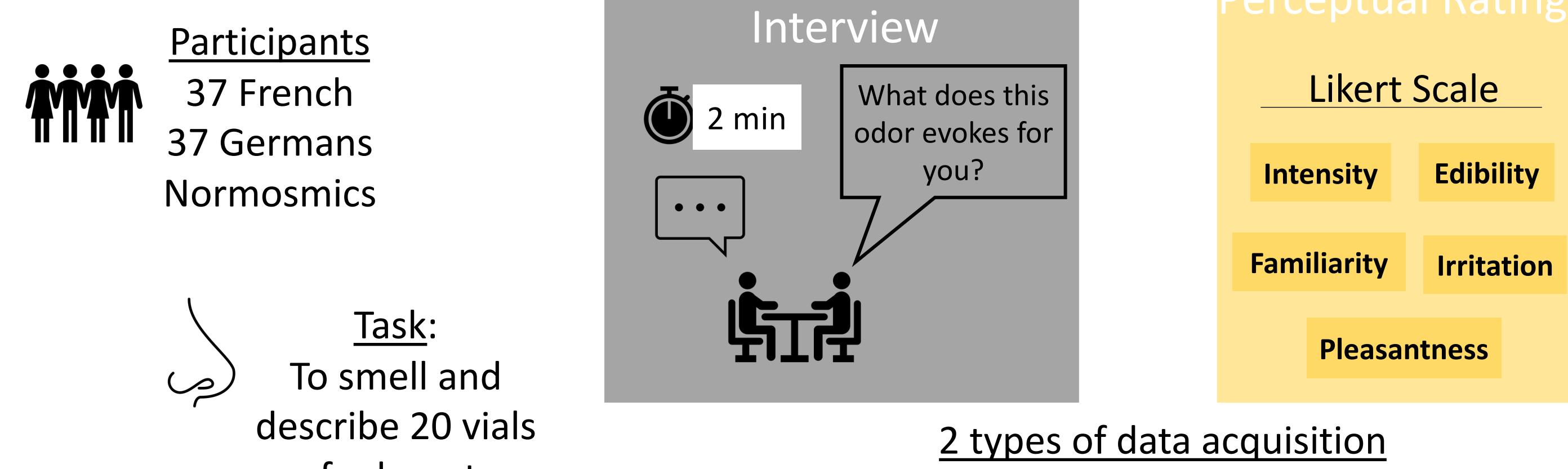
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This study was funded by the IRP-CNRS Human Chemosensation.

