

# Feeling Creepy: A Haptic Haunted House

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**Abstract**—This study explores how haptics can affect the immersiveness, novelty, and creepiness of a haunted house. The study builds upon a previously designed haptic display and vibrotactile signals inspired by natural phenomena. These were combined with video, audio, and additional haptics to create a multimodal narrative experience. In a subsequent questionnaire, nineteen of the twenty-two participants reported that the haptic effects increased their sense of immersion.

## I. INTRODUCTION

Interest in the immersive potential of haptics is growing. This is especially true for VR, but there is evidence that haptics can enhance in-person experiences, too; consider a theater performance that uses haptic feedback to enable shared experiences among sighted and blind audiences [1].

This study aims to use haptics to heighten one’s sense of immersion in a haunted house. Our participants sat in a black booth lit by tealights, watching a black and white film as a narrator spoke in their ear to guide them through a séance. When directed to place their hand on a haptic display, the participant felt signals patterned after realistic natural phenomena – like the eerie buzzing of a forest brimming with cicadas - under the palm of their hand.

## II. BACKGROUND

### A. Related Work

This study builds on the palmScape project, the vibrotactile signals and haptic display developed by Shim and Tan [2]. The low-arousal palmScape signals were designed to imitate natural phenomena - like booming thunder, a croaking frog, or a beating heart. The user feels the signals by resting their palm on a 3D-printed housing containing a 2-by-2 array of tactors (Tectonic Elements, Model TEAX13C02-8/RH), shown in Fig. 1. Our project uses the palmScape apparatus and a subset of the signals. In order of first appearance, the palmScape signals used were: “cicadas,” “frog,” “thunder,” “earthquake,” “heartbeat,” and “knock.” For further details about the palmScape signals and apparatus, see [2].

### B. Relevant History

The narrative of our haunted house was inspired by a séance, a form of ghostly entertainment popular in the 19th century [3]. In a séance, a medium instructs participants to sit in the dark, join hands, and attempt to communicate with



Fig. 1. The palmScape apparatus

spirits. The medium often rigs the room with effects, such as knocking sounds and disembodied voices, to create the illusion of a spiritual presence [3]. The choice of the séance for the theme was motivated by its multisensory aspects and its endurance as a symbol of the eerie and unknown.

## III. METHODS

### A. Participants

Twenty-two participants (15 females) aged 18 to 27 years ( $20 \pm 2.3$  years) volunteered to participate and signed an IRB-approved informed consent form.

### B. Apparatus

In addition to the palmScape, four actuators (Tectonic Elements, Model TEAX25C10-8/HS) were hidden in the participant’s chair, two under each thigh. The actuators were freely suspended using a plastic attachment to ensure they could be excited up to 1.5mm under the weight of the leg. They were driven at 15 volts, 1.5 amps at a frequency of 170 hertz. The synchronization of the video and haptic signals was automated by a computer out of the participant’s sight.

### C. Procedure

Each participant wore noise-cancelling headphones and sat alone inside a decorated black booth, as shown in Fig. 2. A captioned video, shown in Fig. 3, was projected on the booth’s wall. The video’s narrator gave instructions to “reach into the box” to remove a key and “rest your right palm” on the palmScape. Synchronous sounds, visuals, and haptics were integrated into the narrative. For instance, the line “can you feel the way the earth rattles beneath the roll of the thunder?” was accompanied by a storm-inspired vibrotactile signal, video, and sound effect. At the climax, haptic actuators hidden in the chair vibrated without warning. After the five-minute experience, the participant was invited to answer sixteen questions.

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Fig. 2. A participant sits inside the haunted house

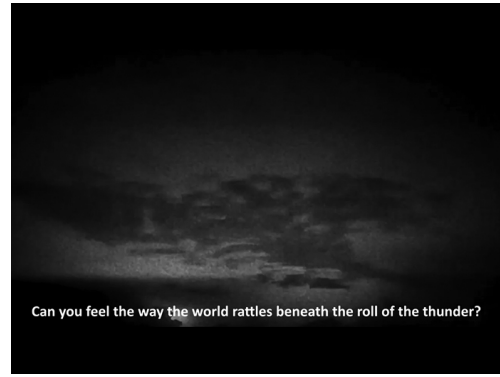


Fig. 3. A screen capture from the video shown to participants

#### D. Questionnaire

Participants were asked open-ended questions (e.g. “How did it go?” “What did you expect to feel, sense, or see?” “What surprised or was novel to you?” “Tell me about an experience that stands out to you.”). They were also presented a palmScape and a randomly ordered word bank, shown in Table 1. For each signal, participants chose an applicable adjective, in their own words or from the bank, as well as a modifier on a 5-point Likert scale ranging from “Very strongly” to “Not strongly.” All words except “creepy” and “scary” were from the Microsoft Desirability Toolkit [4].

### IV. RESULTS

All twenty-two participants positively reviewed the overall experience. Nineteen felt the haptics enhanced their sense of immersion. One said they were “not in [the] building anymore,” and several others credited the “multisensory” experience. Three participants gave neutral responses about immersion. One called the haptics “distracting”; another commented that the palm placement decreased their immersion; the third was “scared to break” the palmScape, perhaps due to request that participants treat the device gently.

When asked to select adjectives, participants were most likely to use positive words to describe the “rattling chair,” “heartbeat,” and “frog” signals, in that order. They were also most likely to use strong modifiers (e.g. “Very strongly”) for the these signals. Fig. 4 shows all adjective responses for the “heartbeat” signal, scaled to indicate frequency of response.

When asked “What surprised or was novel to you?” or “Tell me about an experience that stands out to you,” popular



Fig. 4. Adjectives used to describe the “heartbeat” signal

responses were “rattling chair” (19 times), “heartbeat” (6), “cicada” (6), “nothing”/“no response” (5), and “thunder” (4). The strong response to “rattling chair” was anticipated; participants were told they would experience mild vibrations, but the location of presentation was left ambiguous. The prevalent mention of the first signals (“cicadas”) and last signals (“rattling chair,” “heartbeat”) in free recall may be partially attributed to the serial-position effect.

### V. CONCLUSION

These findings suggest unexpected and life-like haptic effects may increase perceived immersion and enjoyment of a haunted house. The results have encouraged us to continue development. We hope to use the responses to this pilot study to draft a multidimensional map of emotional responses for future user testing.

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TABLE I  
WORD BANK

Negative	Positive	Neutral	
Boring	Exciting	Simplistic	Complex
Confusing	Clear	Expected	Unpredictable
Ineffective	Effective	Familiar	Unconventional
Undesirable	Satisfying	Slow	Fast
Inconsistent	Consistent	Calm	
Overwhelming	Comfortable	<b>Context-specific</b>	
Distracting	Engaging	Creepy	Scary