Send Me Bubbles: Multimodal Performance and Social Acceptability

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Abstract
The use of performance as the focus of interaction provides the opportunity for exploratory and individual experiences but can also put users in an uncomfortable position. This paper presents an initial user study of a mobile remote awareness application in which users can control their own fish in a virtual fish tank using multimodal input from an external sensing device, where the input styles are created and performed by participants in an open ended sensing model. The study was designed in order to better understand the issues of performance when audience members are both casual passersby and familiar others watching remotely. Additionally, this study investigated the creation of performances and the effects of props when used in different social settings. The study involved pairs of participants interacting with the system in both public and private locations over repeated sessions. The results of this study show how users created and interpreted performances as well as how their consideration of passersby influenced their experiences.

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Social Acceptability, Multimodal Interaction.

ACM Classification Keywords
H.5.2 [User Interfaces]: *Input devices and strategies.*

General Terms
Human Factors.

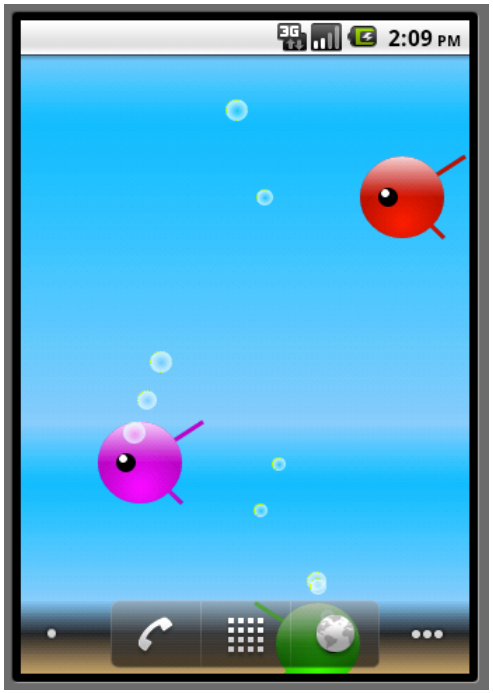

Figure 1. Animated multimodal fish tank visualization as the background of a mobile phone home screen.

Introduction

When designing performative interfaces, considering the audience of the performance [5] and the social acceptability of partaking in that performance [7] is of key importance in design, deployment, and acceptance. However, previous work in this area has not addressed the affects of the different types of simultaneous audiences, the way that props can affect social acceptability, and how users might create, adapt, and appropriate multimodal interactions for everyday settings.

This paper presents an initial study of a mobile remote awareness visualization running on a set of phones that is controlled by distributed users generating multimodal input from external sensing devices. The interface portrays a fish tank shared by a group of users where each user controls his/her own fish in the tank using a prop containing a set of sensors. The system is designed to explore the issues of performance and the usage of props when the user is performing for two different audiences: one audience is the fellow participant watching the performance through the fish tank visualization and the other is the passersby watching the live performance without necessarily being aware of its purpose or the interface itself. This application uses highly flexible input methods, where participants were required to create their own performance style in real world locations using gesture and voice. Using this system, users are free to create a variety of performances to suit their current context as well as participate as an audience member where divergent and imagined interpretations of the visualization are possible.

Performance and Social Acceptability

Performance as a method of interaction [9] has seen use in a variety of interfaces including large art and museum installations [2], tangible interfaces [9], and mobile interfaces. Because mobile phones are becoming increasingly integrated into daily life we must consider how we use these interfaces in public and social contexts. These considerations and the resulting actions can be considered performances, even if we do them unconsciously. As performance becomes the focus of interaction, the user experience [3] and appearance [1] of the performer play a vital role in how users choose to take part in a performance, as both participant and audience member, and the experience that they hope to take away from it.

Because performative interfaces bring users into a public spotlight, considering the social acceptability of the performance is a key factor to consider otherwise users may feel too inhibited to participate or interact. Previous work in the area of social acceptability has mainly focused on the methods that can be used to discover early perceptions of social acceptability. For example, Ronkainen *et al.* [8] completed a survey that used video scenarios to explore the social acceptability of a variety of gesture-based interaction techniques. Rico and Brewster conducted a study where participants were asked to perform a set of gestures in public and private settings and were then interviewed about their experiences [7]. Other work has looked at identifying some of the factors that influence social acceptability. For example, Montero *et al.* [4] ran a focus group study examining how various combinations of visible or hidden actions and their effects influenced the social acceptability of performing gestures. Rico and Brewster also completed a focus group study that examined how users in different age groups evaluated social acceptability using a variety of low cost prototypes [6].

Figure 2. Participants could select one of six objects containing an embedded sensor pack to control their fish in the tank.

