Social acceptance from the perspective of HMD users in small social settings – Observations from the field

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ABSTRACT

HMDs for mixed reality are receiving more and more attention in research and practice, as hardware is advancing and becoming affordable for the public. With this process, questions arise on the acceptance of such HMDs in practice, especially when it comes to wearing them in social settings. Existing work shows social acceptance of HMDs is an important factor. While this has been explored for larger (public) groups and VR HMDs, little work is available on the use of AR HMDs in smaller social settings. In this paper, we look at HMD wearers' perceptions of social acceptance and provide suggestions how to deal with these.

KEYWORDS

INTRODUCTION

Head mounted displays (HMDs) provide its users with a mixed reality containing additional virtual information [6]. As powerful and inexpensive HMDs have become commercially available, companies start using them e.g. in production settings or for training. Besides questions on the utility for the task HMDs are used for, this raises questions on the acceptance of HMDs by potential users. A lot of research in this area focuses on the perceptions of comfort (in terms of weight and other ergonomic aspects [3, 7, 8]). Other work focuses on the attention HMDs draw to its user but by being quite new, due to their shape and due to how people need to interact with them, wearing an HMD also draws attention, which was described as uncomfortable in public [12].

The factor of social acceptance plays an important role for wearables being adopted in public and social settings [1, 5]. This has been researched recently for virtual reality (VR) HMDs [2, 9, 15]. Regarding social acceptance of AR HMDs, research mostly focuses on the acceptance of HMDs from the perspective of bystanders, but not wearers of HMDs. Profita et al. [10] observed that their participants were more likely to express negative opinions about the use of an HMD when it was considered unnecessary for the user [10]. Similarly, Koelle et al. [4] concluded in a study that knowing what an HMD is used for made a difference for others observing the HMD wearer. Not being able to infer what a technology is used for in a situation made them feel uneasy [4].

There is little work available on the perspective of users wearing an HMD and their perceptions and assumptions of acceptance of bystanders in social settings. In particular, little is known about this in what we may call small social settings, with a limited amount of people. These situations differ fundamentally from large groups or even public settings, as people are more likely to communicate with each other and feel as a social group (cf. [14]). This is an important gap in existing research for two reasons. First, there are many situations in which HMDs are used in small social settings. Second, for technology acceptance it has been shown that this perception can determine whether a user feels comfortable and uses certain devices in daily activities [1, 11]. The work presented here looks at the perceptions and users of HMDs in augmented reality (AR) settings, investigating potential barriers for acceptance and potential ways to overcome them.

Our work is grounded in observations we made, in which two or more people used HMDs in small social settings. On two occasions during our work we encountered people reporting to us that they feel awkward wearing and using an HMD in smaller social settings in front of others. Contrary, in two other situations we did not encounter this phenomenon. By describing and contrasting these observations in this paper, we aim to contribute to the understanding of individual perceptions of wearing an HMD is small social settings. We suggest that transparency and equality may be decisive factors towards the acceptance of HMDs in this regard.

HMD WEARERS' INDIVIDUAL PERCEPTIONS OF DISCOMFORT: OBSERVATIONS FROM TWO STUDIES

In a project aiming at the support of caregivers working with patients, we conducted field tests with selected features of the so called "Care Lenses" (see Figure 1). During these tests, some of the participants mentioned that they felt uncomfortable interacting with their patient. They named

Figure 1: A caregiver using the Care Lenses to support pain management of a patient during a field test

Figure 2: A group of participants works together to solve a cooperative puzzle experiment.
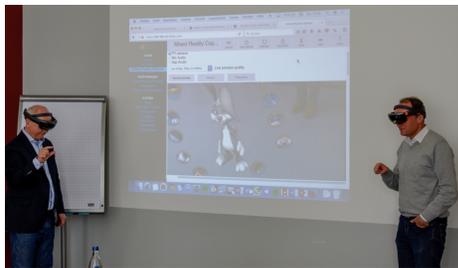
Figure 3: Workshop participants experiencing AR for the first time wearing a Microsoft HoloLens.

two reasons for this, including (a) their perception of how they might appear with the Care Lenses on and (b) their assumptions on how patients might react towards them with Care Lenses on. Five participants mentioned that they felt strange or even ridiculous engaging with a patient while wearing an HMD ("*but the patient will laugh at me...*"). Others were afraid that their patients would not take them seriously anymore if they were focusing on using the Care Lenses instead of looking at them. Some care givers also assumed that their appearance or professionalism would suffer by using it ("*I am not sure how I will be appearing*"). As a result, they were afraid that the care quality could suffer from wearing the HMD.

