Scented Days: Exploring the Capacity of Smell Narratives

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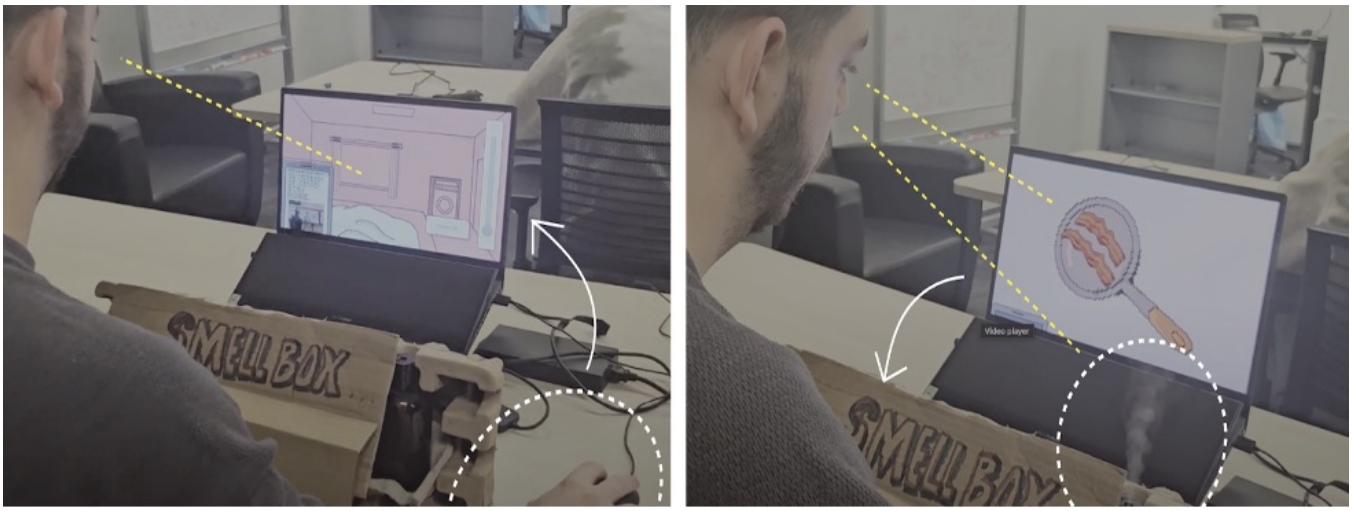


Figure 1: Initial Version of *Scented Days* Gameplay

ABSTRACT

Scented media and technology offer a unique way to engage users, specifically to convey information and provide alternative sensory experiences. In addition to serious applications, scents can be used to augment games and playful technologies, enrich the play experience, and evoke specific emotional responses. However, scent can also serve as an effective storytelling tool by itself and be a game narrative mechanism. In this paper, we present the narrative game *Scented Days*, where we carefully design and showcase the use of olfactory cues to deliver narrative elements and explore the significance of a sense of smell. The game is a scent-focused narrative experience, where the focus is placed on the loss of olfactory senses, a common consequence of COVID-19. This demonstration sheds light on using smell as a game design tool to enhance game narratives, particularly in scenarios involving smell change or loss.

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CCS CONCEPTS

• **Human-centered computing** → **Scenario-based design**; **Contextual design**; **Interaction techniques**; • **Hardware** → Emerging interfaces.

KEYWORDS

Scent Technology; Olfactory Narrative; Multisensory Design

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1 INTRODUCTION AND RELATED WORK

Narrative, in the words of Polkinghorne (1988), can refer to the *process of making a story, or to the cognitive scheme of the story*, and its intelligibility is set in the "ordinary, everyday actions of human beings" (p.13) [28]. It is a pervasive part of human cognition, and framing of daily experiences (Dickey, 2011) making it so compelling [6]. Meanwhile, olfaction, on top of shaping and contributing to

human development for survival and evolution [37], takes a sociocultural role endowed with symbolic associations in the most basic, everyday lives [14]. Smell is not an intrinsic property, but rather perceptual, and the only sensory modality which the brain observes as visceral [20]. Due to these properties, Morie (2002) argued that smells can be one of the most powerful coercive elements in narrative design [21]. 'Visceral' reactions from the human brain while processing olfactory information leaves smell as invasive and compelling [3] with ample potential to be leveraged for evocative storytelling mechanism.

