



The emotional air in your space: Scrubbed, wild or cultivated?

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ABSTRACT

The space around or in our buildings is not empty but is full of air. This air naturally contains some potential toxins but also useful biochemicals that we are not aware of; however, our olfactory system has evolved to detect some of them subliminally. Conscious preferences for or against types of air may be insufficient for decisions about the desirability of natural, green air. It is a 21st challenge to “green technology” to extend and incorporate behavioral science approaches to understanding influential subliminal processes. We argue that these decisions require an experimental approach because the olfactory system is not easily accessible to conscious analysis. The subliminal effects of “something in the air” are illustrated first in a case study to show the surprising range of emotional effects from natural human mood odors. Then in a controlled study we show some similar subliminal effects from natural plant odors. Here “wild” local air is contrasted with two types of “cultivated” air, either with undetected (a) flower ingredients or (b) perfume ingredients. The subliminal effect of the floral additive led to more positive emotional thought and supported social approach behavior. This implies air management has the potential to provide an invisible support system inside and around buildings just as carefully designed and maintained parks provide a larger support to communities.

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1. Introduction

In a seminal behavioral science article titled “This side of paradise – discovering why the human mind needs nature,” Jaffe (2010) summarized experimental evidence showing that “natural” environments have a salubrious effect on psychological processes. Attention, positive moods, and indices of health are improved when people are exposed to trees and other plants. Although there are neurological and implicit cognitive processes behind these effects (see Joye, 2007, for review), Jaffe proposed that the positive effects occur because our ancestors lived in a nature-filled environment. Our ancestors’ “nature” is that pre-civilization, wild ecology, once disparagingly called “indeterminate” and “formless” by landscape architects (Waugh, 1912: 288). However, Jaffe’s first example of “nature” is actually of Central Park in New York City, a cultivated collaboration of the landscape designer Frederick Law Olmsted with the architect Calvert Vaux.

Jaffe’s contrast is therefore primarily one of nature versus a relatively sterile “nature-free” environment. There are two problems in his overview: First, little attention is given to the probability that some natural features are better for humans than others and, second, he neglects senses other than visual, particularly he neglects olfactory contributions.

Cultivated plants, such as those in Central Park, provide the benefits anticipated from landscaped beauty but there is another very significant benefit they affect the air. Though there is a substantial literature on the physical properties of air and on metaphorical allusions to “airy” spirits (see Connor, 2010), research on olfaction and emotion has not reflected this fascination until very recently. This reflects a bias in Western research as it is in Western society. Studies of olfaction run “...the risk of being brushed off as frivolous and irrelevant. [In Western technological societies, the fact that] odours cannot be readily contained...cross boundaries, blending different entities into olfactory wholes... is opposed to our modern, linear worldview, with its emphasis on privacy, discrete divisions, and superficial interactions” (Classen et al., 1994: 4).

The lack of spatial boundaries for odors is related to common inability to identify odors or their effects (see Sela and Sobel, 2010). This means that simple observations and reports of immediate

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preferences often are unreliable and unlikely to predict immediate behavior or long term consequences. The effects require experimental study, often of subliminal processes. Just as experimental studies show that our lungs have taste receptors to sense and react to bitterness in chemicals without any mental imagery or awareness on our part (Deshpande et al., 2010), the studies in this article will show that the olfactory system senses emotional messages in the air that may change behaviors, also without awareness.

Discussion of how the air around us affects our well-being is an especially controversial subject. This is not exactly a novel concern in medicine or literature. For example, in the 1800s, John Perceval, one of the first advocates for the mentally ill, described how mental health depended on inhalation and exhalation (Connor, 2010). Literary characters discuss the healthy or unhealthy qualities of sea air, or boroughs of London air, or the odors of the sick room thought to carry disease (e.g. Austen, 1984). But focus on the biochemistry of plant odors and their effects on physical and mental health have waited for science to examine the process. During this time, fashion has dictated whether sick rooms are open or closed, whether windows are open to night air, whether camphor should be in the air and many other habits, some reasonable, some less so. Presently the view prevails that air in public buildings or vehicles should be particle free. Yet for many years, businesses have quietly engineered fragrances for public places to improve worker productivity or to influence consumers (see Davies et al., 2003) and airlines advertise invigorating air in their cabins. Cultivating air may not necessarily be any more detrimental than cultivating plants; it may even be important to better moods and health. Trying to sterilize air may create stress similar to any sensory deprivation. Without returning to early biases we need to consider “fitness and fitting – the selection of a fit environment and adaptation of that environment... [for] health” (McHarg, 1969).

