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Towards a Smart and Socialised Augmented Reality

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Abstract

This paper introduces a nascent project aimed at exploring new avenues to support creativity, socialisation and community through smart interfaces for augmented reality. Augmented reality has been so far largely conceptualised from a point of view of ‘power users’ seeking to support very specific applications, e.g. in training and simulation. With the availability of devices to mass market, new applications become possible, and new research problems open up. We offer a preliminary framework consisting of 2 orthogonal continua (virtual-real and human-thing) and 2 critical perspective (postphenomenology/posthumanism and cultural interface). With this poster we hope to stimulate valuable discussion and seek input from the CHI community about the challenges, opportunities, and theoretical perspectives underpinning a smart, socialised AR.

Author Keywords

Augmented Reality; Sociality; Creativity; Community; Socialisation

Introduction

Augmented Reality (AR) is quietly and steadily moving from research facilities onto the shelves of tech shops. Despite some bumps along the road, for example the rise and fall of the Google glass [9], this technology conceived no less than 50 years ago [28] is now considered mature for its

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market debut. As this happens the research focus is predictably shifting from the hardware and software engines to the interface [13]. However, much research focus is still firmly set on traditional, high end, single user applications.

We introduce a research project at Queensland University of Technology aimed at exploring the social side of AR, *Augmented Sociality*, and the main challenges and opportunities that emerge from weaving this new technology (in its diverse materialisations) into the fabric of everyday social life.

Augmented Sociality

With AR we can imagine an extended family, with children, parents, and grandparents getting together to read an interactive book or play a game, some of them being physically present, some joining remotely, each engaging in interaction with the others, as well as with different elements of the AR experience. What people see is potentially different for everyone involved, as it may have been silently adapted by the AR engine to suite one's skills, interests, or age. Yet, to be able to interact effectively, this family will need to:

- make sense of what everyone is seeing and doing, as well as the information being presented;
- understand how to sift through services and data available and use AR functions effectively;
- develop social norms to govern behaviour, use the augmented spaces politely, and attract each other's attention;
- learn how to communicate with other people, while simultaneously using gestures, voice, or other combinations of intelligent interfaces to control the AR system.

For this vision to become reality many technical developments still needed to allow seamless socialised AR interaction and co-creation of AR experiences, for example to make their experiences meaningful, family members will need to be able to create their own AR content, as they would create a sketch on a notepad.

Additionally, many theoretical problems have to be considered in the design of AR services and applications. As some social cues become virtual, users will need ways to share what they want, keep private the rest, and also at the same time, make sense of others' actions. How will we remain accountable when the visible cues are different for different people? How will we perceive the social presence of others? How will we interpret the focus of others attention and actions? How can the experience be engaging for adults, and at the same time not overwhelming for children? How to fine tune all of the above when designing the AR experience?

These (and more) research questions pose a range of interesting future challenges to the HCI community that we hope to have an opportunity to discuss at CHI2020.

Open Issues

In spite of the growing popularity of AR, many aspect of its use are still in early infancy. Crucially, a larger majority of previous research has looked at individual and specialised applications and tasks, such as aircraft control, largely because of the high cost of the involved equipment [2]. To make these initial scenarios possible much focus of AR research has been traditionally technology-centred, focused on developing e.g. real time scene tracking, displays, and control devices [13]. While much research exists on AR interaction techniques, including in collaborative settings [21, 20], this is oriented at specific collaborative situations, e.g.

maintenance in industry, training in military and medical, entertainment in games, and education in museums. As a result there is a remarkable lack of practical examples, empirical knowledge, and theoretical understanding to guide the development of smart and socialised AR interfaces.

Previous research has exposed a lack of understanding of the aspects of socialised use [9], social acceptance [5] and how AR potentially conflicts with social norms [15]. Notably, while one key aspect of AR devices is to allow see through, hands free interaction (e.g. goggles, glasses, head up displays), the obvious choice of a voice interfaces to complement AR has been a major determinant of the ban of Google glass from many public venues [9, 15].

