Odor identification in children and adults – results from investigations at a science fair ("Lange Nacht der Wissenschaften 2014" at the TU Dresden, Germany)

Adam Patterson[1], Thomas Hummel[2]

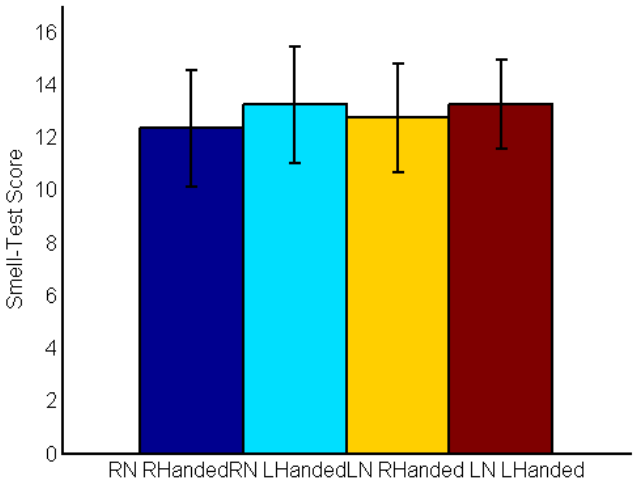
[1]Schulich School of Medicine & Dentistry, Western University, London, Ontario, Canada; [2]Smell & Taste Clinic at the Department of Otorhinolaryngology of the TU Dresden, Germany

A total of 164 people participated in the study. Of these, there were 27 participants that had incomplete information recorded and were not included in analysis. Of the 137 valid participants, 42 were male and 95 were female. The ages of participants ranged from 4 to 71 years, with a mean age of 24 and a standard deviation of 17. There were 127 right handers and 10 left handers in the study.

All participants received a test for odor identification ("Sniffin Sticks" 16 item test) either on the left or on the right side. There were 73 right nostril and 64 left nostrils tested. The data was recorded at a science festival open to the public at the *Technische Universität Dresden* (Technical University of Dresden), and test participants consisted of people at fair who came to the booth to have their sense of smell measured.

Figure 1 shows the olfactory ability of right handers and left handers tested in either their right or left nostril. Previous research has examined whether being left or right handed is correlated with better olfaction in the left or right nostril. The brain is well known to be lateralized, with some functions being localized on one side or the other. An example of lateralized function is in motor cortex: The hand is the most striking example of asymmetry, but a preference is also seen in the feet, eyes, and ears. To determine if there is lateralization present in the olfactory system, the olfactory ability of individual nostrils in relationship to subject handedness was tested. As evident in Figure 1, no significant difference of olfactory ability of left versus right nostril in association with right or left handedness was found.

Figure 1: Olfactory Ability of Nostrils Compared to Handedness



There are several reasons why the data used is likely insufficient to detect a difference. The age distribution of participants was quite imbalanced: there was a high number of children and low number of older adults. There were also a low number of lefthanders (N = 10) that were tested. In order to determine if olfaction is lateralized in the brain, more investigation is needed.

Figure 2 shows a scatter plot of the relationship between olfactory ability and age. It can be seen that, with age, odor identification ability increases in children, reaches a plateau in adulthood, and then steadily decreases. Across all ages of subjects a positive correlation between age and olfactory ability was found, but this is likely due to the disproportionate number of young children that performed poorly at odour identification. Splitting the data between children and adults, a positive correlation with age and olfactory ability was found for children and a negative correlation with age and olfactory ability was found for adults. The positive correlation with age in children is likely due to increased familiarity of odours as they grow older. The negative correlation with age in adults is likely caused by the well documented olfactory loss that occurs with age.

