
Workshop on Amplification and Augmentation of Human Perception

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Figure 1: Examples of amplifying human perception by showing multiple views (left) [2], actuated navigation (center) and artificial vision (right).

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Abstract

Technical capabilities increase steadily while human evolution is slow. Technical sensors improve while human senses remain largely the same. Many tasks are becoming much easier when our perception is augmented with additional information. In this workshop, we want to bring researchers together that are working on the augmentation and amplification of human perception. For many augmented reality (AR) use cases the fundamental design concept is to improve human perceptual abilities. This area, becoming more and more central to human-computer-, human-data, and human-environment interaction is so far not well researched and we lack conceptual foundations, theoretical models, and best practice examples. This workshop will be a forum to jointly catalog the state of the art and to discuss future directions for amplifying and augmenting human perception in a human centered way.

Author Keywords

Amplifying Perception; Augmenting Perception; Augmented Human; Augmented Reality Interaction.

ACM Classification Keywords

H.5.m [Information interfaces and presentation (e.g., HCI)]: Miscellaneous

Introduction

Amplification of human perception, physiology, and cognition aims at using technical systems to enhance existing human abilities or to create new capabilities. Technical sensors, such as cameras and microphones, are in temporal and spatial resolution superior to the human senses of vision and hearing. Artificial intelligence is outperforming humans in games such as chess and go. These facts are often used to paint a dark vision of the future in which machines take over the world. In this workshop, we want to bring people together who look at opportunities of using technologies to amplify and augment human perception to keep up with technical advances. In this the interaction between humans and technology and their interplay are the core scientific challenges. The CHI community has demonstrated the feasibility of amplifying human perception by extending the human vision (e.g., sensory substitution [7] or change the perspective [2]) and by adding novel sensors and learn them as new senses (e.g., color vision [1] and spidersense [4]). Amplification can be extended beyond perception to cognition and physiology. Adding additional control to muscle movement (e.g., in the Hand [6, 3] or while walking [5]) allows to create new motor abilities. This growing research area poses many fundamental questions in human-technology collaboration and sets tough technical, ethical, and societal challenges.

Amplifying Perception: Fundamental Challenges

In order to create systems that amplify human capabilities we face fundamental challenges in different areas.

Data transfer from Sensor to Human. When adding new sensors and when acquiring new information through technical systems the big questions is: how to provide this information to the user without overloading. Given a microphone that extends the hearing into higher ultrasonic fre-

quencies the question is how to present this to the user in a pleasant way without reducing the ability to hear the original frequencies and without information overload?

Mixing Conventional Senses with new Sensor Information.

With more information available we have to find ways to combine our naturally perceived stimuli with new information from technical sensors. Here a central question is, how this can be done in a way that humans can easily learn mappings and acquire information subconsciously.

Intuitive Control for Amplified and Augmented Senses.

Once we have created an amplified sense it becomes a challenge to intuitively control them. We can easily control our natural visual perception, for example, by head and eye movement. If we add further camera perspectives and if we extend the visual spectrum we have to find mechanisms to control these additional features implicitly.

Understanding the Implications for Human Self-Awareness.

If we change the input channel in human perception we can expect that this changes how we perceive ourselves. It is a central question how altering the way we perceive our everyday world will impact us and how we can design for this to be a positive change. This includes ethical questions in many different areas.

Many augmented reality systems are a first step towards amplifying and augmenting human perception. These fundamental challenges need to be addressed in these AR-Systems already, but become much harder as the amount of information available increases and augmentation becomes ubiquitous. These fundamental challenges are becoming more important across many areas in human computer interaction.

Key Questions for the Workshop

Given these developments and the new challenges it is surprising that there is so far little practical, theoretical, and conceptual work beyond examples and cases studies. As AR is becoming ubiquitous and as we move more and more towards amplifying our sense we still have a very limited understanding of how to create a seamless and intuitive user experience for interacting with such systems. At the workshop will discuss the following questions:

- **Understanding what is out there.** In a first step, we aim at gaining an overview of the types of existing systems and forms of interactivity that have been created over the last years and to discuss systems currently under development. Our approach to this is to analyse and discuss a broad set of case studies participants are willing to share at the workshop.
- **Understanding the Impact on Users.** To make such systems usable and useful it is important to understand what kinds of experiences are created. How additional information impacts perception, and how it effects the experienced cognitive load. The impact may be intended by the system designer or unintentionally happening.
- **Charting the Design Space.** This design space should describe all known factors that impact the user experience of amplification of human perception. Such a design space could become a conceptual foundation and a tool for reflecting on the design of such systems.
- **Research Agenda.** Based on insights from the current systems and experiments as well as factors identified in the design space we would create a research agenda. In particular, it is assessed which are the

central open issues and how to further study and design user experiences for augmenting and amplifying human perception.