Previous work, however, has not addressed how props can be used to encourage performance or how users might develop performance techniques in the wild. Props can be used as part of a performer's appearance [1] and therefore not only change the performance but may also provide a way for performers to explain their actions to spectators. Since the demonstration of interaction plays an important role in social acceptability [7], props might provide a way of encouraging performance. The creation of user input in the wild…

Multimodal Fish Tank: Performative Remote Awareness

The purpose of this study was to investigate the social acceptability of multimodal performance, including the usage of props for interaction, the creation of performances in real world settings, and the user experience of performing for multiple audiences. The interface designed to facilitate this study is a mobile remote awareness application that used gesture and voice input to control a fish tank display with simple behaviors. However, although this system was based around remote awareness, the purpose of this system was not concerned with the meaning or intention behind communications but the ability to support divergent multimodal inputs and create the experiences performing in different setting and participating as a distant audience member for a familiar other's performances.

The System

In the Multimodal Fish Tank, participants were each represented by a fish in a virtual fish tank, as shown in Figure 1, that could be watched by all the participants as the animated background on a mobile phone home screen and controlled using multimodal input. Participants were told they could use gestures or motions to make their fish swim faster or use audio and voice to make their fish blow more bubbles. In each case, the fish behavior was based solely on the magnitude of input, although this was not explained to users. For audio input, the louder the sound level the more bubbles the corresponding fish would create. Thus, users could perform any kind of speech or sound based action and see the result in the fish tank. Changes in swimming movements were based on magnitude of acceleration of gesture. This type of sensing was designed specifically to support both extravagant and subtle input, meaningful and abstract input, or simply environmental input that would be reflected in the fish tank visualization in real time. The inputs were specifically designed to include unconstrained controls in order to encourage participants to generate creative methods of controlling the visualization but also allow for imaginative interpretations for those watching the visualization. The interface was controlled using the SHAKE sensor pack to collect accelerometer data [7] with an added microphone. This was then embedded into the various objects or props shown in Figure 2. These props were chosen to provide a variety of objects that could facilitate performance in different ways. These included playful objects, abstract objects, everyday objects, and an object that exhibited the bare sensors. These props were selected to provide different visual and cognitive clues for spectators about the performance in order to give performers different methods of exaggerating, disguising, or explaining their performance.

The Study

The study involved 8 participants recruited in pairs. The pairs included two couples and two pairs of friends, with 4 females and 4 males. The participants ranged in age from 20 to 28. The pairs each completed two usage

Figure 3. One participant, top, performs swimming actions outside using his prop while the other participant, bottom, watches the visualization remotely.

sessions spaced about a week apart. These sessions were repeated to give participants multiple chances to experiment with the system [7] as well as to allow participants to reflect on their experiences together between sessions. Before each session, participants were told only that they could control their fish's swimming behavior using gestures and the bubbling behavior using sound and were given a chance to experiment with the system. Each session began with the first participant being taken to a public location, a busy pavement, while the second remained in a private indoor location. Once both were ready to begin, the first participant was asked to complete three performance tasks, such as creating more bubbles, while the second was asked to interpret the first participant's actions by watching the visualization on the phone, as shown in Figure 3. After theses performance tasks were complete, the first participant was then asked to interpret the other's actions while the second participant completed three performance tasks. The participants would then switch locations and the tasks were repeated. Each task lasted two minutes. This study design allowed each participant to perform actions in both the public and the private setting as well imagine how their partner would perform actions in both settings. Once both participants had been in each location, they were interviewed together about their experiences.

Results

The results of this study are based on observations, interviews with participants and their written observations and perceptions recorded during the sessions.

Creating Performances

Given that participants were allowed to create open ended performances using gesture and speech, it is not surprising there were a wide variety of styles and actions that resulted.

Performative Actions – Even though the sensors were contained solely within prop, performances were not limited to interactions with that prop and often involved additional interactions purely as an enhancement to the experience of performing. For example, some participants chose to sing to the prop, purely for the enjoyment of singing even though this was not necessary functionally. In these cases, the experience of performance was augmented with either playful or meaningful actions being performed for non-functional purposes.

Hidden/Subtle Actions – Participants found ways of performing input that was subtle or entirely hidden from passersby while still giving their fellow participant highly visible actions on the visualization. This included actions such as tapping the prop to make noise, fidgeting with the prop in hand, and using environmental noise to create input. For example, one participant chose to use the music of an outdoor performer as the input for their performance.

Functional Actions – In some cases, participants chose only to perform actions that completed the task without adding any additional performance or play. For example, participants would simply shake or wave the sensor to create gestures or say things like "I'm creating test speech for a system" or "I'm talking into the sensor now to see if something happens."

Imagining Others

Because the system forced users to create their own style of input and performance, the fellow participant watching the interface could not be sure what kinds of actions the other was performing and had to imagine how they thought their fellow participant would be be-

having. This was both a positive and a negative aspect of this system, where some users found it difficult to attach meaning to these actions and some users enjoyed the process of imagining and thought their fellow participant might be performing highly energetic, silly, or emotional behaviors. This occurred both when pairs of participants used highly visible interactions and when pairs of participants used the most subtle and discrete methods of interaction. For example, one participant imagined her partner "singing a relaxing song" and "jumping with it [turtle] on one leg." These interpretations were recorded even though both participants used extremely subtle actions for input. Imagining others also included an emotional element. Although the interface did not include input based on mood or changes in the facial expressions of the fish, participants described them as being happy, sad, or excited.

