Toward Discreet Interactions and Publicly Explicit Activities

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ABSTRACT

In this position paper, we present two different approaches to help social acceptance of head-mounted display in social and shared spaces: (1) discreet interactions and (2) a public spectator view. On a daily basis we evolve in shared and social spaces which may have different levels of acceptance for the use of head-mounted display (HMD), either from the users or the surroundings people. In contexts where the HMD is usually accepted by the non-HMD users (e.g. public transport) but still struggle to be adopted, we will approach the potential benefits of discreet interactions. Finally, we suggest and raise questions about the public spectator view approach to address contexts where the use of HMD is perceived by the surroundings as inappropriate.

KEYWORDS

Mixed Reality; Smartwatch; Head Gestures; Gaze Gestures; Spectator; Mobile; Social Context

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INTRODUCTION

In this position paper, we focus on the use of mixed reality (MR) head-mounted display (HMD) but some problems concern as mush virtual reality (VR) HMD. We try to tackle the social acceptance of HMD in public spaces by suggesting two potential solutions. First, derived from our current work, we suggest the necessity to provide discreet HMD interactions for a wide range of tasks. The second solution is based on an informal survey where we asked 7 persons the only question: "If so, why do you think HMD are not accepted in social and shared spaces?". Among different reasons, 5 disliked facing the unknown of the HMD user's actions and activity. Thus, we suggest a public spectator view for every HMD allowing the surroundings to be explicitly aware of the HMD user's activities and more.

DISCREET INTERACTION

The authors are currently working on interactions in an industrial context where the use of specific dedicated controllers, and "mid-air gestures" or "voice control" interactions commonly implemented by MR HMD are inappropriate or problematic to use for various reasons (e.g. in physically/spatially constrained and noisy environments). This problematic concerns as much the contexts of use in social and shared spaces [28]. For instance, in public transports [24] it would be difficult or little agreed to make big gestures and voice command aloud in a fully packed wagon or bus. We think that interactive indiscretion slows the acceptance of HMD in social context from the people surrounding unwilling to be "disturbed", therefore from the HMD users too, unwilling to be "disturbing". Many interactions fulfilling the discretion characteristics have been explored, among those currently (or in the near-future) feasible and promising for social and shared spaces, we found: head gestures, gaze gestures and the coupling smartwatch-HMD or even a combination of all.

Head Gestures

Several researches explored head gestures for HMD [3, 8, 23]. They are computationally feasible and mostly based on motion-sensors. GlassGesture [27] demonstrated head gestures to perform specific commands from defined shapes, simplistic gestures, letters and numbers. HeadGesture, [26] provided an implementation of 9 gestures for HMD, selected from participatory design and experimented on 4 tasks including zooming in/out, dragging and scrolling. However some of their gestures still require a large movement range, thus disqualifying the discretion. Head gestures for HMD could also borrow some results from several researches that already exploited this interaction in different settings such as controlling desktop [17, 18] or mobile devices [4].

Gaze Gestures

Due to their natural movement correlation [2], gaze gestures have been explored as multimodal interaction combined with head gestures, helping calibration and improving accuracy [21, 22].

Gaze and Head gestures were also combined to provide new interactions [7, 8, 12] such as selection by staring content followed by head gestures to perform an action. However, as much for the head gestures as for the gaze gestures, theses interactions are naturally used by humans to communicate [9], therefore the defined gestures need to avoid inappropriate situation caused by unintended conveyed messages in social and shared spaces. Gaze gestures are currently more difficult to implement for HMD due to hardware limitations (eye-tracking usually unavailable or requiring add-on [16]).

Smartwatch with Head Tracking

We assume the smartwatch is already well adopted or accepted by HMD users and surroundings. This kind of device is promising thanks to the intimacy provided by its form factor. The smartwatch offers either the use of motion-sensors, the touchscreen or the combination as explored by WatchVR [6] while coupled with a virtual reality (VR) HMD for performing a Fitt's Law task. TickTockRay [10] also exploit the smartwatch with VR HMD by providing pointing interaction from motion-sensors but their implementation imply low mid-air hand gestures as of [19, 20] and [11] for objects manipulation or [1] for sharing data.

Challenge

Previous researches on these three kinds of interactions focused on specific tasks. We think there is an important need to provide a much wider range of tasks with discreet interactions in order to be used and accepted in social context. We suggest at least four kinds of basic tasks: 3D manipulation (which include translation but also scaling and rotation of contents), menu navigation (on several levels), micro-interaction (such as action on notification) and text-entry. Without tackling a wide range of tasks with discreet interactions, the use and acceptance of HMD would be limited in social contexts because the users would have to rely on other "very expressive" interactions (such as mid-air hand gestures or voice command).

PUBLIC SPECTATOR VIEW

This proposition is based on the idea that every HMD must share a part of (or the whole) content currently displayed to their surroundings, thus addressing different relevant workshop topics, here presented in multiple scenarios. We assume most of the people own at least a smartphone.