## Introduction

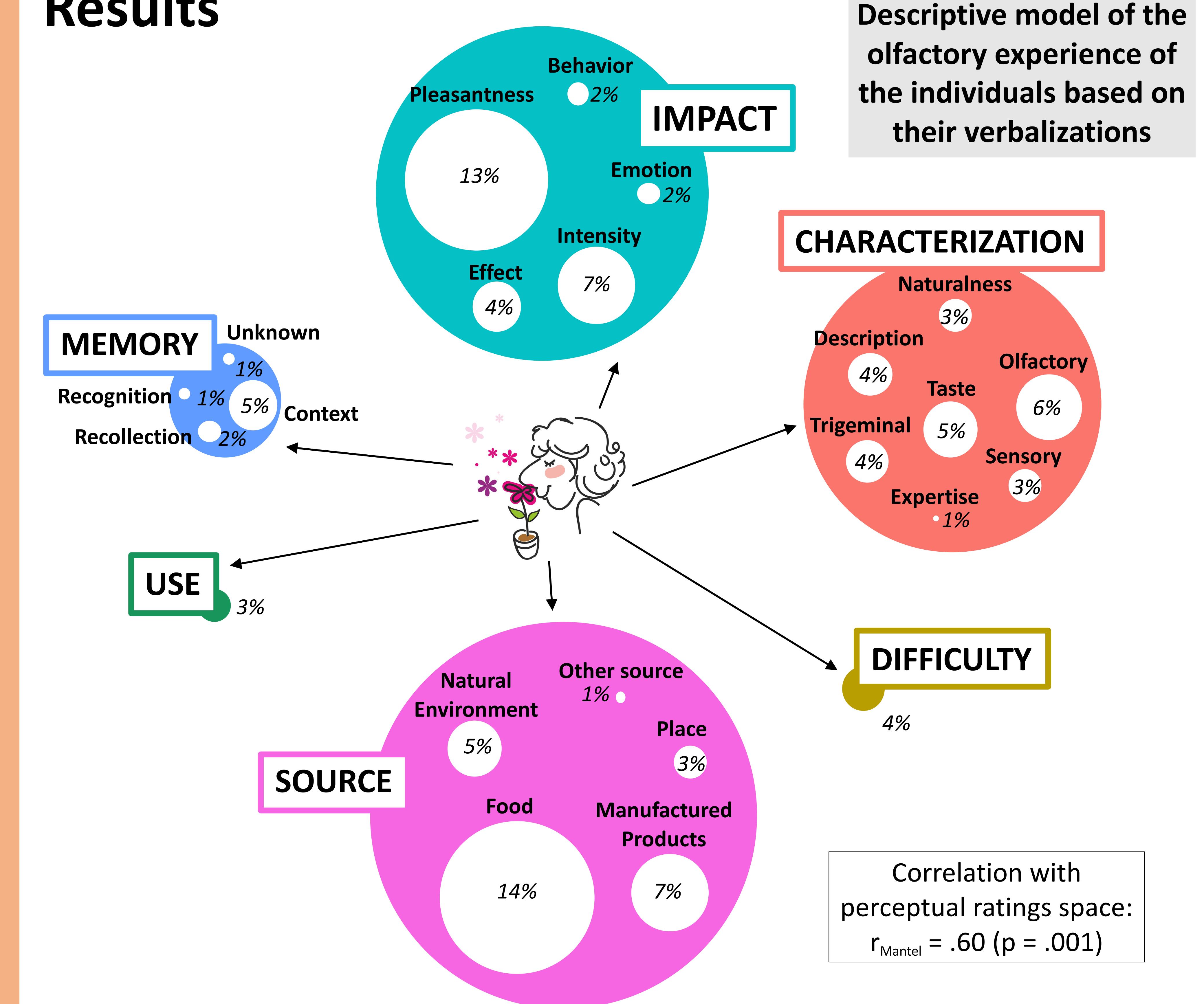
- Experimental research on human olfaction generally rely on perceptual ratings (e.g. intensity, pleasantness...) or semantic description (e.g. floral, musky...) as measures of the olfactory experience. However, these measures are biased as the instructions orient the subject towards specific aspects of their experience.
- Moreover, there is no unified model of the subjective olfactory experience and its features, even though it is necessary to understand odor perception and its variability among individuals (very high in olfaction: Ferenzi et al, 2013; Rouby et al, 2009).
- The aim of this study was to build a descriptive model of the olfactory experience in a sample of individuals, from two linguistic backgrounds.
- To this end, we used a semi-directed interview method (Petitmengin et al, 2006) with non-biased questions to help the subjects to verbalize their experience of odors.

## Methods



Analysis: The verbalizations for each odorant and each participant were transcribed, translated into English and categorized into types of references with Nvivo Software