Props and Performance

During each of the two sessions, participants could choose an object of their choice as their prop. The turtle object was chosen 8 times, the dolphin was chosen 5, the book, jar, and owl were chosen once and the jelly mold was never chosen. When discussing their choices of these objects, participants described how the objects worked and failed as props.

- *Props as Toys* – The most commonly picked objects were the turtle and dolphin soft toys. These were chosen because of their playful nature and their ability to relate to the fun nature of the application. These props were often used in a playful manner, even though participants knew it did not directly affect the visualization. For example, participants would move the fins of the turtle or cover it's eyes as part of their performance even though this did not generate additional effects.
- *Props as Pairs* – Participants often chose their props based on their partner even though they knew the props would not be used together. One participant originally chose the book prop but after seeing their partner choose the turtle, she quickly switched to the dolphin.
- *Props as Everyday Objects* **–** Although some objects, such as the book, were common things to carry around, participants felt less comfortable using these object when interacting with the system. One participant stated that "I thought the book would be easier to carry around but when I had to talk into it, it was uncomfortable."

Discussion

This initial work provides some interesting insight into the ways in which users might create performances and use props to enhance their interactions and demonstrate their intentions to passersby. Because this system required only basic actions but also supported extravagant ones participants took full advantage of this flexibility and adapted their performances continually. The types of performances created were highly dependant on the location of the performance, with participants actively making decisions on this basis. Additionally, participants adjusted their performances to match their fellow participant. Because the first session ended with an interview, participants learned what kind of actions their fellow participants had imagined them doing and what actions were actually performed during the first session. This was reflected in the second session where pairs of participants seemed encouraged to perform actions that might be amusing to their fellow participant or actions they thought the other participant might be performing as well. This indicates that usage over time might result in constantly evolving practices and behaviors as the users of the system respond to

each other and learn how to interpret to system based on their knowledge of each other.

The awareness of the fellow participant watching the fish tank in provided motivation for participants to perform amusing actions but also led participants to perform extremely subtle actions and encourage their fellow participant to imagine entertaining actions. Pairs of participants had varying degrees of enjoyment imagining the performance of their fellow participant, with the two couple pairs being the most imaginative. Even when both participants performed subtle actions in the outdoor settings, both imagined amusing performances. Although users were motivated by their fellow participants, they were still aware of the passersby and in some cases modified their performance for outside use. For example, one participant used singing input while inside and conversational speech while outside. These adjustments show how considerations for both audiences must be balanced while using the system in public contexts.

Conclusions

The study presented in this paper explores appearance, audience, and performance through a mobile remote awareness application that uses multimodal input. The choice of prop used in the system had an impact on performance, not only by making the user feel more connected to their fellow participant but also by providing an element of fun to the experience overall. The places where performance can take place and the objects that might be used as props play an important role in the overall experience of using technology in public. These issues play a key role in the design of mobile interactions where reliability and accuracy are just as important as experience and appeal.

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References

[1] Goffman, Erving. The Presentation of Self in Everyday Life. Penguin Books, London (1990)

[2] Jacucci, G., et al., Bodily Explorations in Space: Social Experience of a Multimodal Art Installation, Proc. INTERACT 2009, Springer, pp. 62–75.

[3] Law, E. L., Roto, V., Hassenzahl, M., Vermeeren, A. P., and Kort, J. 2009. Understanding, scoping and defining user experience: a survey approach. In Proc. CHI 2009, ACM Press, pp 719-728.

[4] Montero, C. S., Alexander, J., Marshall, M. T., and Subramanian, S. 2010. Would you do that?: understanding social acceptance of gestural interfaces. In Proc. of Mobile HCI 2010, ACM, New York, NY, 275-278.

[5] Reeves, S., Benford, S., O'Malley, C., and Fraser, M. Designing the spectator experience. In Proc. CHI 2005, ACM Press, pp 741-750.

[6] Rico, J., and Brewster, S.A. Gesture and Voice Prototyping for Early Evaluations of Social Acceptability in Multimodal Interfaces. To appear in Proceedings of ICMI 2010 (Beijing, China). ACM Press.

[7] Rico, J. and Brewster, S.A. Usable Gestures for Mobile Interfaces: Evaluating Social Acceptability. In Proc ACM CHI 2010, ACM Press, pp 887-896.

[8] Ronkainen, S., Häkkilä, J., Kaleva, S., Colley, A., and Linjama, J. Tap input as an embedded interaction method for mobile devices. In Proc. TEI 2007, ACM Press, pp 263-270.

[9] Sheridan, J.G. and Bryan-Kinns, N. Designing for Performative Tangible Interaction. International Journal of Arts and Technology. 1(3/4), pp 288-308