
Evaluating the Social Acceptability of Multimodal Mobile Interactions

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Abstract

Multimodal mobile interfaces require users to adopt new and possibly strange behaviors in public places. It is important to design these interfaces to account for the social restrictions of public settings. However, past research in multimodal interaction has primarily focused on issues of sensing and recognition rather than the investigation of user opinions and social factors that influence the acceptance of multimodal interfaces. This research examines the factors affecting social acceptability of multimodal interactions, beginning with gesture-based interfaces. This work includes a survey and an on-the-street user study that examine how users determined which gestures were acceptable. Future work seeks to examine other modalities, in order to create guidelines for socially acceptable designs and a methodology for investigating social acceptability.

Keywords

Multimodal interfaces, mobile interfaces, social acceptability.

ACM Classification Keywords

H.5.2 [User Interfaces]: *Input Devices and Strategies*.

General Terms

Human Factors.

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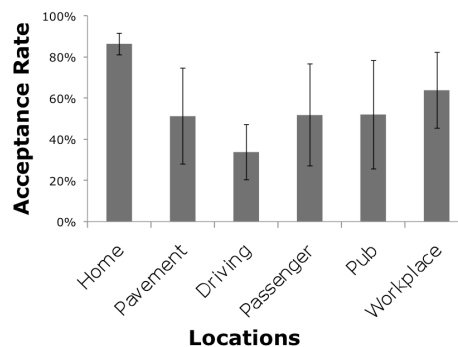


Figure 1. Average acceptance rates for all gestures grouped by location. The following gestures were included in this study:

1. Shoulder Rotation
2. Device Shaking
3. Device Whipping
4. Head Nodding
5. Nose Tapping
6. Hand Proximity
7. Device Screen Tapping
8. Pocket Tapping
9. Device Squeezing
10. Wrist Rotation
11. Balance Shifting
12. Device Shoulder Tap
13. Clapping
14. Foot Tapping
15. Finger Proximity
16. Belt Tapping
17. Device Lifting
18. Arm Squeezing

Introduction

In every social situation, we are constantly aware of how we are presenting ourselves to those around us [1]. As mobile phones become integrated with daily life, they also become a part of our appearance and a part of our presentation of self. Multimodal interfaces, that often utilize multiple streams of input and output via different modalities such as gesture or speech, provide an opportunity for new interactions on mobile phones. However, they also require users to adopt new behaviors that might be highly visible or noticeable in common mobile contexts and may cause them to feel embarrassed or shy about using them. In order to create multimodal interfaces that can be used in the real world, input methods must be designed to account for social acceptability. While an understanding of social acceptability could greatly improve the design of multimodal mobile interfaces, this has received little attention in multimodal research literature thus far. These interfaces should not be designed based solely on the abilities of technology, but also take into account user willingness to accept them. In this paper, I discuss two studies that begin to examine the social acceptability of gesture-based input in mobile settings and an outline of future plans for this research.

Why Social Acceptability?

Although social factors have been identified as an important factor in technology acceptance [2], this has been limited to minimal range of social factors. With respect to mobile interfaces, the social factors that influence acceptance are as complex as the variety of situations where mobile devices might be used. Designing for social acceptability is especially important for multimodal interfaces because the modalities used often require users to adopt new behaviors that might

be strange or embarrassing in public places. However, social acceptability is not simply a matter of embarrassment or discreetness, but a culmination of a variety of factors including setting, audience, appearance, and culture. Individuals make decisions about socially acceptable actions by gathering information about their current surroundings and combining that with their existing knowledge. Actions are then carried out and feedback is gathered from the reactions of any observers [1]. These actions should therefore be described as a *performance* [1], where individuals intentionally make some action with the awareness of how others might perceive it. Therefore, the process of making decisions about social acceptability is circular, with performances being made and feedback gathered fluidly. With respect to multimodal interfaces, there has been limited research on the social acceptability of these performative interactions. One of the few studies on this topic, by Ronkainen *et al* [5], asked respondents to assess whether a gesture was useful, fun, silly looking, or not useful, in order to eliminate unacceptable gestures for a future study based on user opinions. This study used video scenarios that required users to evaluate locations and tasks in addition to gestures.

Previous Work: Gestures in Mobile Settings

As a first step towards understanding the social acceptability of multimodal mobile interactions, I examined gesture-based interfaces. This input method requires users to adopt new behaviors that can be highly visible, which may become embarrassing or disruptive in different usage contexts. Additionally, gesture interface research has often been significantly influenced by the limitations of technology [6]. These issues make gestures an interesting starting point when investigating the social factors of multimodal interface acceptance. I



Figure 2. Screenshot from the finger proximity video in the gesture survey.

