(Perceived) Interactivity: Does Interactivity Increase Enjoyment and Creative Identity in Artistic Spaces?

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ABSTRACT
The HCI community often operates under the assumption that interactivity enhances the user experience. In this study, we are particularly interested in whether interactivity enhances an artistic experience by either promoting or constraining an audience’s enjoyment and creative identity. The goal of the study was to test two research questions in an experimental context: 1.) How does interactive art impact user satisfaction, and 2.) How does interactive art shape the self-concept of the user as creative? Participants interacted with the system in the “Interaction” (34 pairs) or “No Interaction” (37 pairs) condition. Findings reveal that perceptions of interactivity correlate with user satisfaction, but do not influence user identity.

Author Keywords
interactive art, user satisfaction, identity, creativity, music installation

ACM Classification Keywords
H5.1 Multimedia Information Systems H5.5 Sound and Music Computing

INTRODUCTION
Interactive art in HCI is a topic of continued interest and debate [15]. Despite controversy on the topic, the relationship between technology design and art continues to prompt new systems within HCI [4, 14] An assumption of interactive art design is that interactivity engages users, and enhances user self-reflection. However, there are few empirical tests of these effects. The first goal of this study (RQ1) is to test whether interactive artistic experiences enhance enjoyment. The second (RQ2) is to examine whether interactivity will increase creative identity.

BACKGROUND ON INTERACTIVE ART
A trend in HCI is to build interactive art installations in which audiences have some control over the system. Although interactivity is defined as a neutral concept [8], often it is assumed that interaction will lead to more positive experiences [3, 14, 17]. Previous research on interactive systems suggests that the psychological outcomes associated with digital interaction include enhanced learning, entertainment, and persuasive effects [3, 14, 17]. However, to our knowledge, there has not been an empirical test of the effect of interactivity on the user experience in an artistic environment.

According to “reflective design” philosophies, technology can and should prompt user self-reflection [16]. Interactive art has been assumed to shape user identities and self-awareness [11, 14]. For example, technological installations have been developed for the purposes of questioning specific cultural identities [12], or to shift the role of users from ‘audience’ to collaborator [1].

There are competing perspectives on whether interacting with art will support or limit user identity as “creator.” Some note the potential for interactive art to inspire creativity and a sense of authorship from users [6, 18]. Others have raised concerns about a false sense of creative ownership, suggesting that technical constraints may limit a user’s sense of autonomy [5]. Despite mixed predictions from the field, our expectation was that this system would enhance creative self-perceptions, and thus, creative identity through a process of self-perception [2].

THEORETICAL BACKGROUND
Self-perception theory [2] posits that through self-observation people come to determine their own identities, even when behaviors are externally induced. Through self-observation, individuals that create artistic sounds by interacting with the system are expected to think of themselves as more creative than those individuals that do not interact with the system. Evidence of psychological “identity shift” through self-observation has been found in weblogs [9], but has not been tried in offline technological spaces.
EXPERIMENTAL DESIGN
Participants were exposed to an experimental music installation. In a “No Interaction” condition participants were told simply to observe the sound and then provide feedback on their experience. In an “Interaction” condition participants were given a demonstration of how they could manipulate the experimental sounds with body motions, and then told they would provide feedback after interacting with the system.

INSTALLATION DESIGN
Our design of this system consisted of three major components: (1) the music generation component which took the sensor input and produced the resulting sounds, and (2) the sensor component which detected users’ efforts to affect the system.

The music generation component was a Pure Data program that read the sensor information and produced an audio signal. Pure Data is a graphical programming environment, often used in audio processing and music composition. The program we constructed produced sounds that were not conventionally musical, but rather were atypical sounds used in many music installations. Our installation included two bell-like textures, a short chiming sound which corresponded to the user actions, and a longer tolling bell which cycled through different rhythmic patterns unaffected by user interaction.

The sensors used to detect user motion in the installation interaction were Nintendo Wiimotes. Wiimotes are force-sensing controllers originally developed for the Nintendo Wii game system. The Wiimotes transmitted user acceleration data allowing us to infer rhythmic movements of Wiimote-holding users.

Alongside a repeating cycle of bells, the user could produce their own independent chime sound by exploring different motions through the Wiimotes. This led to a change in the cycle if the user successfully matched the sequence of bells. Upon the completion of four patterns the sound would cease.

METHODS
Seventy-one pairs were randomly assigned to “Interaction” (34) and “No Interaction” (37 pairs) conditions. In both conditions, users were brought into a space, and told to “reflect on the space, the sounds, and each other” during the process. As mentioned, in the Interaction condition, users were given Wiimotes that could generate sounds. In the No Interaction condition users did not alter the sound. Instead, they heard the sounds that the system produced from a previously recorded interactive session. This condition was intended to be more reflective than interactive.

RESULTS
Manipulation Check of Interactivity
To ensure that subjects perceive that the interactive design was in fact more interactive than the non-interactive design two questions were posed to users: How much did you affect the sound? Was this installation interactive? Responses were summed for each person to create a single interactivity rating (range 2-14, high score=perceived interactive, $\alpha=.88$). As expected, participants in the interactive condition did find that the experience was more interactive ($M=9.71$, $SD=2.42$) than those in the non-interactive condition ($M=5.27$, $SD=3.07$), $t(69)=6.79$, $p<.01$. Figures 1-4 demonstrate some of the general reactions to the experimental sound in both conditions.

