

DWIIH INTERVIEW

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DWIIH: Can you describe your research and research interests to our readers?

M-B: We increasingly often rely on algorithmic systems in business, society, politics and even in science that help us to make sense of data, support our decisions or spark our creativity. My research revolves around the question of how we can augment human cognition by machine "intelligence" (e.g. semantic technologies, machine learning) to enable human-machine collaboration. With the increasing use of algorithmic systems, a human-centered perspective is indispensable because without such perspective we would deny the inherent nature of technology to serve the greater good. Technology is not an end in itself.

When I started my research career I focused on the analyses of peer production communities. Bots represent the algorithmic systems in these communities. A very active bot community exists, for example, on English Wikipedia. These bots help Wikipedians to deal with the complexity of running such a project, for example, when changed guidelines impact a large number of articles or the number of vandals increases. The Wikipedia community has developed a very sophisticated governance system to deal with bots – what they are allowed to do and what not. This governance system and its development might be a blueprint for how we deal with algorithmic systems in the future.

Today my research entails both an empirical and engineering dimension. The objective is, on the one hand, to advance our understanding of the functioning of complex sociotechnical peer production systems that involve human-machine collaboration and, on the other hand, to contribute to a value-based, sociotechnical-system design that fulfills the specific needs of an application area (e.g. visualization, ideation). Thus, the development and evaluation of systems that involve human-machine collaboration is another important part of my research.

DWIIH: How does human-centered computing and digital collaboration relate to virtual and augmented reality? Relatedly, can you tell our readers about some of your projects?

M-B: I have made two observations in my research that caused me to use mixed reality applications (i.e. virtual and augmented reality).

First, most of my research on human-machine collaboration is tied to digital environments. However, when I asked people about their knowledge, work and how they used specific software, oftentimes “things” (e.g. objects, pen, paper) from the physical world were still a crucial component. People had to switch between their digital and physical workplaces, back and forth. Therefore, as a first approach, we have begun to design applications that integrate data into physical settings (based on the Microsoft HoloLens). Two questions that drive our work are: How can we present and how can people interact with data in a 3D space in a meaningful way?

Second, many algorithmic systems reside in the background of human perception. Many devices are designed to simplify our lives, but, at the same time, they deprive us of authority. Mixed reality applications might be one approach that allows us to interact with the machine “intelligence” (i.e. data and algorithms) in these devices directly or at least make their procedures graspable. We are exploring possible realizations in a current project where students from computer science team up with students from product design.

DWIH: What is the current state of technology in virtual and augmented reality? And what are your hopes for the future of this technology?

M-B: Even though mixed reality technologies, such as the Microsoft HoloLens, mentioned earlier, are quite limited in their technical capabilities (e.g. a field of view of 35 degrees), you get a glimpse of how the future might be. Virtual Reality devices, such as HTC Vive or Oculus Rift, are on a different level, because there are already three production generations available. Both technologies will be mainstream in five to ten years according to the Gartner hype cycle; however, it is a very optimistic perspective when looking at the current situation.

Existing mixed reality environments are often developed for a specific technical setup (e.g. devices) with a clearly defined usage scenario and a predefined information setup. Areas of application are mainly in entertainment, adult content and the military. More recently, well-thought-of applications have emerged in medical, cultural and educational contexts. Distributing mixed reality environments is still challenging for both content creators (e.g. only a niche audience, cameras are too expensive) and the audience (e.g. high-quality content is not conveniently accessible). An exciting development in this area is WebVR, a specification that brings VR into the web. The Mozilla team released a software framework called A-Frame, which enables web

developers who are familiar with HTML and CSS to build VR environments. Open standards and APIs (application programming interfaces) are necessary for furthering the current development.

DWIH: **You used a thought-provoking Ivan Sutherland quote in a presentation on mixed reality for cultural institutions: "*The ultimate display would, of course, be a room within which the computer can control the existence of matter. A chair displayed in such a room would be good enough to sit in. Handcuffs displayed in such a room would be confining, and a bullet displayed in such a room would be fatal.*" Do you think this will ever be possible?**

M-B: Instead of asking what is technologically possible, we should ask what kind of technology we need and where we want to use it. Technology is an enabler; it often makes our life more comfortable, but, at the same time, technology also shapes us. We need to question our technological choices more than ever. Imagine a company provides such an "ultimate display." What would it mean for our society? What would happen if more and more people spend more time in such digital settings rather than in their "real" lives? I do not want to share dystopian views on our future, but I want to call for more sensitivity to what is needed and wanted technology-wise. Engineers cannot answer these questions alone. We as researchers need to engage with society to figure out appropriate ways to deal with technological developments.