Pro-Social Mobility: Using Mozilla Hubs as a Design Collaboration Tool

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SUMMARY

This paper showcases the novel application of Mozilla Hubs in the context of interface design for future, autonomous taxis. It demonstrates that repurposing pro-social virtual reality as a design collaboration tool enables an embodied and spatialised experience affording the co-creation and visualisation of novel interfaces, scaffolded by real-world social dynamics, but unfettered by its physical limitations. The approach has proved to be beneficial during the COVID-19 pandemic, but it also provides genuine opportunity for virtual, "non-contact" collaborative research beyond this.

KEYWORDS

Mozilla Hubs, pro-social virtual reality, Human Machine Interface design, autonomous taxi

Introduction

There has been a recent, marked increase in virtual ways of working and teaching, to a large extent precipitated by the COVID-19 pandemic. Largely centred around online meeting platforms, such as Microsoft Teams and Zoom, these approaches are primarily intended to remove face-to-face, "in-person" contact. However, such services can inadvertently inhibit human affect, thus encumbering effective communication and collaboration (Ramsook and Thomas, 2019). In contrast, pro-social virtual reality ("PS-VR") platforms, such as Mozilla "Hubs" (2021), offer a multiuser experience that typically enables people to embody a virtual avatar and interact with other users in an immersive, three-dimensional virtual space; the ambition is to leverage and promote desirable social behaviours and expectations from related environments in the physical world (Laal and Ghodsi, 2012). Hubs was selected for the current study as it offers good accessibility and customisability – it can be accessed from any standard web browser and does not require a high-performance computer. Moreover, users can create their own virtual meeting spaces (or "rooms") using bespoke development software. A further advantage of virtual spaces, more generally, is that experiences are not bound by real-world physics, and "futuristic" interactions with emerging technologies can be created and reimagined quickly, safely and repeatedly. The aim of the current study was to repurpose Hubs as a collaboration tool to inform the design of human-machine interfaces (HMIs) for future, autonomous taxis. Although the initial motivation to use Hubs was arguably in response to the COVID-19 pandemic, it was envisaged that it could offer a novel method to provide a social and immersive experience during remote, collaborative working (and indeed other related activities, such as teaching (see: Burnett et al., 2021)) that would remain relevant post COVID-19 restrictions.

Method

Twenty-five participants (16 male, 7 female, 2 undisclosed) were recruited to take part and primarily comprised staff and students at the University of Nottingham. Seven workshops took place, each permitting a maximum of 5 participants. Participants were provided with a practice session. Thereafter, they chose their desired avatar and joined research facilitators in two bespoke

Hubs rooms. The first room depicted a roadside scene with several taxis waiting at the roadside. The second room, accessed via a "portal" in room one, depicted a taxi journey from within the vehicle. The facilitator delivered verbal prompts encouraging participants to envision appropriate HMIs relevant to a future autonomous taxi service. Participants subsequently created these using 3D models from an online repository and/or the integrated draw function and located them accordingly.

Results and Discussion

Results relating to the design of interfaces are presented in Hallewell et al. (2022). Here, we reflect briefly on the novel application of PS-VR in the context of collaborative interface design, highlighting key elements of Hubs, in particular, which contributed to its success.

A key advantage of PS-VR is that it harnesses the sociality of place and the affordance of space to elicit real-world behaviours in a virtual world. As such, McVeigh-Schultz et al. (2019) recommend that the aesthetics of the virtual world should be indicative of the kinds of social encounters and interactions users are likely or would expect to have in that context. Hubs allows users agency in shaping virtual world aesthetics, and hence, social expectations, by allowing them to design their own rooms and experiences. Indeed, we created a realistic cityscape with taxis waiting at the roadside and an authentic in-vehicle experience. The aim was thus to present to participants the same dilemmas and challenges that they might face in the physical world (e.g., how to determine which taxi is theirs). We would therefore argue that emerging HMI designs and recommendations are likely to have greater real-world applicability and relevance, compared to, say, utilising a non-immersive virtual experience (such as an online meeting platform) to elicit HMI designs.

Given the freedom that VR affords, it is important in the context of a research study that social norms and expectations are promptly established to avoid participants running amok. A useful strategy to shape social norms is to pre-populate the virtual environment with interactive items that can be explored, and which serve as "social lubricants" (McVeigh-Schultz et al., 2019). While such items may be traditionally introduced to encourage a spirit of fun in virtual worlds, we utilised the strategy by providing 3D objects representing generic HMI concepts (e.g., visual display screens, keypads, digital assistant etc.) that would aid and inspire participants. In practice, these items also naturally served as "ice-breakers", focussed shared attention on the activity in question, and provided a mechanism for the facilitator to demonstrate how to interact in the environment (for example, how to select, move and place items on the vehicle).

Conducting the research in a virtual world allows participants to select and embody an avatar. As well as promoting self-expression and feelings of 'co-presence' or 'social-presence' (Nowak & Biocca, 2003), this enables shared eyelines and conversational orientation (in other words, eye-contact and 'F-formations') (Kendon, 1990; Marshall, 2011) – factors that are arguably lacking in existing online meeting platforms. These elements help to engender human affect and activate shared cultural understandings with other participants, and are thus important in tasks requiring an embodied, "social" experience or collaborative tasks and activities, as we observed in our study.

Finally, we purposefully restricted all participants to a laptop and web-browser. While this was primarily to ensure the experience was controlled and comparable, we recognise that Hubs, and VR more broadly, affords a multitude of gateways, from technology-rich, *immersive* experiences to people-oriented approaches, for which encouraging *presence* is arguably most important (see: Jerald, 2015). In our exploration of Hubs as a design collaboration tool, we aimed for the latter – to encourage participants to believe that they were interacting with an autonomous taxi as a user *might*, not necessarily attempting to convince them that they were *actually the user*. In this endeavour, delivering VR using a laptop browser appears to have been perfectly adequate, although we note that we did not conduct a controlled comparison with other, higher-tech approaches, more rudimentary methods such as MS Teams, or indeed, a traditional in-person workshop.

Acknowledgements

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