Among many cases that employed scents for interactive media, smell memory kit is a design tool to explore the potential of smell memories in game design [13]. Leret and Visch (2017) suggested that smell memories are *transportative associations established through odors* that can function as "game elements eliciting and motivating the sharing of rich multimodal memories" (p.76) [13] and provide therapeutic experience as well as informative sense data. Ultimately, scents are not only apt in enhancing human performance and learning knowledge [4], but also in evoking meaningful memories much more powerful than those from other sensory cues [8].

Scent-based media are also an emerging form of entertainment and utility. Previous examples include notably the Smell-o-Vision, odor-based cinema, and iSmell for scented internet [25]. A series of smell rehabilitation video games developed by Wisbom (2021) corroborates gamification and smell training and yields massively valuable directions that can be used for designing smells [35]. Other examples in games include employing gunpowder, fire, or smoke smell stimuli in video games or virtual reality [34], using 'off-smells' as a police dog as clues in the game [26], and adding food scents in a cooking game [23]. Yokokubo et al. [39] proposed a digital scent-matching game as an inexpensive and casual way to play traditionally physical scent games. Lastly, a fantasy-based horror game [29] utilized scents as game signals and added immersion to the game, hinting that scents can be the core indicator for players to understand the plot and navigate through the passage.

2 CURRENT GAP AND DESIGN GOALS

Yet, by reviewing the examples above, we were able to denote a list of limitations and thereby important insights for implementing scents into interactive media. These were later aptly infused into our design goals.

- First, within the field, researchers have focused on testing scents for virtual environment immersion and memory [20, 34]. Thus, diverting the weight away from testing immersion in a virtual environment, but rather placing it on the efficacy of its use in day-to-day situations [35] serves a worthwhile effort. Here, we endeavor to create a casual 2D game scenario to simulate the effects.
- Second, while smell games exist for training and rehabilitation purposes, their aptness in entertainment and storytelling has been sparsely explored [35]. We aim to understand whether scent-focused narratives can convey information and help fathom the plot whilst being the core mechanic of the game.
- Lastly, despite the primal, conceptual capacities of smell [10] and the known advantage of story-based games in acquiring information [24], inadequate works investigated scents as both the primary narrative and the mechanic. Olofsson (2017) accentuated that scents are able to function beyond assisting other sensory cues[25]; active implementation of scents as the main trajectory and core mechanic of the game serves great importance. Our last design goal is to dispose of scents to tell a journey, juxtaposing the presence and absence of scents as the main narrative of the game.

This demo paper presents a detailed discussion of a game called *Scented Days* and its design goals for future scent-based narratives.

3 LOOPING NARRATIVE STRUCTURE

In order to tell a day-to-day experience in a gameplay, we employ a loop-based system. Loops can be both a game and learning mechanic and centralized around formalizing the gameplay and experience through memory [5]. What makes loops powerful is employing reality-based scenarios that are tied to actualizing—establishing that possible worlds in the game can become actual [11]. Lahdenperä (2018) quoted that "having alternative events an integral part of the playing experience" (p.20) within reality-based stories can elicit successful game experience with repetition and replay [11]. These qualities are in parallel with an everyday scenario of a protagonist losing a sense of smell, having the story told with the presence and absence of game scents to reinforce smell memory with the game context. While physicalization of narrative and embodied learning [16, 18] have manifested their impacts, scentification of narratives is still an underexplored area [25] and deserves attention. Adams (2006) quoted that a Game Mechanic is essentially an *affective construct of visceral information* [1]—here, we find scents analogous to having visceral property in the human brain—expecting a meaningful association with scent narratives that unwraps the everyday life trajectory.