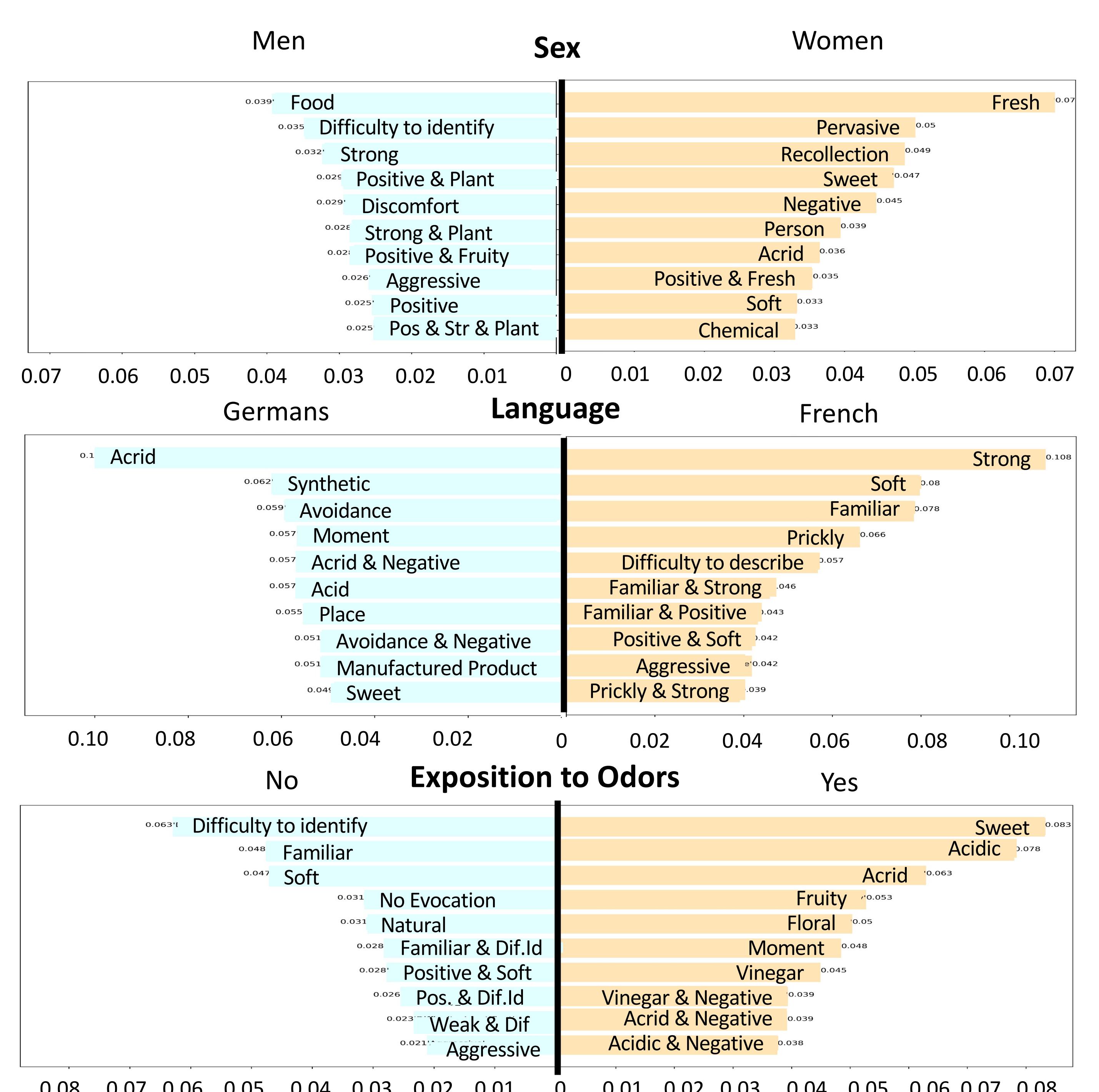
## Results



Here, a subgroup discovery method allowed us to extract overrepresented descriptors in each group of individuals

### Subgroup discovery analysis on the groups of individuals

MTCSExtent algorithm (Mathonat et al., 2021)