In order to break new ground relating ecology and emotion, we have applied innovative methods for assessing emotion. Most studies of mood and environment, such as liking for spaces or feelings about them, use self-report methods; however, self-report is not always useful in studies of olfactory process and is not well related to other measures such as overt behavior, implicit behavior, and physiological changes. To demonstrate the depth of this problem and to show how “air” affects mood in more than one dimension, we first present a psychological case study as a compelling illustration of how non-obvious, natural human “additives” in the air can have profound effects on mood. Then we will turn to **an experimental study of** the non-obvious, natural plant additives in the air that seem to have similar functions as the human ones.

2. Leaving moods in the air: a case study

We use the human mood cues first for illustration because they are intuitively easier to interpret. If someone is happy and we collect odors from him, it would make sense that those odors would either make someone else happy – or have no effect. If we collect odors from a plant, it is harder to make a prediction. This illustration will show, first, that our participant is very sensitive to other people’s happy, fearful or angry mood cues in the air. Second, it will show that her sensitivity is subconscious; she is unaware of it. Third, it will show what kinds of measures demonstrate subconscious mood change. These factors are important to understanding the experiment (see section 3) on other natural molecules in the air that are unrelated to people but still have the potential to strongly affect human mood and behavior subconsciously.

We start with the windows in the room opened to the outside, fans blow ‘fresh’ air in. When the windows are closed and the temperature stabilized, we introduce a jar containing under-arm pads that had been worn by people while they were watching

specially designed emotion videos. Seven pads from seven people, who saw the same happy, then fearful, then anger videos at different times give us three jars of mood odors. Each jar is placed in one of three identical rooms (see Chen and Haviland-Jones, 2000, for details of odor collection methods). This arrangement mimics exposure to the emotions of a small crowd of people. Imagine that a fragrance-free group of students had been telling jokes in this room. They left and a naïve person walked in. Would she be affected by mood in the air?

2.1. Implicit emotional responses to undetected mood odors

A young woman agrees to be in our study. She goes into the room and sits down at the computer. She knows that the odor pads in the jar might be human odors but could be nothing at all or other common odors. She reads her instruction: *Write whatever you like on the computer for 10 minutes while we measure your heart rate response to the environment.* The heart rate record indicates whether she is becoming more aroused or more relaxed. There is a self-report measure. She rates her level of happiness (sadness, anger, fear, etc.) on a 0 to 8 scale. Finally, there is an implicit measure. A computer analysis of the emotion words in her writing also will indicate how her mood is affected.

In this *Happy Air* room she writes (in part):

*I have to clean my room today, it's incredibly messy. I am cleaning it hoping my girlfriend would pay me a **surprise** visit. It's a little **sad**dening since she is so ... far away from here. ... I become that much more **ecstatic** when I do see her. My friends come over a lot and leave **crap** everywhere. That's also fine since they make me **happy** when we hang out. Maybe I should make them clean. **Hahaha**. Writing random thoughts is **fun**. I am really **enjoying** myself....*

While she is writing, her heart rate goes down from 79 bpm (beats per minute) in the first 30 s to 76 bpm in the last 30 s. This suggests that she is relaxing. On the self-report she rates herself as moderately happy (6/8) and interested (6/8). She does not report any negative feelings (0/8). Finally, we count the emotion words¹ in her writing. The positive word count is 6; the negative word count is 2.

In the *Happy Air* room, all the measures suggest happiness. There are happy words (implicit cognitive measure), a happy mood rating (explicit mood measure), and a compatible cardiac index (physiological change). But perhaps she is always this happy.

She leaves the *Happy Air* room and goes into the *Fear Air* room. This is an identical room next door where the odor pads are from the same people, collected when they watched a fearful video. She has the same instructions and writes:

*I am really hungry right now, I wish I had cookies. Sometimes I feel that I think too simply, rather childish actually. Well that's what I am told. I look at myself from the outside and see the way I behave sometimes it is a little **weird** ... I **detest** the way adults look upon younger people as if their thoughts and opinions are all that matters. [boldface added to indicate use of emotion words].*

While she is writing in the *Fear Air* room her heart rate suggests strong arousal. In the first 30 sec it is already averaging 81 bpm. By

¹ The process of establishing categories for emotion words is complex and not yet standardized. Many words that some would consider to have affective tone are not counted as emotional but fall in other categories. Words such as “hopeful”, for example, fall into a cognitive classification. The decisions may be made by groups of experts, or, less often, a naïve group may be asked for judgments. Increasingly, the categories are derived from statistical procedures of factor analysis or clustering.

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