4 GAME DESCRIPTION

Scented Days is a game that aims to simulate the day-to-day experiences of contracting and recovering from COVID-19, with a particular focus on anosmia (see Figure 1). Olfactory loss is an often overlooked side effect of COVID-19 affecting 34 to 86% of individuals that contract COVID [7, 12, 33]. The nature of the symptoms is explored through the use of scent (or lack thereof) in the gameplay. Through this narrative framing, *Scented Days* is designed to explore two key aspects of a scent-based game: 1) leveraging scents to portray narratives, and 2) crafting a cohesive narrative design that combines olfactory engagement with other sensory elements. The gameplay unfolds over six loops, each representing a one-week interval in the game's narrative time, and is segmented into three distinct narrative phases: 'No Smell Impairment (scents)', 'Smell Impairment (no scents)', and 'Recovered Smell (scents)' (Figure 4). The game incorporates a physical 'Smellbox' that emits scents corresponding to in-game events in reality. Additionally, it features a phone interface to portray the social challenges of illness and situational consciousness of the player's health, raising awareness of the under-recognized consequences of smell loss.

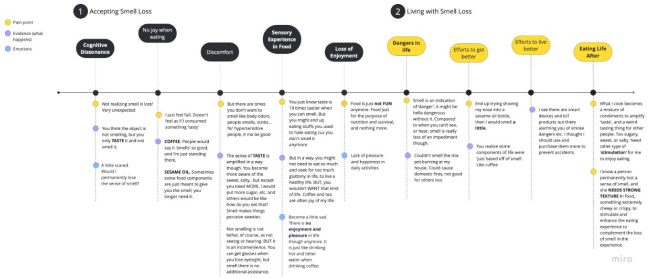


Figure 2: User Journey Map on smell impairment written on a Miro[1] board

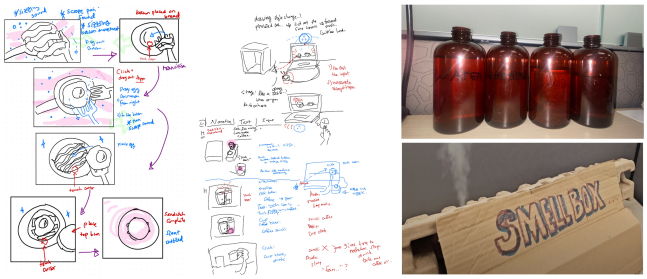


Figure 3: Loop-based scenario sketches and bodystorming

5 DESIGN METHOD

5.1 Contextual Inquiry

We employed an in-depth user experience method typically used in human-centered design research for the conceptual design of the game. Since the game revolves around reality-based situations and difficulties, the narrative design relied on identifying contextual experiences of smell impairment as the interwoven story. Contextual inquiry is a widely adopted design process that is rooted in ethnography [30] that delves into the specific situations of the users or doing certain tasks. Given this, we use the diary studies and user journey map through in-depth interviews as the main design method. Then, we extract scenarios for the conceptual design of the game, and apply the bodystorming strategy [31] to test player perceptions to ensure that the novelty of the mechanic would not blur the portrayal of the story. After having obtained these empirical understandings, we finally prototyped a playable scent game.

5.2 Smell Diary

In previous works, smell mapping strategies such as those of McClean (2013) and Maggioni et al. (2020) [15] were employed as a "playful, inventive strategy for exploring cities" [17] as a geographical and psychological depiction. Here, we strategize similarly to design for smell, with the same purpose of observing the evoked memories, histories, and associations, but less focus on the spatial and navigational properties of smell. In order to create the smellscape, we create a method called 'Smell Diary' that fuses the diary study and smell map methods together. This is akin to the 'Smell My Day' project [40] which recorded the odors felt during the day and drew an emotional axis based on subjective perceptions. We modify this to better suit the contextual and universal usage of a smell diary; the smell diary consists of the following design elements: time, event, object, smell, action, and emotion.