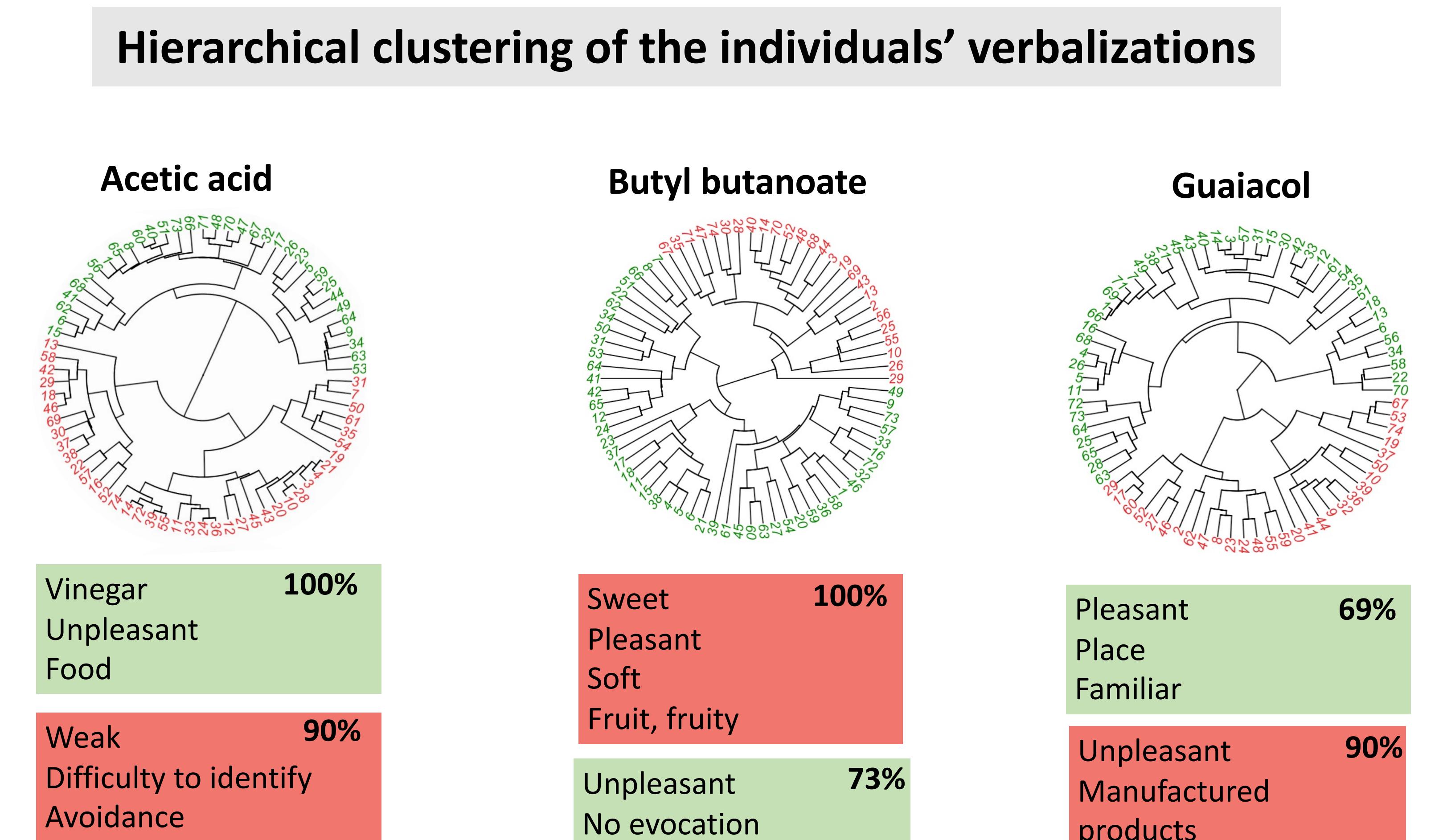
## Discussion

- The descriptive model resulting from the verbalizations of the subjects comprises six main categories, namely: impact of the odor on the individual, use of the odor, difficulty to identify and describe the odor, qualitative characterization of the odor, memory of the odor and source of the odor.
- Consistent with the literature, the odor hedonic valence is the main element found in subjects' verbalizations, as well as references to food. It confirms the importance of edibility and pleasantness in smell perception (Licon et al, 2018)
- The data mining approaches used here showed that salient descriptors in discourse differed according to gender, language and exposure to odors, and that different experiential profiles can be identified for each odorant.
- These results show that odor descriptions are rich and diverse and stress the overall importance of subjective methodologies to understand fine-grained relationships between perception and language. Future studies may investigate the weight of other factors and neural correlates of perceptual experience of odors.

### Cluster characterization

(A priori closed algorithm, Pasquier et al, 1999)

Here, the descriptors best describing participants in each cluster are represented, as well as the total percentage of individuals described by this combination



# Introduction

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- Moreover, there is no unified model of the subjective olfactory experience and its features, even though it is necessary to understand odor perception and its variability among individuals (very high in olfaction: Ferenzi et al, 2013; Rouby et al, 2009).
- The aim of this study was to build a general model of the olfactory experience in a large sample of individuals, from two linguistic backgrounds.
- To this end, we used a semi-directed interview method (Petitmengin et al, 2006) with non-biased questions to help the subjects to verbalize their experience of odors.

