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Demonstrating Fluito: A playful floatation tank experience

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ABSTRACT

The use of technologies for interactions in bodies of water has fostered the WaterHCI field. However, the interactive systems proposed for water activities have, so far, primarily focused on supporting instrumental and performance aspects. In contrast, the use of interactive technology for experiential purposes, such as water play, appears to be underexplored. We designed Fluito, a playful floatation tank experience, to expand discovery potentials. Fluito has a unique combination of technology (a floatation tank, a virtual reality headset, a heart rate sensor, and a pneumatic system) that leverages water affordances to create and amplify different experiences, such as play, relaxation, and bodily illusions. The CHI community will benefit from our prototype through the novel experiences it affords, difficult to describe in words, and the first-hand accounts it can facilitate, which is useful for inspiring the design community towards future playful water experiences.

CCS CONCEPTS

• **Human-centered computing → Interaction paradigms**.

KEYWORDS

Water, floatation tank, flotation pod, extended reality, WaterHCI, water activities, playful experience

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1 INTRODUCTION

The introduction of interactive technology to water activities is increasingly gaining the attention of researchers in HCI leading to the development of the WaterHCI [9]. We note that the design of such interactive systems has mostly prioritized supporting instrumental aspects of water activities, such as improving athletic performance in water (e.g., see systems that help rowers improve their technique to go faster [26]). Moreover, these systems have often been tested by adopting a technology-first approach, where researchers appear to focus on the system’s technology and usability instead of the user’s experience [9]. Hence, the design of interactive systems for experiential purposes, such as water play, appears to be underexplored. In consequence, there is limited understanding of the user experiences while interacting with technology in water. To explore this opportunity, we designed "Fluito," a playful floatation tank experience (Fig. 1). A floatation tank, also known as a sensory deprivation tank, is a bathtub filled with water heated to skin temperature (35° Celsius) and saturated with Epsom salts (approx. 20%) that increase water’s buoyancy, allowing for floatation without much effort [15].We developed Fluito as an extended reality (XR) system, integrating multiple interactive technologies: a floatation tank with ambient lighting, a virtual environment delivered via a virtual reality (VR) headset, controlled with a heart rate (HR) sensor and slight head movements that trigger a pneumatic system to deliver tactile feedback (Fig. 1). We exploit Fluito’s capacity to facilitate a playful water experience by demonstrating its ability to amplify different user experiences afforded by the body-technology-water integration, such as relaxation and bodily illusions.

Figure 1: People using Fluito system. Left: one person inside Fluito’s floatation tank wearing the VR headset and the HR sensor. Right: another person inside Fluito’s floatation tank wearing VR headset and the HR sensor experiencing the bubbles triggered by the interactive pumps.

2 RELATED WORK

We now present lessons learned from prior WaterHCI research, with a focus on the use of XR systems in floatation tanks. Few

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WaterHCI systems have explored XR technology for bodies of water [8], and specifically for floatation tanks. We hypothesize that this is because these systems are often not easily accessible. For example, Ballast VR, a commercial recreational experience uses a custom-made headset called "DIVR", which costs approx. $ 50-70K USD [2]. One exception is the work by Mann et al. [18] [19, 20] where the authors designed a VR game for flotation tanks in which users can interact with other tank users, connected over the internet, by watching visual representations of sound waves produced when they sing together (captured via a microphone in the tank). This work encourages social interaction while in the tank, suggesting that technology could enrich the tank experience. This system suggests that VR interactive technology can support the playful activities while floating, however, not much is known about the associated user experience. In particular, we were inspired by prior work on digital play that highlighted that technologies are particularly good at facilitating playful experiences such as exploration, discovery and relaxation [16], and hence we focused on these, as initial starting point, in our work for now. Moreover, we were inspired by this work and wondered if future designs could leverage other interactions that water can facilitate more thoroughly, such as the haptic feedback opportunity water affords [17].

On the other hand, industry has commercialized VR systems in floatation tanks [3], demonstrating that off-the-shelf VR systems (such as Oculus Quest) and flotation tanks can work well together. In addition, VR discourse articulates the advantages that VR can bring to technological interactions, such as control over visual and auditory feedback and new simulated virtual world possibilities [14]. Therefore we also considered the combination of experiencing simulated worlds in VR headsets while in contact with water. We anticipate that this combination can be advantageous to encourage play through visual elements, while also immersive, thanks to the isolation provided by the tank. Moreover, prior on-land work has proposed that VR can complement haptics to augment the sense of realism and engagement [11, 13]. Thus, we predict that a similar combination of VR and haptics could benefit waterHCI systems, creating a water-XR system.