RQ1. User Enjoyment
The quality of the experience was assessed using three items asking users about their enjoyment of the installation,  

1 http://puredata.info/

2 Although there is debate about the use of parametric tests on Likert-scale data, the normal distribution of this data suggests appropriate application [see 13]
how much fun they had, and whether or not they would recommend the installation to friends. These items were summed to create a single rating of the experience (range 3-21, high score=positive experience, α=.84). We performed a t-test to evaluate whether participants that interacted with the installation liked it more than those that did not interact.

By summing the three items, we found that on average the interactive participants liked their experience more (M=12.62, SD=3.40) than participants that did not interact (M=10.78, SD=4.10) with the piece, t(69)=2.67, p=.01. Further, there is a significant correlation between participants’ perceptions of the installation as interactive and their enjoyment of the installation, (r=.53, p<.01). This correlation was consistent across both interactive (r=.42, p=.01) and non-interactive (r=.57, p<.01) conditions.

**RQ2. User Identity**

Two different scales were used to assess identity shift as a function of interacting with the installation. The first was a summary measure of five questions intended to assess user’s self-perceptions as creative (e.g. How much do you enjoy participating in creative activities?; range 5-35, high score=creative self-perception, α=.85). The second measure was an adjective checklist designed to assess creative personality [9]. Mean ratings of self-perceived creativity were compared across both scales using a t-test. In contrast to our hypothesis, participants exposed to the interactive installation were not more likely to rate themselves as being creative according to either our scale (M=26.08, SD=4.58, t(69)=1.5, p=ns), or the Gough scale (M=5.62, SD=3.10, t(69)=.28, p=ns), relative to participants that did not interact with the sound (our scale: M=26.26, SD=5.21; Gough scale: M=5.41, SD=3.24).

**DISCUSSION**

**User Experience**

Our results support our first hypothesis in that users do enjoy the experience more when they are able to interact with the system. This result is demonstrated by a significantly higher rating of user enjoyment by subjects in the interactive condition. Perhaps more striking is the additional support for this hypothesis provided by the positive correlation between participant ratings of interactivity and user satisfaction. Furthermore, two points can be drawn from these findings. First, the fact that participants in the non-interactive conditions rated the installation along a range of 1 (Not very interactive) to 7 (highly interactive) supports the notion that, at some level, all art involves a degree of interaction, such as psychological interaction [5, 6].

Second, because all people in the interactive condition had the same amount of control, these findings further reinforce the idea that perceptions of interactivity, rather than objectively defined factors, are what shape a user’s experience. Given that interactivity ratings were strongly correlated with user enjoyment across all conditions, these findings suggest that future research would benefit from continued exploration of why users view a particular piece as interactive in addition to why it may be enjoyable.

**User Identity**

In contrast to our hypotheses we did not find that interaction with the art installation had any effect on users’ self-perceptions of creativity. Although it is difficult to make generalizations based on null results, in brief, we note some possible explanations for the lack of effects.

First, it is possible that our manipulation failed to activate participants’ creative self-concept. Perhaps if we had explicitly prompted users to explore their “creative potential” they may have altered their perceptions of themselves as creative. Also, the design itself may not have been sufficiently interactive to activate perceived creative control.

On the other hand, it is also possible that interactive art does not actually induce a sense of creativity as otherwise presumed. Or, finally, it may be that interactive art inspires a temporary state of creativity without actually shifting users’ self-concepts. Because this is an important issue for future discussion, the next section will explore some possible rationales for the lack of effects we observed.

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**Table 1. Mean level of perceived interaction, user enjoyment and reported creative identity. Standard deviation is in parenthesis. *p<.01**

<table>
<thead>
<tr>
<th></th>
<th>Interaction Condition</th>
<th>No Interaction Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Interaction</td>
<td>9.7 (2.4)</td>
<td>5.3* (3.0)</td>
</tr>
<tr>
<td>User Enjoyment</td>
<td>12.6 (3.4)</td>
<td>10.7* (4.10)</td>
</tr>
<tr>
<td>Creative Identity:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Our Scale</td>
<td>26.1 (4.6)</td>
<td>26.3 (5.2)</td>
</tr>
<tr>
<td>Gough Scale</td>
<td>5.6 (3.1)</td>
<td>5.4 (3.2)</td>
</tr>
</tbody>
</table>

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**Figure 2. Participants use Wiimotes to generate sound during interaction with the installation.**
component of many interactive designs, we feel that the question of whether or not interactive art actually can influence identity [7, 18] deserves continued attention.

As mentioned, future tests using this system may involve a different set of instructions to users. An additional alternative is to alter the design to increase users’ sense of control. Finally, adjustments to our measurements of creativity may also be necessary to capture self-perceptions of creativity.

LIMITATIONS
Finally, we must make a note of caution that although an experimental test of this system revealed that user enjoyment increases as a function of interactivity, we can not be sure that these findings would generalize to other forms of interactive design, or even to additional interactive art installations. Specifically, future tests of this design should distinguish the effects of the Wiimotes from actual interactivity, by allowing participants to hold Wiimotes without impacting sound output. In all, however, we do feel that this finding encourages continued exploration into the relationship of interactivity and user satisfaction, especially in artistic realms.

CONCLUSION
This study was design to provide quantitative data on the relationship between interactivity and enjoyment, and interactivity and creative self-perception in an art installation. Indeed, users in the “Interaction” condition believed the installation to be more enjoyable than participants in the “No Interaction” condition. Furthermore, variability in the amount of perceived interactivity, even within condition, demonstrates that interactivity is as much determined by individual perceptions as it is by the design itself, which may inform future research on interactive design, and interactive art in particular. Interactivity failed to influence self-perceptions, however, future research should continue to explore the relationship between identity and interactivity from this perspective.

REFERENCES