6 GAME DESIGN

6.1 Conceptual Design

Through our contextual inquiry research method, we had five participants filling out their daily smell diaries, and we mapped their information based on the overlapping themes and activities. We are able to extract three main scenarios which will be looping through every stage through the research process: waking up, doing laundry, making a meal. We also interviewed four participants who had experienced or are experiencing anosmia on the following three sections: everyday routines before and after the loss of smell, elicited emotions, and biggest impedances after the loss of smell. Comprehensively, we were able to establish a user journey map (see Figure 2) of which we used to delineate the emotional flow of the game. Based on it, we sketched preliminary game scenes (Figure 3) and performed embodied storming, that is, to replicate the 'scent-enabled' setting [31] to test playability with our paper prototypes by disseminating fragrances manually with a fan.

6.2 Narrative Design

We have designed the game such that olfactory elements are integral to both high-level-narrative—the overarching story of losing a sense of smell and low-level-narrative—individual moments or contextual interactions with each scenario. The presence of scents across the first three loops followed by the absence of scents from the fourth serves as the progression of the story and provides the cognitive realization of the main plot, the smell loss. Meanwhile, each loop is characterized by three scenarios: waking up, doing laundry, and making a meal (initially it comprised of bacon and eggs, and was later altered to pancakes and coffee for a relatively neutral olfactory choice) attributed with distinct scents. Once players have become accustomed to these associations, forming namely *smell memories* [13], we introduce a significant twist: replacing all scent emissions with water. This deliberate substitution is designed to disorient players, effectively mirroring the confusion and sudden realization typical of actual olfactory loss, only powerfully conveyed by the absence of smell itself. We structure our narrative collectively as shown in Figure 4.

6.3 Technical Design

Apart from utilizing olfactory cues as mechanics and narrative to convey the plot of COVID-19 sickness, we use congruent sensory elements that are mutually cohesive for two reasons. First, existing works portray that sensory congruence and alignment like color palettes deeply affect learning abilities and perceptions [27, 32]. Second, we use congruent sensory modalities to have players better understand the plot through psychological priming. It is a technique to induce psychological reactions and anticipation through the use of sensory stimuli, such as colors and audio [22] that will assist the use of smells as the main narrative cue.

[1]UX map [Miro visual workspace]. (2024). Retrieved from www.miro.com/app

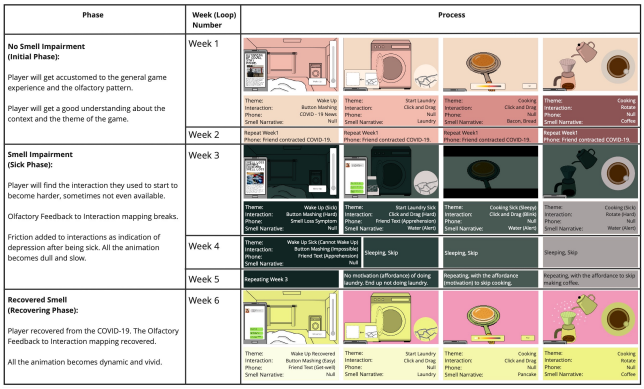


Figure 4: Narrative Structure and Interaction Map: From left to right, the map illustrates the progression of narrative phases, with annotations detailing the context and the design expectations associated with specific loops. Each block represents an interaction or visual element encountered by the player, and these blocks are color-coded according to the palette used within each respective loop.

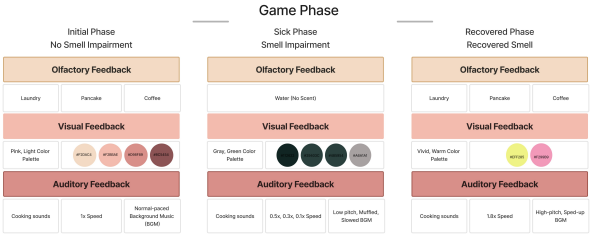


Figure 5: Scented Days sensory design framework

We use visual and auditory modalities for supplementary assistance in plot association. For visual assistance, the color hue and saturation alter according to the color palettes set for each phase also seen from Figure 2. Due to the association of bright colors with positive mood and dark colors with negative [2], we choose specific color palettes as demonstrated by learning design principles from [27]. Hence, we parallel 'No Smell Impairment' with a warm, pink palette, the 'Smell Impairment' with a dark, gray palette, and the 'Recovered Smell' with a vivid, warm color palette.

