Initial Model of Social Acceptability for Human Augmentation Technologies

Eghtebas, Chloe; Pay, Yun Suen; Väänänen, Kaisa; Pfeiffer, Ties; Meyer, Joachim; Lukosch, Stephan

Publication date
2017

Document Version
Final published version

Published in
Proceedings of the CHI 2017 Workshop on Amplication and Augmentation of Human Perception

Citation (APA)
Eghtebas, C., Pay, Y. S., Väänänen, K., Pfeiffer, T., Meyer, J., & Lukosch, S. (2017). Initial Model of Social Acceptability for Human Augmentation Technologies. In *Proceedings of the CHI 2017 Workshop on Amplication and Augmentation of Human Perception*

Initial Model of Social Acceptability for Human Augmentation Technologies

Chloe Eghtebas
Stuttgart University
70174 Stuttgart, Germany
chloe.eghtebas@vis.uni-stuttgart.de

Yun Suen Pai
Keio University
Minato-ku, Tokyo-to
108-8345, Japan
yspai1412@gmail.com

Kaisa Väänänen
Tampere University of Technology
Korkeakoulunkatu 6,
33101 Tampere, Finland
kaisa.vaananen@tut.fi

Thies Pfeiffer
University of Bielefeld
Universitätsstrasse 25,
33615 Bielefeld, Germany
Tpfeiffe@techfak.uni-bielefeld.de

Joachim Meyer
Tel-Aviv University
Ramat Aviv,
Tel Aviv 69978, Israel
jmeyer@tau.ac.il

Stephan Lukosch
Delft University of Technology
Jaffalaan 5,
2628 BX Delft, Netherlands
s.g.lukosch@tudelft.nl

Proceedings of the CHI 2017 Workshop on Amplification and Augmentation of Human Perception, May 07, 2017, Denver, CO, USA.

Abstract
Academia and industry engage in major efforts to develop technologies for augmenting human senses and activities. Many of these technologies, such as augmented reality (AR) and virtual reality (VR) head mounted displays (HMD), haptic augmentation systems, and exoskeletons can be applied in numerous usage contexts and scenarios. We argue that these technologies may strongly affect the perceptions of and interactions with other people in the social contexts where they are used. The altered interactions may lead to rejection of the augmentations. In this position paper we present a set of potential usage scenarios and an initial model of acceptance of augmentation technologies by users and other people involved in the social context.

Author Keywords
Augmentation technologies, social acceptability, model.

Introduction
Human augmentation technologies are intended to enhance our perception, capabilities and experiences [6]. Many of these technologies are wearable and have computational abilities, including AR and VR HMDs, haptic feedback systems [3], and exoskeletons [6]. These devices provide augmentation of human capabilities to achieve superhuman performance.

As the HCI and engineering community develop such novel augmentation solutions, we need to ask, what does it mean to be augmented in a social context? Even though medical augmentations such as prostheses and pacemakers are widely used, many of the augmentation technologies are not yet commonplace in people's everyday lives. Thus, they may cause confusion and even rejection by the people who encounter them in situations in which augmented users interact with others directly, or others just observe the use of the systems [7].

Situated technology has social consequences. Human beings are hardwired to respond to cues in the environment, and computers in our environment can invoke those responses [1]. In social contexts, technology can cause mismatches of expectations. We argue that this may be an especially sensitive topic when the technology is wearable and thus attached to the human body. Other users may not know what to expect from the (apparent) superhumans. Perceptions will depend on the observers' prior knowledge and on the design of the system.

We propose an initial model for assessing and predicting the social acceptability of human augmentation technologies. The model considers the *perceived harms/costs and benefits* of the technologies to the user and to others. We first present four usage scenarios, then describe the model, and show how the scenarios fit into the model. We emphasize the subjective, perceptual basis of acceptance and discuss issues related to the transparency of the augmented users' capabilities and intentions for determining the acceptance of the system.

Social Scenarios Using Augmentation Technology

The following sample scenarios illustrate how human augmentation may affect social situations in peoples everyday and professional lives.

Sports: Augmentation in sports are prominent, especially since sports revolve around the physical performance of humans. The line dividing what is allowed and what is often not clearly defined. For instance, sports gear that enhances performance, such as a particular pair of running shoes or bicycle wheels with better traction, are not banned. However, there is a debate on whether players who require and are augmented with artificial limbs should compete against those with real limbs, due to the possible boost in performance. Many forms of augmentation improve the players performance; the question is if these enhancements are socially acceptable, as they may demolish the concept of an equal play for all players. In a sports scenario, a clear benefit to the user could come at the cost of other's perception of fairness but to the benefit of inclusivity.

Safety and security: There are several examples for human augmentation relying on head-mounted devices with integrated cameras for augmented reality in the safety and security domain. Police agents on patrol could receive real-time information on crimes and criminals in the patrol area [5]. During crime scene investigation, remote experts could provide instructions for collecting evidence [4]. Teams in the safety and security domain could annotate crime scenes or general locations in the public with virtual objects to share information and increase situational awareness [2]. Although the above examples are intended to benefit the safety and security of the general public, there are obvious concerns on how the

information is used by the institutions for safety and security. What would happen when based on wrong information a wrong person would be pursued as criminal and held in custody?

Business: Smartglasses can provide up-to-date business intelligence information, which can provide major advantages during negotiations. At the same time, the facial reactions of the wearer will be influenced by the wearable technology. The wearers gaze may be partially occluded for the interlocutors and eye movements will be affected by the perception process. This will make assessment of the mimics more difficult and may have negative effect on trust-building. Will the use of such tools be accepted during business meetings?