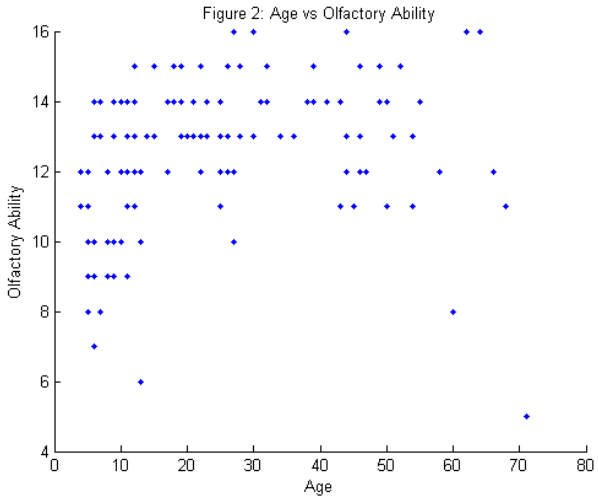
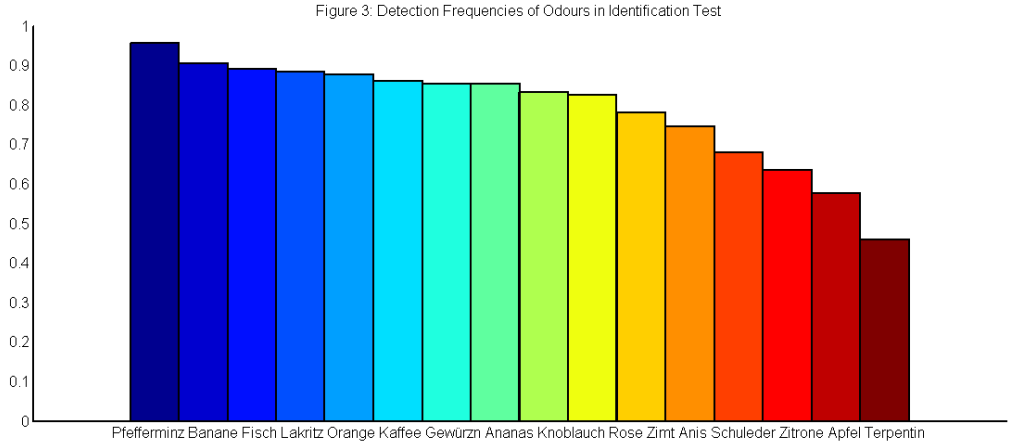


Figure 3 shows the rates of detection for the different odours in the Sniffin' Sticks Odour identification test. It is clearly evident that different odours in the odour identification test are more easily recognized than others. The odours of peppermint, banana, and fish were easily identified, while the odours of lemon, apple, and turpentine were more difficult to correctly identify (Less than half of test subjects correctly identified turpentine). (Figure 3) Factors that cause different detection rates for the different odours include lack of familiaritiy with the smell and varying degrees of similarities between the choices of smell options.



Previous studies have reported a better sense of smell in females compared to males. However, other than predicted, there was no statistically significant difference between odor identification abilities of men and women, although there was a tendency for females to perform better than males. (Figure 4)

Figure 4: Olfactory Ability of Males vs Females

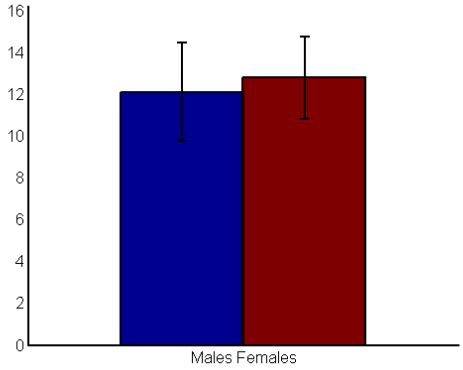
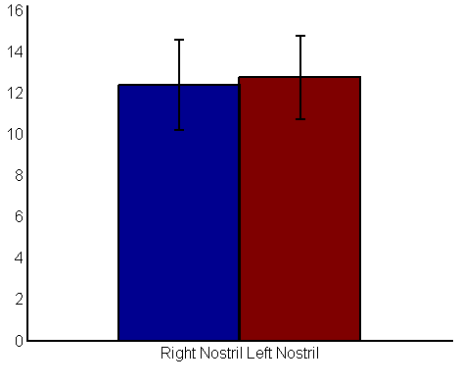