# Methods

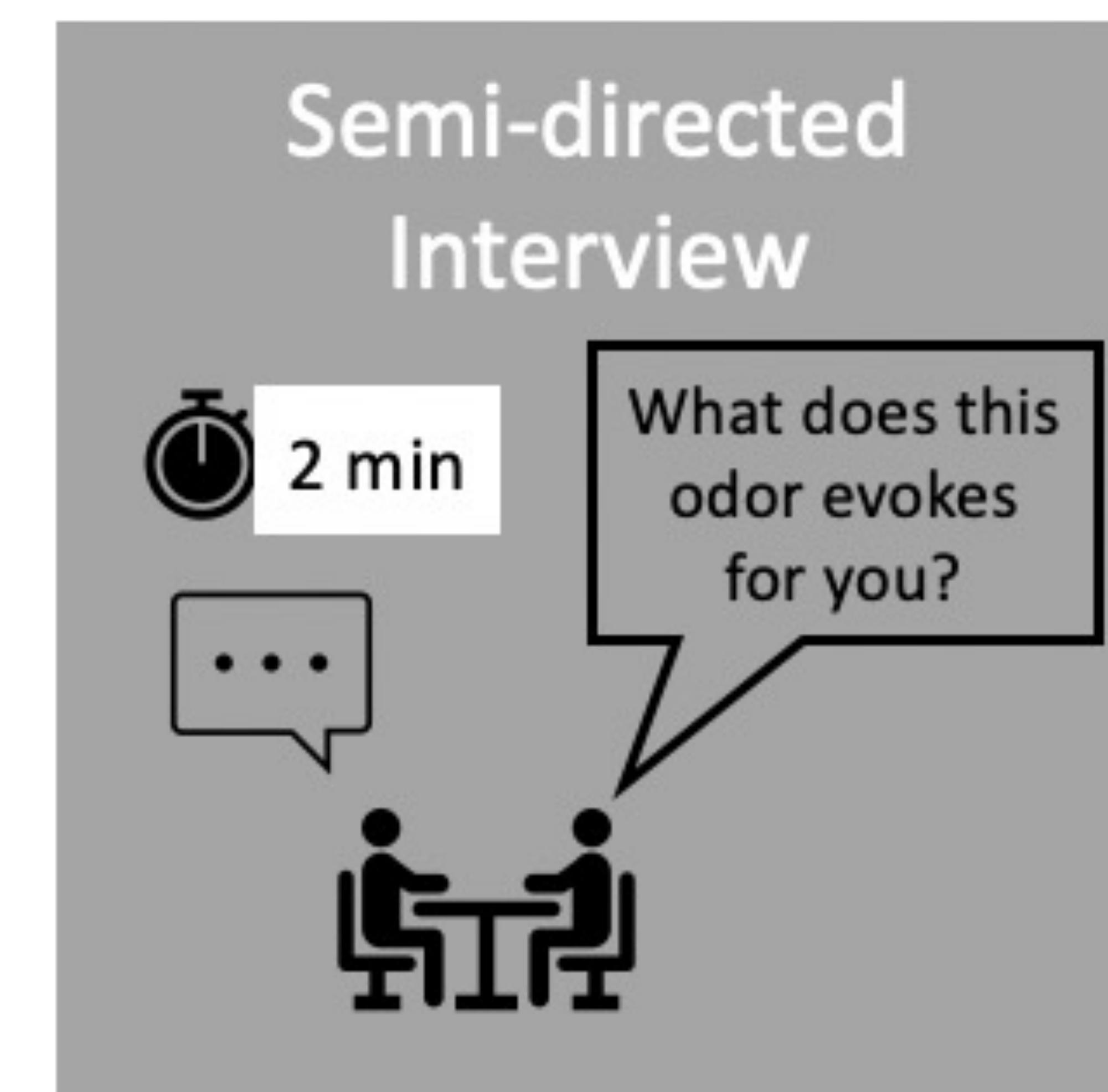


## Participants

37 French  
37 Germans  
Normosmics

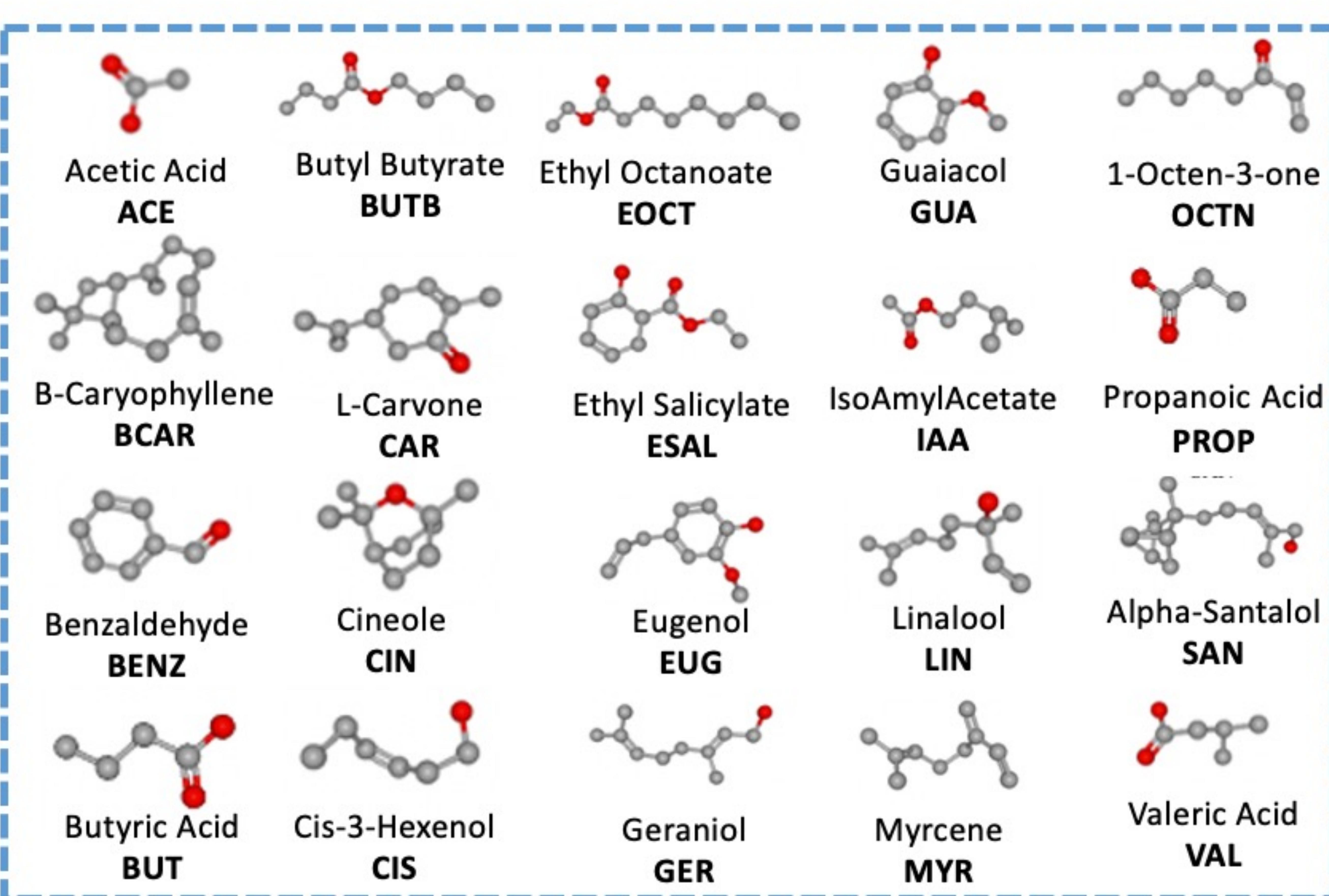