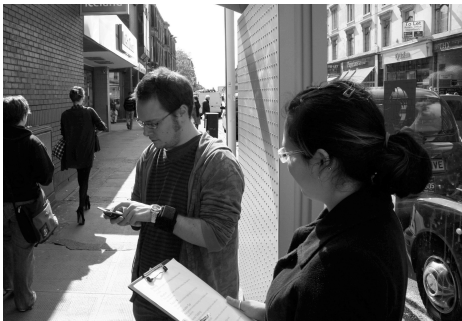


Figure 3. Experimenter (right) and participant (left) at the outdoor location of the on the street study.

completed two studies; a survey using video prototypes and an on-the-street user study that examined the social acceptability of gesture usage based on the locations where gestures might be used and the audiences they might be used in front of. For this initial study, I chose to examine location and audience based on the work of Goffman [1], although there are other factors, such as culture or personality which, could also be investigated. This work describes location and audience as key social factors that help individuals determine appropriate behavior in public places. I used these social factors when developing a social acceptability survey that utilized video prototypes of 18 gestures. These prototypes, with an example shown in Figure 2, allowed me to quickly investigate these gestures without the need to develop gesture recognition code. After watching each gesture video, participants were asked to select from a list the locations where they would use the given gesture and the audiences they would use it in front of. The results, including the responses of 55 survey respondents from 15 countries, showed that both location, shown in Figure 1, and audience played a significant role in determining which gestures were acceptable, with significant differences in acceptance rates between gestures. The results showed the importance of social acceptability, demonstrating that some gestures were significantly more accepted than others.

In order to verify the survey and further analyze those results, I completed an on the street user study in which participants were asked to perform gestures in both a private indoor setting and a public outdoor setting, as shown in Figure 3, over multiple trials. After performing a set of 8 gestures in each setting, participants were interviewed about their experiences, comparing the settings, sessions, and gestures. This study

involved 11 participants completing 3 sessions, each 1 hour long and spaced about a week apart. The results of this survey verified that location plays a significant role in determining comfort levels and gesture acceptability, with 8 out of 11 participants describing the outdoor setting as less comfortable than the indoor one. I also found that user acceptance rates changed over time, with 8 of 11 participants describing subsequent sessions as more comfortable, citing specific positive memories from previous session. These changes occurred mainly during the second session, indicating that even just one positive experience was enough to increase comfort and social acceptability. I also developed some preliminary design guidelines based on the results of this study. Gestures that imitated everyday movements were more acceptable than those that did not. This included gestures such as shaking the phone, which was similar to shaking a bottle of juice, and foot tapping, which was similar to unconscious fidgeting.

The Next Step for Social Acceptability

Although my previous work has been limited to gesture-based interfaces, there are other multimodal interaction techniques that might also benefit from social acceptability evaluations. For example, speech-based input is a technology that shows potential but has not seen widespread use. Like gesture-based interfaces, speech input requires users to adopt behaviors that might be embarrassing in mobile contexts. Social acceptability evaluations of different types of audio input and output, using both speech and non-speech sounds, would not only provide some guidelines for acceptable audio input but also demonstrate successful evaluation methods. Additionally, I would like to evaluate more factors of social acceptability, such as culture, personality, and position on the innovation adoption curve [4].

In my future evaluations of multimodal input techniques, I will experiment with developing a variety of prototypes and research methods, comparing different evaluation methods. For example, video, paper, and Wizard of Oz prototypes will be compared as possible tools for designing and evaluating socially acceptable inputs. These will be compared using different methods such as focus groups or user studies. Results of such studies would provide new guidelines for the design of input with respect to social acceptability. The results of these studies would also include a comparison of different prototypes with respect to the level of detail provided by users, time and effort required to complete, and cost to the experimenter. As a verification to these studies, I would also complete longitudinal studies using ethnographic methods to compare the results gained using prototypes to those gained from real world continued experiences. Other important issues that we have not yet investigated include task pairing and user personality differences [3]. With respect to task pairing, I would like to examine the effect that motivations have on gesture acceptability. For example, if you could quickly silence your phone with a gesture or voice command, would you be more willing to do a more obtrusive movement if it ensured the phone would silence immediately? A better understanding of how personality differences affect social acceptability could also influence the design of multimodal interfaces with respect to the range of modalities utilized and the personalization needs of users.

Long Term Vision

This thesis work seeks to contribute validated evaluation methods for determining the social acceptability of multimodal interaction techniques and define a set of socially acceptable interactions that can be used in a

variety of applications. Additionally, this research will develop a set of heuristics which can be used to describe the social acceptability of multimodal techniques and improve design overall. This will provide designers with a methodology for multimodal interface design based on the social factors as identified by users, guiding future research in sensing, recognition, and multimodal interface design.

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