The Influence of Distractors on Odor Identification

Volker Gudziol, MD; Thomas Hummel, MD

Objective: To investigate the impact of the use of more contrasted distractors on correct odor identification in patients with olfactory loss.

Design: Randomized, cross-over study.

Setting: University clinic.

Patients: Thirty patients with olfactory deficits.

Interventions: The olfactory function of the patients was evaluated by means of the “Sniffin’ Sticks” test battery.

Main Outcome Measures: The distractors of the Sniffin’ Sticks odor identification test (classic test) were modified, and more contrasted distractors were used (contrasted test), while the applied odorants were the same. All patients performed both the classic and the contrasted odor identification tests in a randomized sequence.

Results: Eighteen patients were hyposmic, and 12 were functionally anosmic. Odor identification was significantly better in the hyposmic patients than in the anosmic patients (P < .01). As predicted, hyposmic patients demonstrated a significant increase in correct odor identification in the contrasted test, while anosmic patients did not.

Conclusion: The use of more contrasted distractors in cued odor identification tasks can contribute to better discrimination of anosmic and hyposmic patients, which is highly valuable in a clinical context.

native forced-choice task. Three pens were presented to the pa-
tients in a randomized order: one containing the odorant at 1 of
16 possible dilutions, and the other two containing solvent only.
The patient's task was to find out which of the 3 pens smelled of
the odorant, which had been presented at the beginning of the
test as the highest of the 16 concentrations. A staircase paradigm
was used to present triplets of pens to the patients every 20 to 30
seconds to avoid olfactory desensitization. The patients were blind-
folded to prevent visual identification of the odor-containing pens.
Correct identification of the pen that contained the odorant in 2
successive trials triggered a reversal of the staircase to the next
lower odorant concentration, whereas a single incorrect identi-
fication triggered the reversal of the staircase to the next higher
concentration. From a total of 7 reversals, the mean of the last 4
staircase reversal points was used as threshold estimate.7 The test
of odor discrimination was performed using 16 triplets of odor-
ants. The patients were presented with 3 pens: two containing
the same odorant, and one containing a different odorant. Each
patient's task was to identify the pen that smelled different; there-
fore, a 3-alternative forced-choice task test design was reapplied.
The patients were again blindfolded to prevent visual detection
of the target odor pens. They were allowed to sample each odor
only once. The interval between presentations of odor triplets was
at least 30 seconds. The interval between presentations of indi-
vidual odor pens was approximately 3 seconds. For odor identi-
fication, 16 odors were presented in a randomized sequence. The
patients were free to sample the odors as often as necessary in
order to identify them from a list of 4 distractors. The experi-
menter presented odor pens separated by an interval of at least
30 seconds to prevent olfactory desensitization.8,9 Hereafter, this
odor identification test will be called the classic odor identifica-
tion test. Results from the 3 tests were added together to obtain a
composite score, the so-called TDI score.
In an additional trial, 16 odors of the classic odor identifica-
tion test were used, while more contrasted distractors were available
(Table). An attempt was made to ensure that dissimilarity
of the selected distractors corresponded with the classification of
odors described by Saito et al.10 All applied distractors have been
confirmed to be familiar to the population studied.11 Hereafter, this
test will be called the contrasted odor identification test. The test
interval between the classic odor identification test and the con-
trasted identification test was at minimum 30 minutes. Whether
the classic or the contrasted odor identification test was per-
fomed first was randomly determined.