Task:  
To smell and  
describe 20 vials  
of odorants



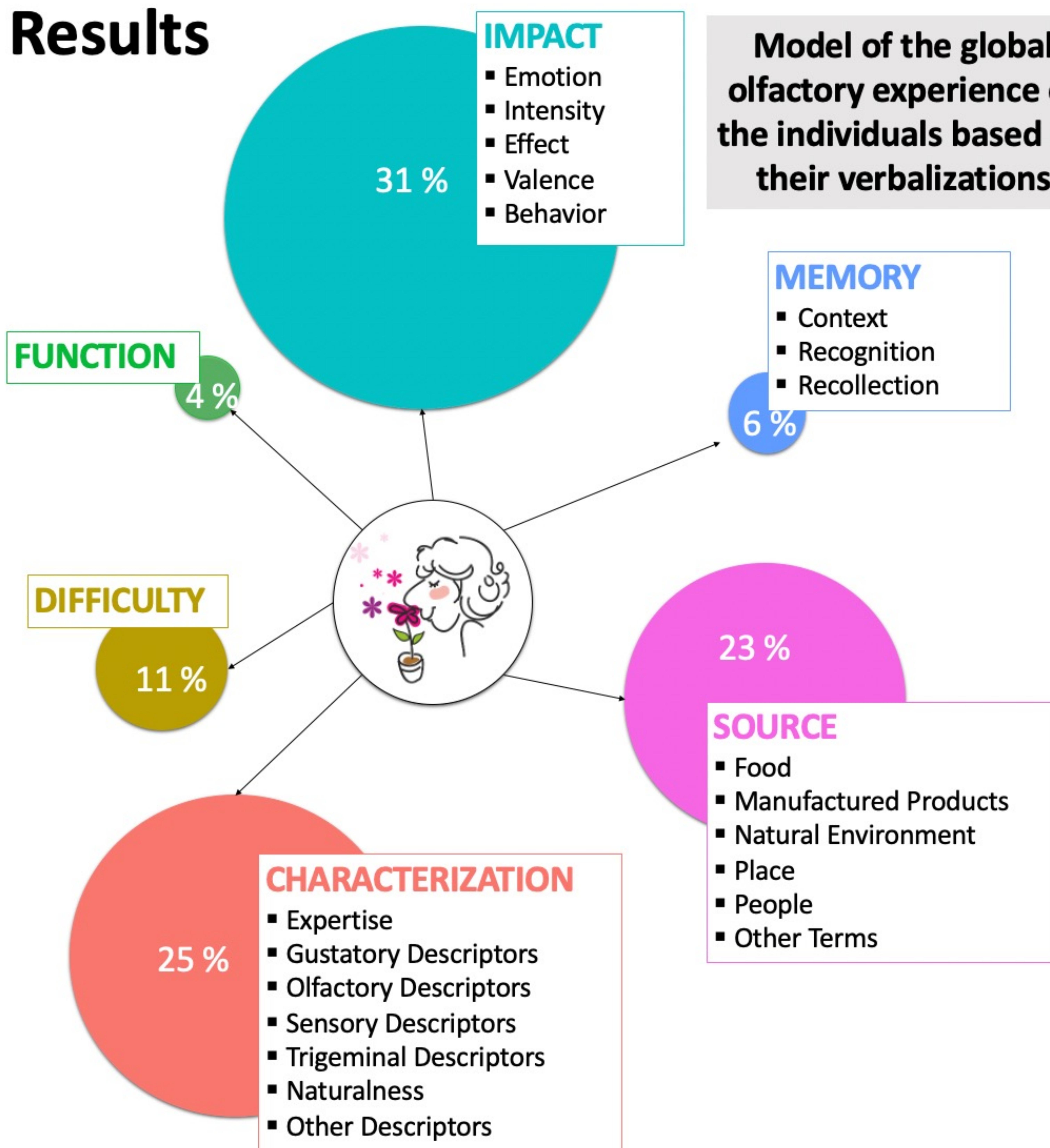
2 types of data acquisition

