User Engagement for Mid-Air Haptic Interactions with Digital Signage

Hannah Limerick – User Research and Insights Lead

Ultrahaptics
Digital displays are becoming increasingly interactive.

**Motivation for study**

1. How do we measure the added value for interactive advertising displays?
2. What is the end user value in interactive advertising displays?
3. Does more interactivity lead to higher engagement?
4. What roles does mid-air haptics play?
5. Is there a link between haptics and interactivity?
User Engagement

User engagement is a quality of UX, and is characterised by the depth of an actor’s investment when interacting with a digital system. Obrien et al. 2008

User Engagement scale

- **Focused Attention** - the feeling of being absorbed in the interaction and losing track of time.
- **Perceived Usability** – the degree to which an interface is fit to use and the degree of control and effort expended.
- **Aesthetic Appeal** – the attractiveness and visual appeal of the interface.
- **Reward** - involvement, having fun and interest in the interface and willingness to do it again.

Emotional response

- Russell’s circumplex model of affect

Verbal report

- Post task interviews
Methodology

Aim: determine the impact that different levels of interactivity and mid-air haptic feedback have on user engagement with interactive digital signage.

<table>
<thead>
<tr>
<th>Interactivity</th>
<th>Haptics</th>
</tr>
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<tbody>
<tr>
<td>Gamification (high)</td>
<td>On</td>
</tr>
<tr>
<td>Non gamification (Low)</td>
<td>Off</td>
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</tbody>
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17 participants. 5 male, 12 female
Mean age 34
Recruited from an online database
Half participants had tried the mid-air haptics briefly at an event, half were completely new.

<table>
<thead>
<tr>
<th>Stage</th>
<th>Steps Involved</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study Explanation / Demographic Questions</td>
<td>Study explained to participant Demographic questions answers</td>
<td>5 mins</td>
</tr>
<tr>
<td>PHASE 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Practice Stage</td>
<td>User explores the Ultrahaptics sensations via ‘Sensation Library’</td>
<td>10 mins</td>
</tr>
<tr>
<td>PHASE 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Main Study</td>
<td>User undertakes 1 of the 8 conditions Answers questionnaire</td>
<td>8 x 2 mins 8 x 3 mins = 30 mins</td>
</tr>
<tr>
<td>PHASE 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-Evaluation</td>
<td>Post-evaluation questions administered</td>
<td>5 mins</td>
</tr>
</tbody>
</table>

Figure 2 Descriptive image of interactions. A) Dead Static, Level 1 B) The Sorcerer, Level 2 C) 2D Maze, Level 2 D) Beyond Terra, Level 2. Red lines indicate required actions to complete game.
Quantitative Results

User Engagement Scale

Emotional Affect

Figure 5. Emotional Affect ratings for the haptic and interactivity conditions. Asterisks show higher affect scores. More asterisks signify lower p values.
Qualitative results

83% participants mentioned enhanced experience with haptics

“It is fun! The haptics make it easier to do, it allows you to know what to do. Without haptics it feels like I am missing out.”

Gamification more engaging

“I was very engaged in the gameplay, I felt a bit disappointed that the others were a bit less immersive.”

Increased usability with haptics

“The maze was easier with the haptics, it was more satisfying.”

Need for a call to interact

“I wouldn’t know it was interactive”
Findings

Higher interactivity (gamification) =

- More focused attention
- Increased reward
- Higher emotional arousal

Presence of haptic feedback =

- More focused attention
- Increased reward
- Better perceived usability
- More aesthetic appeal
- Higher emotional arousal

Directions for future user research
Future work

Public spaces?

The spectator experience is also important for public displays

Brand recall

Groups of people

More complex gestures

Kiosks or utility driven public displays
QUESTIONS