For audio assistance, background music plays at a default speed (78 beats per minute) during the 'No Smell Impairment' phase. In contrast, during the 'Smell Impairment' phase, the music becomes muffled and slowed, reflecting both altered auditory perception associated with sickness and the protagonist's depressed mood [19]. As players advance to the 'Recovered Smell' phase, the audio maintains the pace established as seen from Figure 4. The sensory design is collectively shown in Figure 5.

6.3.1 Smell Design and Smellbox. Players can understand the context of the game with various scents. The device exerts a corresponding scent as per the game element—including the pancake, coffee, and laundry detergent scents—while during the "Smell Impairment" phase, players are given with no scents, and only engage with the water, simulating the loss of smell. The olfactory system is triggered by the Smellbox that comprises an Arduino Uno and a 5V power supply, linked to four humidifier modules on two PCB boards and two boxes that resemble conventional stereo speakers. Based on the smell map guidance when working with multiple scents [15], we distance the smells of different properties far from each other, by separating them into different boxes. Hence, coffee and pancake scents composed with fatty, oily properties are located in the same box, while the laundry scent and water are placed in another. A fan is positioned nearby to disperse the scents. Our game interfaces with the Ardity Unity asset [36], enabling communication to activate the relays controlling the humidifiers seen in Figure 6. Each humidifier module is housed in oval bottles containing distinct scents from the Candlemaker's Store [2] that are compliant with IFRA and EU Allergen standards. To avoid biasing players, the bottles and wiring are concealed with laser cut boxes. The gameplay is seen in Figure 1.

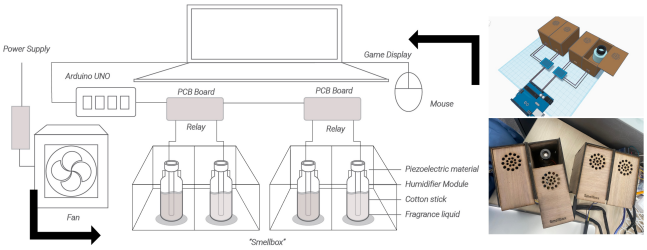


Figure 6: Smellbox hardware diagram

7 DISCUSSION AND FUTURE WORK

We conducted an informal playtest to test our smell narratives and the playability of the game with our participants (n=4) who were students at UC Santa Cruz. Each session took around 8 minutes, followed by a semi-structured interview that ranged from 5 to 20 minutes. Playtesters were asked about their impression of the smell at different stages, as well as their interpretation of the narrative.

We found that while players interpreted the storyline relatively easily and effectively, they also positioned heavy focus on pure smell triggers itself—waiting for its dispersion after their interaction. This corresponds to the theory that the scent triggers followed after player inputs can be perceived as "rewards" and achievements [38]. There is also the apparent design challenge of familiarizing players with the concept of "smell-enabled" gameplay. Given the unconventional nature of olfactory feedback in gaming, it is vital to design the game for players their in- and ability to smell as natural. Quantifiable measures of players' mental models and scent perceptions during gameplay are essential for optimizing scent usage in games. Design considerations on scent locations and mutual scent exclusivity can optimize the interpretation of scents. Further and importantly, stakeholders must be responsible for allergen control and scent exposure to those who are sensitive.

[2]www.thecandlemakersstore.com, 4951 Hamilton - Middletown Rd, hamilton, Ohio 45011, info@thecandlemakersstore.com, 513-868-9425

Using contextual design methods and our design goals, we made a scent-based narrative *Scented Days* to depict the capacity of smell as the main narrative tool and structure. We believe the visceral nature of smells can effectively evoke empathy and awareness due to their loaded emotional capacity. This resembles the empathetic, embodied system by Kors et al. [9], making a follow-up study desirable. In our subsequent research, we aim to quantify the impact of scent-based narratives on empathy and emotions and provide qualitative insights on incorporating scents into day-to-day scenarios.

8 ACKNOWLEDGMENTS

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