Although recent explorationin floatation tanks have led to individual reports or online vlogs[5, 8] as well as art provocations [7], we still know little about the design challenges and associated user experience, hence, our work aims to begin building this knowledge aiming to start answering the research question: How do we design playful interactive flotation tank experiences?.

3 DESING OF FLUITO

We designed Fluito (Fig. 2), a novel water-based XR system, in order to begin answering the research question. The design of Fluito followed the soma design methodology [12, 21]. By following this method and being informed by the related work, we aimed to integrate the three agents of the interaction, the body (soma), the technology, and the water, and synergistically work towards a playful experience in a floatation tank. In the soma design prototyping phases, we carried out three 30-minute sessions over three weeks (one per week) in the flotation tank that was installed in our laboratory [1]. We confirmed that using VR allows creating a stimulating visual experience, encouraging playful elements such as exploration, relaxation, and captivation, as prior work suggested [16]. We evaluated the use of different technologies while floating, including various VR headsets and environments, with a range of tactile feedback modalities, such as a pneumatic air pump triggering bubbles, and a water pump triggering water jets on the immersed hands and feet. Based on the learnings from this prototyping [21], our design decisions can be summarized as follow:

We chose the Oculus Quest 2 VR headset to provide visual and auditory feedback. While not fully waterproof, we determined that the headset can be suitable for a flotation tank experience, as flotation tank participants keep their heads above water due to the high salt content. The factors for opting for this existing stand-alone headset included availability, accessibility, and performance (image resolution).

Our soma design prototyping also revealed that the floatation tank's space is inadequate to perform gross-motor movements that Oculus controllers' sensors usually encourage. We decided not to use the Oculus controllers but rather to leave participants' hands free to support comfortable floating, without fear of hitting any walls. We are aware that our flotation tank is restricted in width (1.5m), and although larger flotation tanks exist [35]. Hence, we decided not to encourage hands or arm body movements through our design, instead, we employed the use of the headset's IMU sensors. The soma design prototyping revealed that moving the head in a flotation tank requires much more deliberate attention than in land-based activities. As we wanted to avoid strenuous head movements (as sometimes required in traditional VR experiences), we limited the range of the head movements participants were invited to perform in the software. We also provide a flotation neck pillow (common in flotation spas) to ensure a comfortable experience and support the slight head movements (turning left/right) we intended as input.

We monitor participants' HR to support safety, as usual in floatation tank studies [15]. We also leverage HR as input for the experience, inspired by previous work using it as a playful mechanic [7, 24]. Our soma design experience also speaks to this, as we found that the floatation tank amplifies one's awareness of breathing and HR, encouraging relaxation and self-awareness. Then, we decided to sense breathing via the headset's microphone to inform the movement of virtual focal objects in the VR environment. We use the "Polar Verity" HR sensor as input for background changes in the VR environment. Changes are triggered when the HR exceeds 80 bpm (the normal resting heart rate in healthy adults [22, 23]), inspired by prior work with open feedback loops using this threshold [10].

Finally, our soma design prototyping showed that the sensation of bubbles touching the skin while submerged in water can be delightful, added a feeling of relaxation, and we envisaged that it could be used as a playful reward. Moreover, as suggested by prior work, we hoped that tactile feedback, when synchronized with visual feedback in VR, could increase overall immersion [13].

The result of our design was "Fluito" (Latin for "float"), a novel extended reality system aimed to provide a playful water experience and amplify the benefits of being in water, such as relaxation and pleasure (Fig. 2). We found the waterproof "Polar Verity" light-based sensor to be the best wireless HR solution with real-time data transfer for the VR development platform Unity 3D, supported by the physiological plug-in "Excite-O-Meter" [25]. We also found air pumps to create bubbles inside the tank as the best solution for our haptic stimuli since they can be placed outside the tank, delivering air through hoses attached to the tank's walls. The custom pneumatic system consists of four 5V air pumps connected to an "ESP8266" microcontroller. The microcontroller wirelessly communicates with the Unity 3D over WiFi using the Uduino plugin [4] and Arduino Servo libraries.

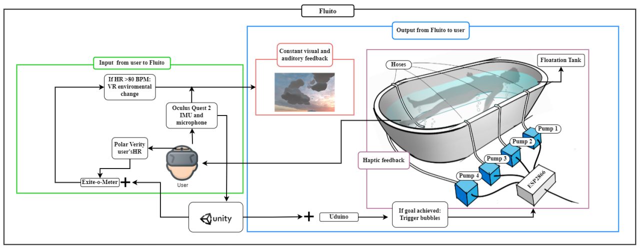

Figure 2: Components of Fluito. Left: input from participant to Fluito. Right: output from Fluito to participant.