Education: Students may use augmented vision devices in class, possibly enriching the course material by viewing explanations and examples they would not otherwise see. However, when using such devices, it is unclear whether the student is actually engaged in class, or does something else. It may be possible to design devices or interactions so that observers (such as teachers) could know whether the student is indeed involved in the class. However, such a system may cause social discomfort or may violate the students' privacy.

Initial Model of Social Acceptability of Augmented Technologies

We propose an initial model of social acceptability of augmentation technologies, such as AR and VR devices (see Figure 1). The model analyzes acceptability as a function of the perceived harms (costs) and benefits of the augmentation technology. The model takes into account both the person who actually uses the device and the others with whom the user interacts or who are otherwise present in the social context.

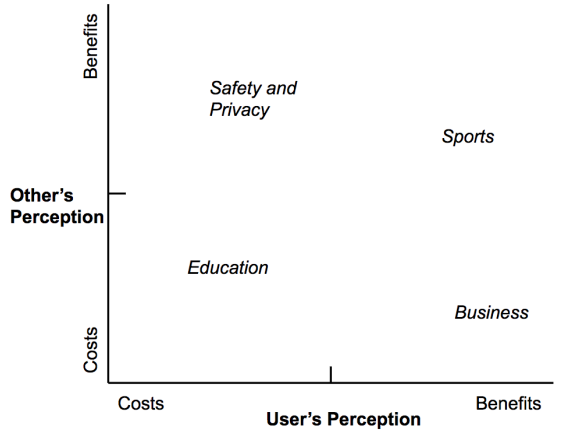

Figure 1: Initial model of social acceptability: Perceived costs and benefits of the user vs. those of others in the social context.

We assume that the device either has negative consequences (costs or harms), has no consequences, or it may have positive consequences (benefits) for both the user and others. Figure 1 depicts a space in which the X axis is the perceived value of the consequences for the user and the Y axis is the perceived value for the others in the social context. The four scenarios are placed in the model. This consequence space is subjective, and it may differ between different people, depending on their attitudes, previous experiences with similar technologies, and on how the device design and the person wearing it communicate its purpose and functionality to other people. In particular, users may see the consequences for themselves differently from the ways others see them.

The values for different parties in the interaction may seem correlated, or not. If the interests of the user and the others are aligned, social acceptability will likely be high. If, in contrast, there is a possible conflict of interest (e.g., parties engaged in negotiating a business contract, or competing participants in a competitive sport), a system that provides benefits to one party without providing apparent benefits to others is likely to be unacceptable.

A major concern in the context of social acceptability of an augmentation system is its *visibility to others*. If others are unaware of the existence of a system, its use may be accepted as long as others do not know that a person uses it. The moment the use becomes known, the question arises whether the system provides a differential, possibly "unfair", benefit to the user, who gained this benefit without making others aware of the device she or he is using. This may raise concerns of dishonesty, or at least confusion, even if the actual benefits from using the system might be limited. Even when the system is clearly visible and its use disclosed, the user's intentions and the capabilities the system provides may still be unknown to observers. This may cause negative responses to using the system, especially if there is the possibility for suspicion.

Conclusion and Future Work

New human augmentation technologies can possibly help people in a wide range of contexts. However, their adoption will depend on their social acceptability. To be accepted, they must provide clear benefits to people, and must not create unacceptable harms, costs or inequalities in abilities and opportunities. The design of these system and the way they will be integrated into daily activities will determine whether they elicit the positive perceptions, needed for their acceptance.

We touched here on some of the issues that will determine acceptance. The development of acceptable technologies will require much research from technological, design and behavioral perspectives, considering individual and cultural differences between users. With such research, it will be possible to create systems that will have positive effects on users in numerous social contexts.

Acknowledgement

We thank Schloss Dagstuhl for providing an excellent atmosphere for discussions and preparing this paper.

References

[1] Fogg, B. *Chapter 5 Computers as Persuasive Social Actors*. Magazine Ubiquity, 2002.

[2] Lukosch, S., Lukosch, H., Datcu, D., and Cidota, M. Providing information on the spot: Using augmented reality for situational awareness in the security domain. *Computer Supported Cooperative Work (CSCW) – The Journal of Collaborative Computing and Work Practices 24*, 6 (2015), 613–664.

[3] Pfeiffer, M., Dünte, T., Schneegass, S., Alt, F., and Rohs, M. Cruise control for pedestrians: Controlling walking direction using electrical muscle stimulation. *CHI* (2015).

[4] Poelman, R., Akman, O., Lukosch, S., and Jonker, P. As if being there: Mediated reality for crime scene investigation. In *CSCW '12: Proceedings of the 2012 ACM conference on Computer Supported Cooperative Work*, ACM Press (New York, NY, USA, 2012), 1267–1276.

[5] Streefkerk, J. W., van Esch-Bussemakers, M. P., and Neerincx, M. A. Field evaluation of a mobile location-based notification system for police officers. In *Proceedings of the 10th International Conference on Human Computer Interaction with Mobile Devices*

and Services (MobileHCI '08), ACM Press (New York, NY, USA, 2008), 101–108.

[6] Tony Fernandes, U. I. Human augmentation - beyond wearables. http://interactions.acm.org/archive/view/september-october-2016/human-augmentation.

[7] Vahabpour, F., Rantakari, J., Colley, A., and Häkkilä, J. Exploring everyday use cases for smart glasses. *NordiCHI* (2014).