<table>
<thead>
<tr>
<th>Odor</th>
<th>Distractor 1</th>
<th>Distractor 2</th>
<th>Distractor 3</th>
<th>Distractor 1</th>
<th>Distractor 2</th>
<th>Distractor 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orange</td>
<td>Blackberry</td>
<td>Strawberry</td>
<td>Pineapple</td>
<td>Smoke</td>
<td>Garlic</td>
<td>Vanilla</td>
</tr>
<tr>
<td>Leather</td>
<td>Smoke</td>
<td>Glue</td>
<td>Grass</td>
<td>Honey</td>
<td>Rum</td>
<td>Apple</td>
</tr>
<tr>
<td>Cinnamon</td>
<td>Honey</td>
<td>Vanilla</td>
<td>Chocolate</td>
<td>Plum</td>
<td>Rose</td>
<td>Strawberry</td>
</tr>
<tr>
<td>Peppermint</td>
<td>Chives</td>
<td>Fire</td>
<td>Onion</td>
<td>Chocolate</td>
<td>Cherry</td>
<td>Ham</td>
</tr>
<tr>
<td>Banana</td>
<td>Coconut</td>
<td>Walnut</td>
<td>Cherry</td>
<td>Grapefruit</td>
<td>Onion</td>
<td>Fir</td>
</tr>
<tr>
<td>Lemon</td>
<td>Peach</td>
<td>Apple</td>
<td>Grapefruit</td>
<td>Chives</td>
<td>Cigarette</td>
<td>Cookie</td>
</tr>
<tr>
<td>Licorice</td>
<td>Gummi bear</td>
<td>Chewing gum</td>
<td>Cookie</td>
<td>Grass</td>
<td>Wine</td>
<td>Bread</td>
</tr>
<tr>
<td>Turpentine</td>
<td>Mustard</td>
<td>Rubber</td>
<td>Menthol</td>
<td>Lilac</td>
<td>Peanut</td>
<td>Honey</td>
</tr>
<tr>
<td>Garlic</td>
<td>Onion</td>
<td>Sauerkraut</td>
<td>Carrot</td>
<td>Solvent</td>
<td>Eucalyptus</td>
<td>Banana</td>
</tr>
<tr>
<td>Coffee</td>
<td>Cigarette</td>
<td>Wine</td>
<td>Candle smoke</td>
<td>Soap</td>
<td>Peach</td>
<td>Mustard</td>
</tr>
<tr>
<td>Apple</td>
<td>Melon</td>
<td>Peach</td>
<td>Orange</td>
<td>Wood</td>
<td>Cigarette</td>
<td>Rubber</td>
</tr>
<tr>
<td>Cloves</td>
<td>Pepper</td>
<td>Cinnamon</td>
<td>Mustard</td>
<td>Carrot</td>
<td>Glue</td>
<td>Melon</td>
</tr>
<tr>
<td>Pineapple</td>
<td>Pear</td>
<td>Plum</td>
<td>Peach</td>
<td>Sauerkrat</td>
<td>Pepper</td>
<td>Menthol</td>
</tr>
<tr>
<td>Rose</td>
<td>Chamomile</td>
<td>Raspberry</td>
<td>Cherry</td>
<td>Cheese</td>
<td>Candle smoke</td>
<td>Turpentine</td>
</tr>
<tr>
<td>Anise</td>
<td>Rum</td>
<td>Honey</td>
<td>Fir</td>
<td>Chocolate</td>
<td>Chives</td>
<td>Fuel</td>
</tr>
<tr>
<td>Fish</td>
<td>Bread</td>
<td>Cheese</td>
<td>Ham</td>
<td>Gummi bear</td>
<td>Raspberry</td>
<td>Anise</td>
</tr>
</tbody>
</table>

Data were analyzed using SPSS 12.0 for Windows (SPSS Inc,
Chicago, Illinois) and repeated-measures analysis of variance
(within-subject factor classic/contrasted; between-subject fac-
tors anosmia/hyposmia and sex). Patient age was used as a co-
variate to account for age-related differences between groups.
The α level was set at 0.05.

### RESULTS

Hyposmic patients demonstrated better odor identification
than anosmic patients ($F_{1,23} = 15.0; P = .001$). The hy-
posmic patients scored 3.2 (3.1) mean (SD) points higher
in the contrasted odor identification test than in the classic
odor identification test. Functionally anosmic patients
exhibited only a minimal increase (0.2 [2.6] points)
(Figure). The significance of this observation was empha-
sized by the interaction between factors classic/contrasted
and anosmia/hyposmia ($F_{1,23} = 7.93; P = .009$). The factor sex
had no significant effect ($F_{1,23} < 0.01; P = .99$).

### COMMENT

Our findings showed that (1) odor identification was in-
fluenced by the distractors that were provided, and (2)
the use of contrasted distractors resulted in a significant
increase in correct odor identification in hyposmic pa-
patients but not in anosmic patients, both in absolute terms.
O道具 identification has been shown to be influenced
whether it is performed as a cued or a free identification
task.12 Even the color of the odorant has an impact on
the verbal identification of the odor.13 Whether an odor
is presented together with a verbal identifier or a pho-
tograph/pictogram that would show a graphical represen-
tation of the odor source14,15 also appears to make a
difference. Therefore, it seems to be obvious that the
choice of distractors in cued odor identification tasks may
make correct odor identification more or less difficult.
However, to our knowledge, none of the studies we re-
viewed involved patients with olfactory loss, and none
In conclusion, the selection of distractors in cued odor identification tasks influences the results of the tests. This effect can be used to better differentiate between hyposmic and anosmic patients.

**Submitted for Publication:** November 7, 2007; final revision received April 1, 2008; accepted April 21, 2008.

**Correspondence:** Thomas Hummel, MD, Smell and Taste Clinic, Department of Otorhinolaryngology, University of Dresden Medical School, Fetscherstrasse 74, 01307 Dresden, Germany (thummel@mail.zih.tu-dresden.de).

**Author Contributions:** Dr Gudziol had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

**Study concept and design:** Gudziol and Hummel.

**Acquisition of data:** Gudziol.

**Analysis and interpretation of data:** Gudziol and Hummel.

**Drafting of the manuscript:** Gudziol and Hummel.

**Critical revision of the manuscript for important intellectual content:** Hummel.

**Statistical analysis:** Gudziol and Hummel.

**Obtained funding:** Hummel.

**Administrative, technical, and material support:** Hummel.

**Study supervision:** Hummel.

**Financial Disclosure:** None reported.

**Additional Contributions:** Monika Roesner and Silvia Wolff-Stephan helped in collecting the data for this study.

**REFERENCES**