Similar statements were made in an interview study we conducted on the use of mixed reality (MR) in trainings. Two interview participants explicitly mentioned situations in which some designated users did not want to use the HMD for the situation in which it was supposed to be used. According to our interview partners, users felt uncomfortable and feared to be embarrassed by wearing and interacting with HMDs. The first interview partner stated that users thought an HMD would look silly and strange, and thus they weren't willing to use them. The other interview partner described a situation in which a potential user was surrounded by a group of observers with one of them being highly amused by what she witnessed. In both cases, the interview partners stated that these feelings were not induced by the usage of the HMD, but rather by worrying about the perspective of what others may think about them. As a result of that, the users tried to avoid a situation where they would be vulnerable to embarrassment in front of a group.

POTENTIAL MEANS TO OVERCOME INDIVIDUAL FEELINGS OF DISCOMFORT: OBSERVATIONS FROM TWO MORE STUDIES

In a series of studies on the cooperative use of HMDs, we conducted an experiment on groups solving a puzzle task in AR together (see Figure 2). We provided the participants with an introduction and tutorial and asked them to try the system in a hands-on session themselves. The experiment provided them with a MR setting in which all participants could see all virtual objects as well as what others were looking at and interacting with. Out of these groups, no one explicitly mentioned during or after the experiment that there was a feeling of discomfort or unease created by others while wearing the HMD and interacting with the group or the researchers.

As part of a consulting project, we conducted several innovation workshops with trainers and middle managers to assess the potential of HMDs and AR for their respective areas of work. In a hands-on session they could try demo applications on the Microsoft HoloLens (see Figure 3). Early on, we noticed that those waiting were unable to see what the HMD wearers did and reacted similar to findings reported above and in literature, potentially causing unease for users. Although this was never mentioned explicitly, some were asking whether others could see what they were seeing. To ensure transparency for all users, we started to stream the view of the HMD onto a large projector for others to observe what an HMD wearer sees and does. While our main intention of this was to spare people getting bored waiting for their turn, we also had the impression that people were at ease using the system. The participants didn't express any uncomfortable feelings although for the most parts a large group was watching them interacting with the virtual world.

DISCUSSION

Our observations point to an aspect not covered well in the literature: wearers' perceptions of social acceptability of AR HMDs. In both cases, users did not express concerns about shape and weight of HMDs or their usability and utility, but on the impressions, others may have of them interacting with it. This is a new aspect in research, which has up to now looked at the attention HMDs draw on their wearer in large public settings (e.g., [12]) or on VR HMDs in social settings (e.g., [13]), and it draws attention to the problem of accepting AR HMDs in smaller social settings.

There are different reasons we could attribute our observations to. This may involve a feeling of being observed while wearing a somehow strange device (similar to what [11] found) and a sense of distraction from social interaction (related to what [13] describe for VR HMDs in small social settings). Another reason may be the problem of the wearer not being able to easily share what they see with others, which is also known from VR HMDs [2] and may create a sense of exclusion towards others (and a corresponding perception of the wearer). When contrasting these observations with the two settings in which we did not find traces for unease or discomfort of HMD wearers, the aspect of knowing what the wearer sees (e.g. [2, 4]) and having access to the same virtual information by being in a shared setting may also be a reason. In these situations, the content of the AR HMD was either streamed to bystanders or there were no bystanders, as all group members wore an HMD and could see what the respective others were seeing and doing.

Based on these observations, we suggest that *transparency* and *equality* between the wearer of an HMD and other persons can be means to overcome feelings of unease or discomfort in wearing an HMD. By transparency, we refer to making the MR setting available to people not accessing it directly via HMDs or other devices. In the situation described above this was done by projecting the MR field of view of users onto a large screen. By equality, we refer to a situation, in which all people in a small social group have access to the same mixed reality session, be it on the same device (as in the situation described above) or on different devices (e.g., accessing MR on a handheld device). This creates a situation in which the wearer or the HMD knows that the others can see what they see and may diminish assumptions leading to discomfort.

CONCLUSIONS AND DISCUSSION THEMES FOR THE WORKSHOP

In different studies and consultations, we observed that some users wearing an HMD do not feel at ease wearing an HMD in front of others during professional tasks, while in others we did not observe this issue. We argue that transparency and having equal access to information might be a factor to lessen this phenomenon. Since the social aspect of a technology is an important factor of the general acceptance of new wearable technology [1, 5], these suggestions can provide fruitful paths for further research. We are aware of the fact that we provide initial insights from only a few empirical observations. Therefore, further work is needed to investigate these factors. However, we are convinced that our insights could be used to push forward the use of HMD more and more.

In the workshop, we would like to discuss our findings with interested colleagues. Other topics of interest could be differences in the acceptance of HMDs in small and large social groups as well as differences regarding acceptance of AR vs. VR HMDs.

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