

A Nose-Tracked, Personal Olfactory Display

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Abstract

An interface that involves all five senses, including olfaction, would be the ultimate interface for virtual reality (VR). We are trying to construct an olfactory display that does not require the user to wear anything on the face. We used an "air cannon" to transport small packets of scented air to the user's nose from some nearby place. In this paper, we report the ongoing development of an olfactory display system with a nose-tracking feature by incorporating vision-based face tracking technology.

1 Introduction

Our VR experience so far has been a kind of a "journey in a spacesuit," as we have not acquired ways to feel the atmosphere. It might be effective for obtaining sensation of presence to make full use of the air as a medium. The origin of this approach could be found in Heilig's Sensorama [Heilig 1992] (system appeared in 1962), and some researchers have already started to explore the possibility of olfactory displays for VR [Barfield and Danas 1996]. However, olfactory displays are still not so popular.

There are many difficulties to realize general-purpose olfactory displays. One major problem is that there is no counterpart of the "three primary colors" in olfaction; this means that it is difficult to provide "virtual alternatives," and that we might always have to come up with "real" scent. We are not attempting to develop sensing or synthesizing technologies. Our current focus is on display technology that provides easy-to-use, unencumbering personal olfactory displays.

2 Principle

One of the problems in interactive olfactory displays has been the spatio-temporal controllability, i.e., once the scent was diffused into the space, it was hard to extinguish it. A direct way of solving this problem is to transfer the scented air through a tube and attach the end of the tube under the nose [Hirose et al. 2000]. However, people may not want to wear any encumbering devices or trailing tubes to enjoy scent. Consequently, we explore a way to transfer scented air through free space, and find that a so-called "air cannon" could be used for this purpose.

An air cannon (also known as a vortex cannon) is a chamber with a circular aperture, and it launches a small clump of air (doughnut-shaped vortex) that can travel several meters. According to our preliminary experiment [Yanagida et al. 2003], we could successfully transfer the scented air from 1–2 m away to the user's nose. If we track the user's nose and control the direction of the air cannon, we can configure a nose-tracked, personal olfactory display that provides a short-time switch of scent.

3 System Configuration

The system consists of a nose tracker and a scent projector. The nose tracker is a modified version of a vision-based eye tracking technology [Kawato and Tetsutani 2002]. It uses the "Between-the-Eyes" pattern instead of the eyes themselves, and can robustly

detect and track the user's eyes and nose in real time. The scent projector is composed of an air cannon, scent generator (currently a simple commercially-available scent diffuser), and a 2 degrees-of-freedom platform. The platform is controlled so that the air cannon aim at a point just under the user's nose.



Figure 1. System components: a vision-based nose tracker and a scent projector using an "air cannon."

The air cannon is driven gently so that the user feels a waft of incense reaching his/her nose. The user can sense the scent at the moment when the clump of air arrives, and the scent diminishes in a short time. Other people can hardly sense the scent, as long as the scent projector successfully aims at a certain user.

Future works include the development of switching mechanism for multiple incenses, improvement of the performance of air cannon, and practical evaluation of the system.

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