List of the 20 odorants that were used



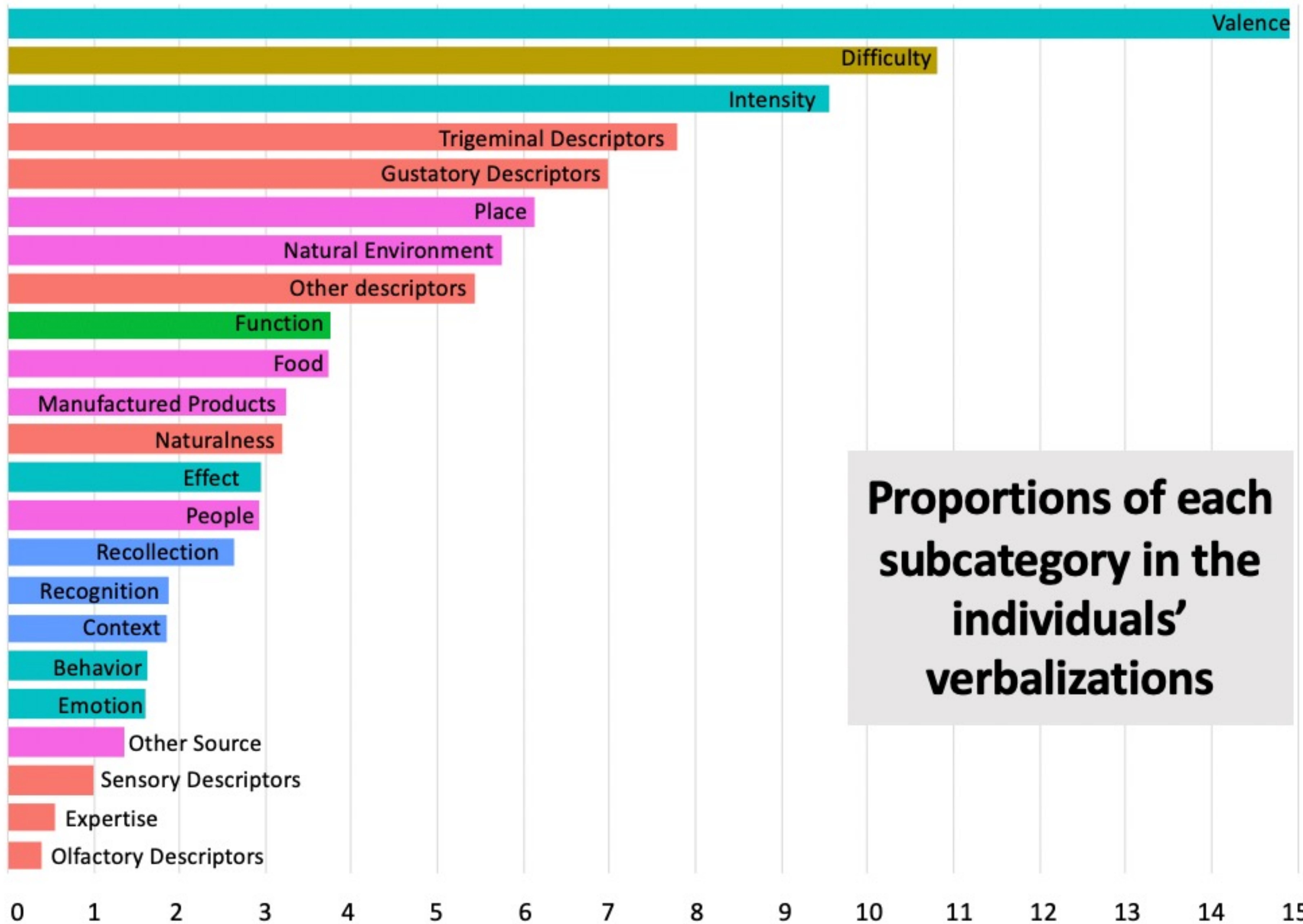
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# Results