Topics of Interest

We focus on different topics within the context of this workshop. These topics range from application scenarios, to implementations of novel interaction concepts or novel sensing and actuating means. We also highly welcome reflections and discussions. In particular, we focus on but are not limited to:

- Amplifying Human Senses
- Creating Novel Senses
- Actuating Humans through EMS
- Brain-Computer Interfaces and Eye-wear Computers for Implicit Input
- Super Human Sport
- Augmented Reality for increasing Human Perception
- Creating Seamless Interactions with Novel Senses
- Alternative or Novel Feedback Techniques
- Interacting with Augmented Reality
- Models, Theories, and Concepts of Digitally Augmented Human Perception
- Ethical Implications of Amplified Senses

Date	Action
1st December	Release of the Webpage
9th December	Release of the Call for Papers & selection of program committee
15th December	Early Submission Deadline
21st December	Early Notification of Acceptance
20th January	Submission Deadline
10th February	Notification of Acceptance

Table 1: Important workshop dates.

Workshop Structure

Dates

The most important dates are summarized in Table 1. Prior to the workshop, the call for participation will be distributed through various channels such as mailing lists, social media, and personal contacts. We will also distribute advertisement material to different research institutions and conferences. Concurrently, we will recruit a set of experts in the field serving as program committee. Approximately 20 submissions will be accepted based on the quality and novelty of the submitted position paper. We will particularly allow participants to submit positions paper in 2016 to leverage 2016 budget. We will shortly after the early submission deadline accept strong submissions.

Prior to the Workshop

The following steps are planned prior to the workshop.

Participants. We will recruit participants through related mailing lists as well as through personal contacts with experts working in the field of amplifying human perception. We strive for a workshop size of 20 participants.

Submissions. Workshop participants are requested to hand in a position paper of up to 4 pages in the ACM SIGCHI

Extended Abstract format. The position paper could contribute the authors opinion on the workshop theme but also provide specific ideas for a prototype allowing the amplification of humans perception. The submission of the position paper will be handled through a conference management system.

Webpage & Social Media. We will create a webpage (hosted on our institutional servers) and social media accounts (e.g., facebook group) to foster the communication between participants before and after the workshop. The webpage will contain general information on the workshop such as the important dates but also provide hints to literature on the topic of amplifying human perception. In particular, we will focus on literature published outside the CHI community (e.g., background on human senses in psychology). This will support the participant in gaining a foundation of the background of the overall workshop theme.

Detailed Plan of the Workshop

After a brief opening and introductory round, the workshop will be start with a keynote speaker to motivate the overall topic of the workshop. Afterwards, the submitted position papers will be presented in brief presentation slots of 5 minutes with additional time for questions. Next, we will conduct group work activities to generate concepts of amplified human senses. This will be done in small groups of 3-4 participants. Material to visualize the ideas will be provided (e.g., cardboard, clay, mock-ups of wearable devices, etc.). The ideas generated in the workshop will be presented afterwards. Finally, we will wrap-up the workshop and discuss future research directions. Furthermore, we will highlight the possibility of submitting to the planned special issue on amplifying human perception and encourage the participants to work together on the ideas and concepts created during the workshop.

Time	Activity
9:00-9:10	Opening & Introduction
9:10-10:00	Keynote on Augmented Perception
10:00-12:30	Presentation of the Workshop Submissions (incl. coffee break)
12:30-14:00	Lunch
14:00-17:00	Generating concepts of novel and amplified human senses in groups (incl. coffee break)
17:00-18:00	Presentation of the generated concepts
18:00-18:30	Wrap-up and discussion on future research directions

Table 2: Detailed plan of the workshop.

After the Workshop

We plan to create a special issue on the workshop theme to provide participants a platform to publish their work. We will encourage the participants of the workshop to realize the ideas and concepts generated during the workshop and submit them to the special issue.

Organizers

Albrecht Schmidt is a professor of human-computer interaction at the University of Stuttgart. His primary research interest is at the crossroads of human-computer interaction and human perception. Albrecht received his PhD in computer science from Lancaster University in the UK.

Stefan Schneegass is a research associate within the Human-Computer Interaction group at University of Stuttgart. His current research interest centers on ubiquitous computing and human-computer interaction (HCI) particularly wearable computing.

Kai Kunze works as an associate project professor at Keio Media Design, Keio University. Beforehand, he held an assistant professorship at Osaka Prefecture University. His major research contributions are in pervasive computing, especially in sensing, physical and cognitive activity recognition. Recently, he focuses on tracking and improving knowledge acquisition activities. He is also a JST Presto grant recipient working on Eyewear Computing.

Jun Rekimoto is a professor at the University of Tokyo and director of the Interaction Lab, Sony Computer Science Laboratories. He was appointed to the SIGCHI Academy in 2007. Rekimoto's research interests include human-computer interaction, computer augmented environments and computer augmented human (human-computer integration).

Woontack Woo is a Professor in the Graduate School of Culture Technology (GSCT) at Korea Advanced Institute of Science and Technology (KAIST), Daejeon, Korea. The main thrust of his research has been implementing ubiquitous virtual reality in smart space, which includes Context-aware Augmented Reality, 3D Vision, HCI, and Culture Technology.

Conclusion

Amplifying the perception of humans with technology has the potential to highly impact our everyday life. One of the core challenges will be to identify ways to seamlessly interact with these technology so that the novel sensors have the potential to become senses. In this workshop, we explore the foundations of how technology can in the future be used for amplifying and augmenting humans and in particular the perception.

Acknowledgments



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