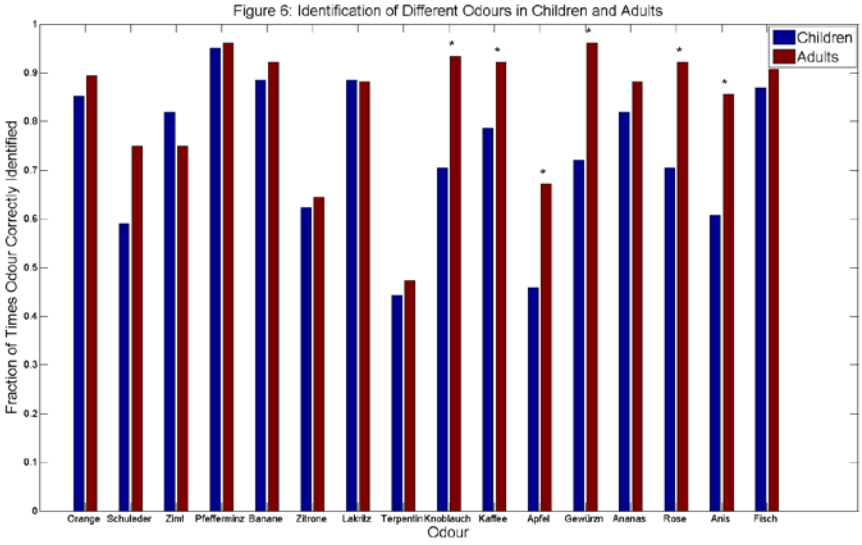
Figure 5: Olfactory Ability of Right vs Left Nostril



There was no statically significant difference between odor identification abilities of the left or right nostril (Figure 5).

There was a difference between detection of specific odors in adults compared to children (Figure 6). As already mentioned above, this could be due to a lack of familiarity of certain odors in children compared to adults. Adults performed significantly better than children in the detection of garlic, coffee, apple, cloves, rose, and aniseed. It could be that adults, due to changing popularities of the odours in the enviorment (green apple odour used to be added to many cleaning products) or to selected exposure in adults (children do not commonly cook with garlic or drink coffee). Conversely, some odours may be equally ubiquitous in the lives of children and adults (cinnanmon, peppermint, banana), while others may be equally obscure (turpentine).

Figure 6: Identification of Different Odours in Children and Adults



Differences between males and females are not due to differences in age groups, as each age group had a similar number of males and females.

Across all age groups, there was no correlation found between the subjective self-rating of olfactory ability and actual olfactory ability. In adults, however, there was a correlation between perceived sense of smell and actual sense of smell. Across all ages there was a negative correlation between nasal breathing and olfactory ability, but this is likely due to children's tendency to self-report higher values for subjective quantities. When excluding children from the analysis, there was no correlation between the self-rating of nasal breathing and olfactory ability.

A positive correlation between age and odour identification was found for children, and a negative correlation between age and odour identification was found for adults. There was no difference found in odour identification between the left and right nostril. There was no significant difference found between the odour identification ability of females or males. Adults were found to be more able to identify the odours of garlic, coffee, apple, cloves, rose, and Anise. In order to determine if there is a relationship between right or left handedness and olfactory dominance in one nostril over the other, more investigation is needed.

All in all, major findings were:

- Olfactory odor identification was slightly better on the right side than on the left (not significant)
- Children performed worse than adults
- Older adults showed a decrease of odor identification abilities
- Female subjects identified odors slightly better than male subjects (not significant)
- Adults performed significantly better than children in the identification of garlic, coffee, apple, cloves, rose, and aniseed