

# Inclusive and Playful Multisensory Experiences for Children Through Olfactory Stimuli

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## ABSTRACT

Multisensory experiences can reach more diverse audiences. With inclusivity emerging as an important value both in industry and in education, there is a need to explore alternate types of interactions. Olfactory technology can introduce new design possibilities for inclusive social experiences beyond the prevalent focus of visual- or audio-based systems. Children with sensory disabilities (e.g., visual or hearing impairments) may experience exclusion from activities that rely on a single sense. This short paper supports the goal of designing ways to incorporate olfactory technology into social experiences to promote inclusion and engagement between children with different abilities.

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## 1 INTRODUCTION

Although vision, sound, and haptic technologies have received considerable attention in the human-computer interaction community, technology-mediated scent is less understood in comparison. Prior research has been conducted into olfactory perceptions of locations [14] and smell as a sociocultural phenomenon [13]. However, these studies do not investigate how scent can – or should – be incorporated in technological design with positive social benefits. How might children be better included in the design process?

Non-participatory approaches are common in the design of interactive technologies for children with disabilities [7], despite the value in perspectives of children’s lived experiences that adult designers cannot imagine. Incorporating multiple modalities of interaction can facilitate more inclusive experiences. For instance, Mehrotra et al. [15] describes scent emission as improving social interactions (e.g., communication) during collaborative story writing. Furthermore, multisensory physical and digital educational materials (e.g., storytelling) are suggested to have positive effects on learning for children [18].

Olfactory technologies may require new considerations in accessibility and real-world multisensory integration. Consequently, in addition to multidisciplinary approaches, intergenerational perspectives should be taken into account while advocating for the inclusion of underrepresented populations in designing future technologies. This position paper seeks to highlight opportunities for playful olfactory social experiences that can be enjoyed by children with varying sensory needs and abilities.

## 2 BACKGROUND

There are substantial opportunities to explore how olfactory technologies can be integrated with real-world applications including social experiences. For example, certain smells are associated with effects, such as peppermint to enhance concentration [15]. Regarding the trending reemergence of tangible multisensory experiences for children, Kucirkova and Tosun [12] propose that "scratch and sniff" features can create similar narrative information as visuals, which challenges established perceptions of children’s picture books. This section discusses social play and collaboration, accessibility, and examples of potential applications.

### 2.1 Social Play and Collaboration

From face-to-face interactions to virtual meetings, social interactions are often multisensory. Unfortunately, children with disabilities often report feeling lonely and excluded despite strategies for social inclusion at school [22]. Apart from school interventions, there may be further possibilities for technological mediation to maintain long-term relationships. Perhaps there are insufficient inclusive multisensory activities that everyone can participate in.

In primary school education, interactive multisensory environments can provide an inclusive context for children with and without disabilities to play together [8]. According to Sobel et al. [20], facilitators of inclusive play comprise: direct support, embedded support, transparency, adjustability, focus on child interests and strengths, and technology as a tool. Moreover, research about technology for social play between children with different abilities is an underexplored area, especially studies actively including children during the design process [19].

Technology can support collaborative experiences, such as the aforementioned study by Mehrotra et al. [15], and including multisensory elements within the creation and sharing of stories between children with different visual abilities [6]. In the latter study, materials were all tangible, with scent in the form of candles, pens, cinnamon bars, etc. The study proposes multisensory integration with technology designed for children with different abilities, which can facilitate collaboration and discussion. In edutainment, haptic

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and olfactory elements in addition to audio may be more attractive to children with visual impairments [16].

While physical scratch and sniff stickers have existed for decades, innovative technologies such as aroma dispensers (e.g., Sony's AROMASTIC) can now support digital applications. How might children appropriate olfactory technologies in playful activities? Their insights can inform new ways of thinking, which is especially applicable for public interactive experiences.

## 2.2 Accessibility

Virtual reality (VR) is a platform that has been used for immersive experiences such as games and simulations. Unfortunately, this technology primarily relies on visuals and audio with few experiences incorporating multisensory stimuli. For example, Boyd [1] studied children with different sensory needs (i.e., neurotypical, ADHD, and autism spectrum disorder) in immersive VR and suggested that sensory stimuli be not only considered in mainstream designs but also assistive technologies.

Currently, there continues to be bias in design perpetuated by social norms, as reflected in discussion of "normative bodies" in human-computer interaction [21]. These common assumptions can limit the diversity of design thinking, leading to experiences catered to a specific audience (i.e., white, male, young adult, heterosexual, non-disabled, etc.).

Likewise, olfactory integration with day-to-day or assistive technologies need to consider similar notions. How can olfactory devices become accessible for the general population outside of a research lab? Along with technological advancements, multisensory integration would require additional spatial considerations beyond user interfaces on a fixed 2D screen. Cornelio et al. [4] suggests sense of agency (control) as a key concept in real-world applications of multisensory integration.

The perspectives of children with disabilities have also been underrepresented in educational and HCI research [3, 7], and co-design with children with different abilities is underexplored [6]. Participatory approaches involving communities with lived experiences of sensory disabilities can inspire unique alternate outlooks on experiencing different senses. For example, a blind person's recollection of a memory through non-visual senses may be vastly different from a sighted person with the same shared experience. Developing a code of practice for multiple modalities would be beneficial in creating more inclusive experiences.

## 2.3 Potential Applications

There are many potential applications for multisensory experiences such as food-related entertainment activities [17] and olfactory cues in wayfinding for people with visual impairments [11]. Similar to how several animal species track odours, humans are also capable of navigation through only their sense of smell [10]. For deafblind individuals, olfactory technology may be beneficial as indication for an emergency (e.g., knowing when to evacuate a building).

Multisensory technologies, including scents, can engage children in more immersive and interactive learning experiences. Educational games can be enhanced with embodied experiences including alternative forms of interaction and media, such as with the Fragrance Channel game [5] and Magika environment [9].

An interactive game based on olfactory or other multisensory navigation may be interesting to explore, both as a training tool for people with late-onset vision loss or as part of a disability awareness program (e.g., classroom or museum setting). For instance, the Diffability cooperative VR adventure exhibit provoked thought relating to the animal kingdom where "a weakness in one area can be compensated for by developing a 'superpower' in another" [2].

Scent can furthermore support narratives and memory, as demonstrated through studies such as McLean [14] and Kucirkova and Tosun [12]. Perhaps in the future, olfactory technology may also be used to reminisce about childhood memories (e.g., the smell of grandma's house).

## 3 CONCLUSION

This short position paper has discussed possible applications of multisensory experiences including olfactory technology to support inclusive social play for children. Through a lens of child-computer interaction and accessibility, this paper suggests an incorporation of olfactory technology in playful and assistive technology contexts. By imagining beyond sound and visual experiences, design may break the constraints of normative practices and increase acceptance and adoption of innovative multisensory interactions.

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