3.1 Experiencing Fluito

Experiencing Fluito means joining a journey guided by a virtual water spirit. Through this journey, both the water spirit and the participant will (hopefully) transform themselves while cooperating: the participant will help the water spirit regain life, and the water spirit will give the participant a superpower: the ability to experience their body in new ways. Furthermore, the water spirit will guide the participant through different VR worlds where they must overcome various challenges, such as controlling their breathing and guiding the water spirit in collecting virtual objects. The VR scenes and how the participants interact with them are explained as follows:

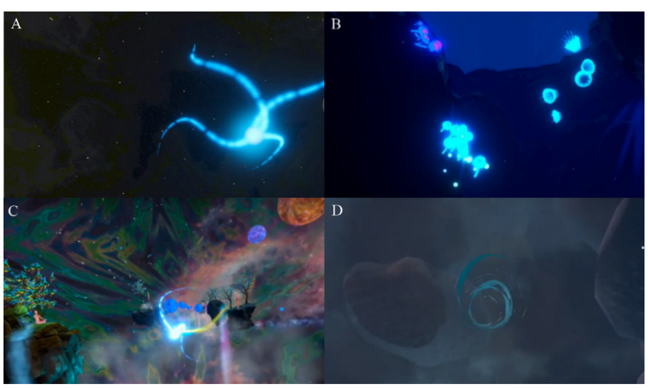

Figure 3: A) The onboarding and offboarding scene, where the water spirit says welcome and goodbye. B) The underwater scene, where participants use their breath to collect lights. C) The psychedelic space water scene, where participants collect water droplets. D) The rainy water scene, where participants rise to the sky (note, it started to rain, and the color is red due to the HR > threshold).

- Onboarding and offboarding to Fluito's water experience: Fluitos' journey begins in a virtual water scene, where the participant's avatar is floating in an infinite ocean at night with a sky full of stars, hearing the ocean's small waves (Fig. 3A). A water spirit (as depicted in the middle of figure 3A) emerges and invites the participant to take a journey together. This virtual scene repeats at the end to offboard the participant: the water spirit emerges from the ocean and thanks the participant for participating in the journey.
- Underwater scene: The first interactive scene, where the participant dives into a virtual underwater scene (Fig. 3B). The participant is encouraged to explore the environment full of sealife: they receive auditory and textual instructions to search for emerging lights by performing small head movements and breathing them "in," promoting rhythmic breathing to facilitate relaxation and breath awareness. The air pumps activate if the participant is pointing to the lights with their head and breathing aloud. The environment will change to red if the participant's HR is above 80 bpm.
- Psychedelic water scene: The participant enters a "psychedelic" water scene, where they see a bright horizon with floating islands, waterfalls, and planets while hearing relaxing music (Fig. 3C). The water spirit invites the participant to collect water droplets approaching the participant's avatar position. The participant guides the water spirit via head movements to collect the water droplets. If a water droplet is collected, the air pumps are activated triggering the bubbles. Again, the environment changes to red if the HR exceeds 80 bpm.
- Rainy water scene: In this final scene, the participant is transported to the top of a cloud in the sky, where they can hear and see the wind, cyclones, dark clouds, and rain. As the participant's avatar rises through the clouds, they collect the moving cyclones with their head movements, triggering the bubbles. The environment will change to red if the HR is above 80 bpm. Additionally, the rain and the storm will activate in response (Fig. 3D).

4 FLUITO DEMONSTRATION

A study with 13 participants [6] helped determine a suitable design implementation for a public demonstration at CHI'23 Interactivity. Furthermore, we have experience having demonstrated Fluito informally over an extended period of time. A public demonstration affords the opportunity to showcase a feasible integration of the body, technology, and water to create a playful experience facilitating the natural benefits of floating in the water. Furthermore, a public demonstration will give attendees interested in the emerging field of waterHCI an understanding of the design of playful water experiences using interactive technology in floatation tanks.

5 CONCLUSION

We demonstrated a novel design called Fluito for playful water experiences in a floatation tank. We implemented Fluito through a soma design methodology, integrating the human body, technology and water to synergistically facilitate the benefits of being playful in the water. Our aim is to inspire HCI researchers to develop playful experiences in water by leveraging technologies and potentials in the emerging field of WaterHCI. Demonstrating Fluito offers the opportunity to discuss novel extended reality systems while offering a unique immersive journey to attendees. Our work provides a foundation for researchers to explore these design considerations when designing for water interactions, particularly in an experiential context such as play.

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