Exploring Experiences with Transparent Natural Materials

Abstract
New technologies and manufacturing techniques for interactive artifacts open new possibilities for using novel materials for interaction. In this paper we consider the material side of interacting with see-through interfaces. In our user study (n=16), we investigated how people experience interacting with different natural materials. Here, we report the results on three see-through materials, which represent different types of elements – ice, water and air.

Author Keywords
Natural materials; design materials; user experience; user studies

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

Introduction
Material qualities of physical objects are an integral part of the user experience design when physical products with tangible user interfaces are considered. However, in the field of human-computer interaction, tangible materials have so far rarely been in the research focus. In our research, we are especially interested in the use of natural materials, which have so far gained little attention in the design interactive...
system. Here, we focus on three different see-through elements: ice, water and air. Earlier HCI research on these materials has explored playful interaction e.g. in the form of game controllers utilizing the movement of water [2], an interactive public installation utilizing a city landmark made of stone and water [3], and a touch screen made of ice [7]. Commercial solutions using water as an output medium are also available [1]. However, systematic studies comparing different materials are lacking. This is interesting especially for the area of tangible user interfaces, which have the potential to create more seamless interactive experiences with the real world objects [4].

User Study
In our user study, we applied the material probes method introduced in [5]. Material probes for a total of 7 natural materials were created. These included the following see-through materials:

- Water, contained in a small bowl.
- Ice, in the form of a tennis ball sized block.
- Air, in the form of Wind created as needed from a small desk fan.

The other materials investigated in the study were stone, sand, fire and soap bubbles.

The participants tried out interacting with different materials, see Figure 1, and were encouraged to think aloud while doing that. In addition, participants answered a written survey, and selected 3 adjectives from a list of 20 that best described the material, following a Product Reaction Cards (PRC) based methodology [6]. Table 1 contains the adjectives that were available, and were shown to the participant as separate sheets of paper when s/he had tried out each material. The order in which participants interacted with the materials was counterbalanced to avoid any effects due to the presentation order. Altogether 16 participants (5 female, 11 male) took part in the study. The age range of the participants was 18-24: 13%; 25-29: 37%; 30-39: 44% and 40-49: 6%.

Figure 1. A test participant interacting with water. The ice material probe can be seen on the right of the image.
<table>
<thead>
<tr>
<th>Fast</th>
<th>Slow</th>
<th>Inconsistent</th>
<th>Consistent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responsive</td>
<td>Rigid</td>
<td>Uncontrollable</td>
<td>Controllable</td>
</tr>
<tr>
<td>Fun</td>
<td>Serious</td>
<td>Unpleasant</td>
<td>Pleasant</td>
</tr>
<tr>
<td>Restful</td>
<td>Stressful</td>
<td>Boring</td>
<td>Exciting</td>
</tr>
<tr>
<td>Approachable</td>
<td>Unapproachable</td>
<td>Frustrating</td>
<td>Inspiring</td>
</tr>
</tbody>
</table>

**Table 1.** Adjectives used in product reaction card method. Participants selected 3 that best described each material.

Table 2 shows the most common terms that users associated with each of the see-through materials.

<table>
<thead>
<tr>
<th>Material</th>
<th>PRC terms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ice</td>
<td>Fun (7), Exciting (5), Uncontrollable, Rigid, Restful, Serious, Consistent, Pleasant (3)</td>
</tr>
<tr>
<td>Water</td>
<td>Pleasant (8), Fun (7), Uncontrollable (6), Restful, Exciting, Approachable, Inspiring (5)</td>
</tr>
<tr>
<td>Air (wind)</td>
<td>Uncontrollable, Pleasant (7), Restful, Fast, Fun (5), Approachable, Exciting (4)</td>
</tr>
</tbody>
</table>

**Table 2.** The adjectives selected by users in the product reaction card method. The number in brackets indicates the number of users selecting each word.

Overall, we observed that the participants were interested in trying out the materials, touching and even playing with them. A summary of users’ descriptive comments on the experience of handling each see-through material, reported on the written survey the participants answered after trying out each material, is given below.

**Ice.** Here it was no surprise that the majority of users mentioned the coldness of ice as a feeling they associated with it. Here, only 2/16 users mentioned the transparent nature of ice e.g. “It is interesting to look through it, e.g. what lies under it.” (participant #15). Interestingly 2 users referred to the reflective properties of the ice surface e.g. “…mirror…” (participant #16) and “…shiny looking…” (participant #11).

**Water.** Of the 16 users, 6 mentioned the cool temperature they associated with water e.g. “Feels transparent, quiet and cool” (participant #4). Related to the transparency, many participants (7/16) referred to cleanliness, e.g. “Transparent and clean” (participant #9).

**Air.** Two of the total of 16 users mentioned the see-through properties of air, “It is impossible to see it, you just have to sense, feel and hear it” (user #15), and “Invisible and fantastic.” (participant #4).

**Discussion**

The feedback we received from the study was encouraging, and it illustrated that natural materials provoke users’ emotions. Using material probes was found to be a good method to approach the topic, as the physicality of the materials brought forth stronger associations and feedback. We believe we gained a
richer and more authentic reaction than e.g. if we had used an online survey approach.

Mostly the reactions to all the natural see-through materials were very positive. Interacting with the materials was perceived as fun. Whereas the liquid and gas type elements were described more as uncontrollable and approachable, the solid ice provoked associations that were calmer, such as the terms rigid, serious and restful. We believe that these first steps in the area of charting the user experiences with the materials will lead to the use of natural transparent materials as design elements in interactive installations and applications.

References