Studies ‘in the wild’ of AR use are very sparse, but the ones available have similarly exposed challenges and unwanted consequences. AR technology is often positioned halfway across the virtual-real continuum [18], meaning that the AR user experience to be successful needs to span across, and overcome, both [3]. Yet, studies of AR use in the classroom, or reports on mobile AR games, show that the *virtual* tends to take over the *real* catalysing the learners’ attention [22], or inducing dangerous distractions for drivers and pedestrians [1].

Furthermore, because of AR’s original conception as a display modality, and initial emanation from CGI research, AR design principles and frameworks are skewed towards the graphics modelling aspects, and relatively less attention has been put so far to the study of analytical and generative frameworks focused on aspects of contextualised interaction and use (let alone socialised use).

One key body of theory that is gaining traction in HCI and is likely to offer a solid style of analysis to AR research comes from the philosophy of technology of Don Ihde and his and

others’ work on postphenomenology [23, 11]. Key tenets of the postphenomenological analysis are that human experience is always mediated by technology, that technologies are always characterised by *multistability* in that they can be used and interpreted in different ways by different people and in different contexts. In postphenomenology the nature of human-technology-world relations can be described in terms of embodiment relations (how the device can become part of one’s body); hermeneutic relations (how the technologies can be used to ‘read’ the world, such as mobile mapping); alterity relations (how the technology can become imbued of agency and identity, e.g. a conversational interface); and background relations (giving sense of technologies that become part of the environment) [11].

It is not difficult to see how these principles can shed light on the nature of AR interactions, but also how AR, by enabling at once all the above forms of human-technology-world relations, seems to escape even these powerful analytical tools. Augmented reality offers a see through display that can become transparent and embodied for the users, but at the same time overimposes additional information, that needs to be ‘read’ and interpreted, giving rise to hermeneutic relations. When equipped with a voice or gesture based interface, natural means of communication that imply addressing the system as an ‘intelligent other’ AR generates relations of alterity. And finally AR populates the world of virtual objects, much of which will necessarily need to be relegated to the background or peripheral attention to avoid AR becoming an omnipresent and unwanted noise.

How this (or other) theoretical perspectives can be put to work to address the questions outlined above is far from clear, and a very current subject of investigation. Even more, how this all can lead to generative framework able to inform the practical design intelligent interfaces and mean-

ingful interactions with AR, is an entirely open question for the time being.

A Preliminary Framework for a Socialised AR

While still very open, our research is beginning to highlight interesting areas ripe for further work and exploration. We propose here a tentative framework intended to schematise the main issues and enable some systematic approach to the research space.

Rethinking the Virtual-Real continuum

Conceiving AR as a new medium comprising of both virtual and real element [3] is a useful way to conceptualise the design challenges of new systems, but has a tendency to drive attention to the technological artefacts and away from the collective experience. Looking instead at AR as an assemblage of material and immaterial objects and users can help to shed light on aspects of embodied manipulation and socialised experience, and how human experience of the new AR systems can be affected by novel combinations of real and virtual objects, services, and places. Theories of human cognition such as distributed cognition [10] and embodied cognition [24, 14] recognise that thought is not centred in the brain, but rather we think with our whole bodies, as well as with the tools we use, the objects we manipulate, and the spaces we inhabit. AR can virtualise and make malleable what is normally solid and inflexible (for example the landscape) or, from an opposite perspective can reify make designable what is normally immaterial and out of reach (for example the past [26]) adding to the toolbox of things we may think with, manipulate, and appropriate. With AR this enhanced toolbox will comprise material and virtual objects, places, and people, extending the repertoire of possibilities for social and intellectual achievement.