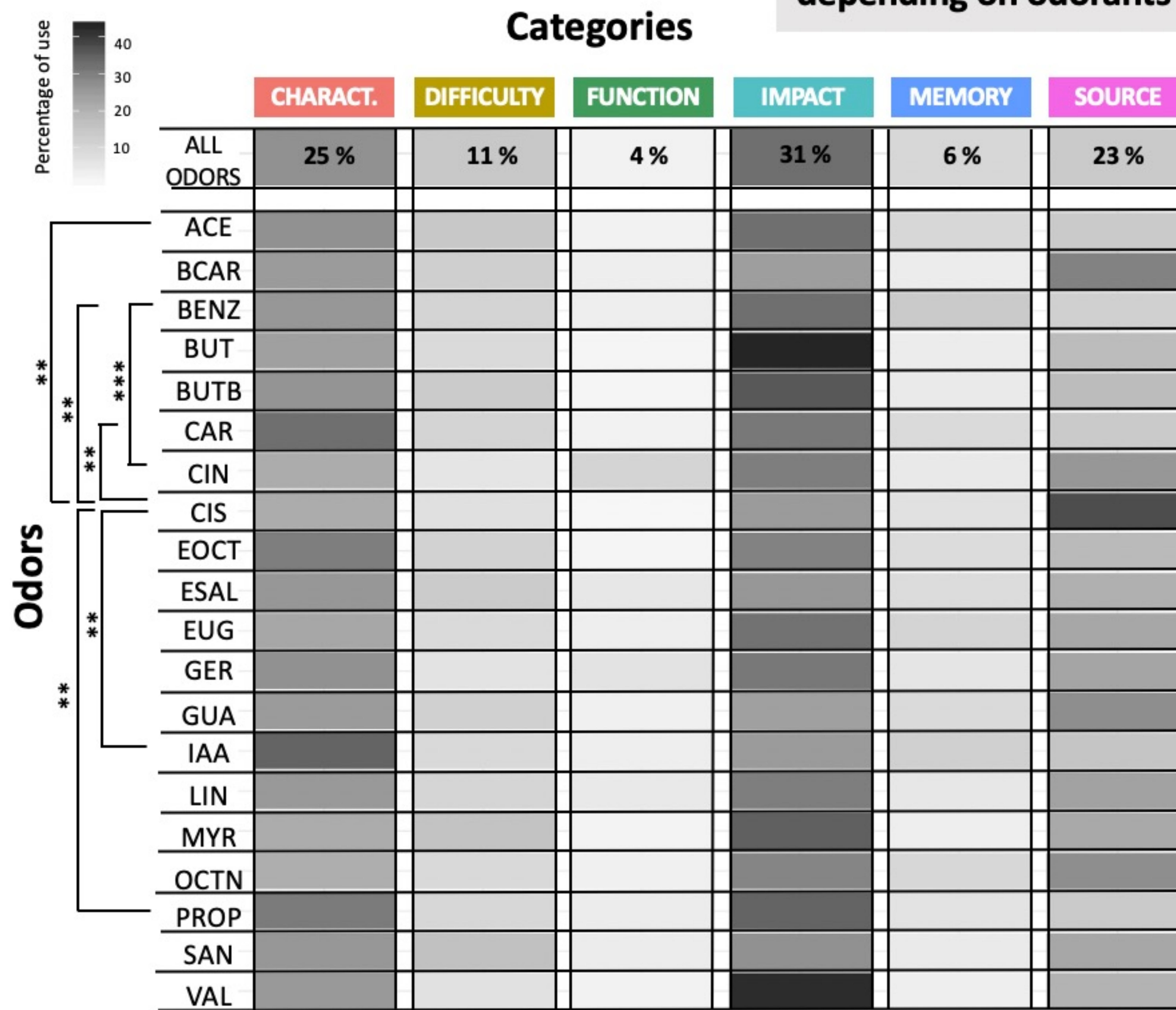
## Categories

### Percentage of use (%)



**Proportions of each  
subcategory in the  
individuals'  
verbalizations**

**Proportions of each category of verbalization depending on odorants**



# Discussion

- The global model resulting from the verbalizations of the subjects comprises six main categories, namely: impact of the odor on the individual, function of the odor, difficulty to identify and describe the odor, qualitative characterization of the odor, memory of the odor and source of the odor.
- Consistent with the literature, the odor hedonic valence is the main element found in subjects' verbalizations, as well as intensity and other sensory descriptors, but olfactory terms per se are very little used. These results suggest to reconsider the weight of these elements in experimental research on odor processing.
- Although there were some differences in the proportions of each experiential category depending on the odorant, no differences between the languages were found. More studies are needed to better understand the influence of identified factors of inter individual variability (e.g. age, sex, cultural background, expertise...) onto this model, as well as its neural correlates.

# References

- Ferdenzi, C., Roberts, S. C., Schirmer, A., Delplanque, S., Cekic, S., Porcherot, C., Cayeux, I., Sander, D., & Grandjean, D. (2013). Variability of affective responses to odors: Culture, gender, and olfactory knowledge. *Chemical Senses*, 38(2), 175–186. <https://doi.org/10.1093/chemse/bjs083>
- Petitmengin, C. (2006). Describing one's subjective experience in the second person: An interview method for the science of consciousness. *Phenomenology and the Cognitive Sciences*, 5(3), 229–269. <https://doi.org/10.1007/s11097-006-9022-2>
- Rouby, C., Pouliot, S., & Bensafi, M. (2009). Odor hedonics and their modulators. *Food Quality and Preference*, 20(8), 545–549. <https://doi.org/10.1016/j.foodqual.2009.05.004>