Odor Experience as an Affective State: Effects of Odor Pleasantness on Cognition

A Summary of Research Conducted for the Fragrance Research Fund

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This research is designed to investigate the effects of pleasant and unpleasant odors on a variety of cognitive-behavioral responses.

The first experiment explored the effects of odors on estimates of the frequency of risks and on ratings of the likelihood of future events.

The second experiment examined the effects of odors on pro-social thoughts and creativity.

The third experiment investigated effects of odors on attractiveness ratings of photographs of people. In each case, research exists suggesting influences of mood in these domains. If it is the hedonic quality of moods that is responsible for these effects, odor pleasantness/unpleasantness should have similar effects.

Can Mood Influence Behavior?

The idea that mood can influence a variety of behaviors has received a good deal of attention in recent years.[4] In particular, research suggests that feeling states can influence the content of thought, as well as the nature of the thinking process itself.[5] However, it is unclear exactly what aspects of mood are responsible for such effects.

Moods are complex phenomena involving valenced (positive or negative) feelings, specific cognitive contents (e.g., evaluations of current situation), and associated cognitions (e.g., pessimism or optimism).

For example, many studies have shown that mood states can influence memory; however, it is unclear whether observed effects reflect the influence of mood per se or of cognitions associated with mood.[1]

To address this issue, Ehrlichman and Halpern,[3] in research supported by the Fragrance Research Fund, used pleasant and unpleasant odors to induce affect (defined as positive or negative feeling states) while minimizing associated cognitive involvement.

In keeping with the results of studies of naturally occurring and experimentally-induced mood, odor experience biased memories toward hedonically congruent content. That is, autobiographical memories recalled while subjects smelled a pleasant odor were rated as happier than memories recalled while subjects smelled an unpleasant odor.

The goal of the current project is to explore whether the findings of Ehrlichman and Halpern[3] can be generalized to other domains believed to be influenced by affective states, including perceived risks, thoughts about helping others,

The Fragrance Research Fund

This article is an informal description of one of the research projects supported by The Fragrance Research Fund. This fund has as its main objective the financing of research related to the impact of fragrances in humans.

It studies the sense of smell and human reaction to olfactory stimulation. The research is of an interdisciplinary nature, including anatomical and ultrastructural observations, physiological and biochemical studies as well as psychological and behavioral reactions to fragrance.

This research is expected to clarify how fragrances operate and how they impact, via the central nervous system and hormonal mediators, on moods, mental attitudes and general physical health.

The President of The Fragrance Research Fund is Dr. Jack Mausner, Senior Vice President Research and Development, Chanel, Inc. For further information on the research and educational activities of the Fragrance Research Fund and of the Fragrance Foundation contact: Annette Green, The Fragrance Foundation, 142 East 30th Street, New York, NY 10016, USA.

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creativity, and ratings of attractiveness of faces.

Methodology

In all of these experiments, participants wear a modified telephone operator's headset to which a tube is attached so that one end can be positioned directly under the center of the nose. This apparatus, which was designed specially for this research, is a novel way to control the flow of an odorant to an individual while permitting completely free movements of the head and hands. A pump moves odorized or non-odorized air through the tube. To minimize habituation, a timer controls a valve which pulses odorized air and non-odorized air in a five second on/off cycle.

We use almond extract and muguet for the pleasant odor condition and thiophene and butyric acid for the unpleasant odor condition at concentrations designed to produce generally equivalent and moderate degrees of pleasantness or unpleasantness.

As a check on the manipulation, all participants rate the pleasantness of the air at the beginning and at the end of the session. Subjects also rate their mood on 15-point bipolar scales (sleepy-alert, pleased-annoyed, depressed-excited, tense-relaxed, and disgusted-delighted) four times during the session.

Participants engage in the experimental tasks while breathing the (odorized or non-odorized) air. In the first experiment, subjects estimated the annual number of deaths due to each of 30 fatal risks, the number of people suffering from each of 20 causes, and the likelihood that each of 25 positive and 25 negative events would occur within the next ten years. For each type of judgment, we hypothesized that the pleasant odor group would be more optimistic and the unpleasant odor group would be less optimistic than the control group.

In the second experiment, subjects free-associated to four vignettes in which helping another individual was possible. They then completed a modified version of the Remote Associates Test, a measure of creativity in which one must determine how three seemingly unrelated words might go together. We hypothesized that subjects in the pleasant odor condition would think more about helping and show higher creativity scores than subjects in the unpleasant odor condition.

In the third experiment, which is currently in progress, subjects rate slides of male and female faces for physical attractiveness and attractiveness of personality. We predict that subjects will rate slides as more attractive while smelling pleasant as opposed to unpleasant odors.

Effects of Odors on Mood

In these studies, we generally find that unpleasant odors tend to produce more negative mood compared to baseline. However, subjects smelling pleasant odors do not differ either from their own baseline or from no-odor controls in self-rated mood. The finding that, under laboratory conditions, odors rated as moderately unpleasant have more impact on mood than do odors rated as moderately pleasant, could reflect an actual asymmetry between pleasant and unpleasant odors in their effect on mood. However, it is also possible that because people generally enter the lab situation in a positive mood, there may be a "ceiling" effect for further enhancement of mood by pleasant odors. This is a topic worthy of continued study.

Effects of Odors on Cognition

No significant differences were found among odor groups for perceived risks (Experiment 1) or for thoughts about helping (Experiment 2). A statistically significant effect of odor condition was found for Remote Associates Test performance (Experiment 2). The creativity score of the pleasant odor group was significantly higher than that of the unpleasant odor group. The no-odor group fell between these two but did not differ significantly from the other two groups. Results for the study on attractiveness (Experiment 3) are not yet available.

The results so far suggest that odor may be functionally equivalent to mood in its effects on less-consciously controlled cognitive processes, such as those involved in creativity or memory recall, but not on more-consciously controlled cognitive judgments, such as those involved in evaluating risks or thinking about vignettes. If so, the results have important implications for identifying the mechanisms responsible for various effects of mood on behavior and cognition. Because odors produce an affective state lacking the usual cognitions that accompany mood, the results may indicate that some effects may be mediated by the positivity or negativity of the feeling state associated with a mood while other effects may require the presence of cognitions that accompany mood.

Our results also have important implications for understanding the influence of odors on people. By showing that odors can have effects that parallel effects of mood, we can go beyond purely speculative (and somewhat empty) statements, such as "olfaction is the emotional sense"[2] and can demonstrate that, indeed, odors can produce feeling states in people that function in a way that is similar to moods.

References

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