AR as Human-Thing continuum

Another possible axis, somewhat orthogonal to the one above, can bridge AR research towards Social studies of Science and Technology (STS), as well as towards practical applications such as the Internet of Things. The STS literature recognise that objects have agency. They act as modifiers and enablers of human action and interaction [16, 27], shape social behaviour and in turn are shaped by people and practice. In a rather pessimistic outlook technology and the knowledge society are often seen as factors behind the disintegration of traditional forms of social engagement and community [31], and Postsocial theory suggests that human sociality is evolving to encompass an ‘object centred sociality’ that fills the void of traditional social forms of community [8]. When material objects meet technology, research in the related field of the Social Internet of Things [25] has shown that augmented interconnected objects and environments can enable new forms of collaboration by extending team and community social practices [7, 17]. AR adds to the toolbox of available objects a varying range of virtual, virtualised, remote, and *diversely material* things, people, and places. Users and systems can become blurred and dispersed. Whether this is exciting or alarming depends on the tools we have for critique.

Posthumanist and Postphenomenological perspectives

We have discussed above the points of contact with postphenomenology, and the potentials (but also some limitations) for this body of theory to critique AR innovations. Posthumanism offers a somewhat related and complementary lens to deconstruct technologies in use, that is gaining attention in the HCI community. It is worth noting that there are many perspectives on what post-humanism is, and what a post-humanist project should look like. One that is interesting to apply to the case of AR is offered by Rosi Braidotti, described as “an empirical project that aims at

experimenting with what contemporary, bio-technologically mediated bodies are capable of doing” [6]. Braidotti’s posthumanism moves from questioning the inherent inequalities and taken for granted relations of dependency that are embedded in flattened and undifferentiated concepts of ‘human’. AR as a tool will be likely integrated in the existing structures of inequalities and dependency. Posthumanism with its roots in feminist studies and postcolonial studies (in turn received in HCI as feminist HCI [4] and postcolonial computing [12]) and postphenomenology, with its focus on empirical cases, embodiment and multistability, can be two key lenses to make sure that future applications lean towards personal creativity and new ways of thinking, and away from technology induced personal hallucinations.

AR at the Cultural Interface

Finally, a key perspective to make sense of future socialised AR interactions comes from cultural studies, and the cross-cultural design agenda. AR is a powerful tool to make alternate realities come to live, and not surprisingly there is a key demand for AR applications of cultural heritage [30]. However, there is more to culture than ruins and monuments. Culture can be seen as performance, collective knowledge, identity and language, traditional practice, and even more [29]. Taking this perspective, every AR performance (a game, a visit to a museum, a dance, a lecture) can be considered a blend of material and immaterial constituents, and through flexible adaptations can embody a plurality of voices and perspectives. An AR that is accessible, open ended, and democratised can give voice to actors that are often marginalised, and can make visible realities that are normally hidden. Nakata coined the term *cultural interface* to denote the overlapping of Western and Indigenous knowledges [19], and described it as “the place where we live and learn, the place that conditions our lives, the place that shapes our futures and, more to the point, the

place where we are active agents in our own lives”. It is exciting to see AR as the *operating system* of the cultural interface, but also scary and potentially devastating if it happens to become a new tool for cultural assimilation, rather than an open medium accessible to a diversity of actors for a diversity of purposes.

Conclusion

This poster proposal highlights some major research directions for AR interaction, and open questions as to what an intelligent interface for AR may look like, and what theoretical framing can support the design and critique of future AR systems. We have offered a tentative framework touching on key theoretical perspectives that may enhance current approaches to AR design and critique. The framework consists of 2 orthogonal continua (virtual-real and human-thing) and 2 critical perspective (postphenomenology/posthumanism and cultural interface). The two continua aim to add nuances to virtual-real continuum often evoked in AR, and to escape the human/thing duality bringing forward a finer take on humans and technology mutated from STS. The theoretical perspectives of postphenomenology and posthumanism in turn contribute a valuable analytical lens to understand how AR acts as a mediator of human experience, and how this new, technology enhanced experience can be put to service to escape (or at least make sense of) structural social inequalities, dependencies, and power imbalances. Finally, the lens of cultural interface, brings to the fore issues of plurality of knowledge systems that AR can contribute to amplify in constructive ways.

This is a nascent research initiative, and at the present stage we have little ‘preliminary results’ to offer, yet with this paper we hope to stimulate discussion and elicit feedback from the CHI community. We are confident that the research questions and framework we are offering will res-

onate with much work being conducted in CHI, and we look forward to discuss these points of contact at the conference.

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