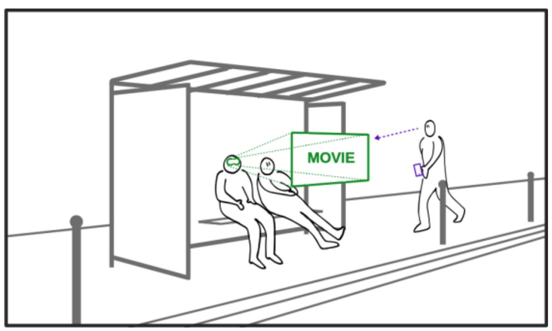

Figure 1: Bus station setting – watching a movie.

Shared Experience in Shared Spaces and Tackling Isolation and Exclusion

An HMD user is playing a video game (or watching TV series/movies) at the bus station (Figure 1). A non-HMD user gets close to the bus station, take out its smartphone and connect to the HMD public spectator view. The non-HMD user is now able to see and hear MR contents of the HMD user. The HMD user is aware of the spectator connection and enjoy sharing the experience. Both have the possibility to engage and create a bond based on the potential mutual affinity about the contents currently displayed.

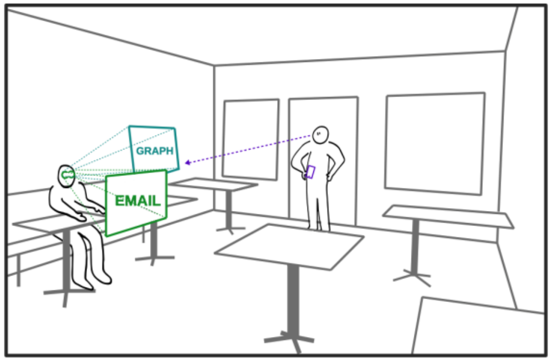

Figure 2: Coffee shop setting – working.

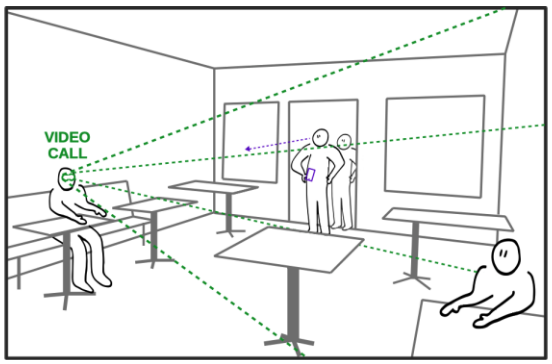

Figure 3: Coffee shop setting – video calling.

Social Acceptability of HMD Usage

An HMD user is sitting in a coffee shop (Figure 2) and is currently working (sending email, analyzing data sheets and graphs in MR). A non-HMD user enters the coffee shop and is curious but suspicious about the HMD user. The non-HMD user checks the HMD public spectator view and sees simplified but spatially located contents of the email client, data sheets and graphs deprived of private data but still showing ongoing activity. The public spectator view provides an inexpensive way to the surrounding people to be aware of why the HMD user is using the HMD device [13]. The non-HMD user is now at ease and sit near the HMD user without paying attention.

Ethical Implications of Public Mixed Reality

In the same settings as the previous scenario. The HMD user is now making a video call (Figure 3) with a colleague and show some real artefacts (papers) placed on the table. The content of the video is not displayed to the public spectator view, but the field of view of the HMD camera is publicly represented to spectators as well as the ongoing recording activity. Two new non-HMD users concerned about their privacy enter the coffee shop, check the HMD public spectator view, notice the ongoing recording activity and decide to sit near a table out of the HMD camera field of view.

Challenge

Such proposition faces important challenges either for technical or ethical concerns.
At least three current technical challenges are noted:

1. Network limitations (5G networks could alleviate the bandwidth and latency challenge),
2. Battery drainage due to extensive communication,
3. Simultaneous localization and mapping (SLAM) synchronicity between devices (HMD and mobile phones, or other HMDs).

We are aware this proposition could be considered as very intrusive for the HMD user, almost provocative, close to "mixed reality voyeurism", yet it deserves to be explored and experimented. Does any contents (even in transformed/simplified form) must always be public? Would it be the case of the HMD camera field of view and recording activity? Could the public spectator view create more awareness and then suspicious about potential recording? Or even make it less acceptable for HMD users?

Discussion

Despite being currently hard to implement as presented on an everyday basis, the (not public) spectator view from Microsoft HoloLens [29] goes technologically into this direction. Moreover, simplified and controlled simulations with augmented reality mobile phone technology (such as ARKit/ARCore) make the solution viable in experimental setting. (The unofficial post-workshop event could fit to receive different points of view from simulated public spectator view users.)

AUTHORS

Damien Brun is a Ph.D. student in Cognitive Computing and tends to specialize in mixed reality HMD interactions, that include text-entry interfaces and multimodal interaction combining different devices. He is supervised by **Charles Gouin-Vallerand** from TELUQ University (Canada) and **Sébastien George** from Le Mans University (France).

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