



# begin

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## Augmented Humans: Cyborg visions of the future

**T**he term cyborg, a mashup of the phrase “cybernetic organism,” has been used to present how human capability will be augmented through technology [1]. This issue of *XRDS* shows different perspectives of this augmentation through the current and future application in arts, materiality, social implications, senses integration, and users’ perspectives.

### COMPUTING SURVEILLING/ REPLACING HUMANS?

Technology has often been used to mimic or surpass human abilities (visual object/face recognition, playing chess or go, etc.). Such

efforts appear to put humans and technology in a competitive relationship, as emphasized in computer versus human game competitions. Once a fantastic fear, computing systems “replacing” humans is now taken much more seriously and discussed in the public sphere. A recent example is the explosion of generative machine learning models, most prominently the text-to-image diffusion models that are able to generate photo-realistic images given any text input (e.g., Stable Diffusion, Midjourney, and DALL E 2). But augmented humans research proposes a different approach to the human-computer relationship by applying a cooperative and empowering framework.

### FROM USING A TOOL TO EXTENDING THE BODY

The idea to use digital tools to “augment the human intellect,” a term coined by Douglas Engelbart in 1962, has a long history [2]. Human-computer interaction (HCI) is a part of this tradition as well, yet usually defines clear boundaries. Here is the user, here is the computer, and in between is a very visible, prominent interface. The most impactful technologies vanish, we take them for granted or



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they even merge with us. We might understand them as part of us. Take clothes as an example. We put them on in the morning, they fulfill a purpose, and we are usually not aware that we are wearing them. Take another example, you are engaging with an even more profound analog technology right now: reading and absorbing thoughts in a written language. Reading has become second nature and changed us fundamentally, it became integrated with our bodies. When we talk about augmenting humans, we are postulating if we can create comparable technologies using computing. Can computing become more “integrated” with our bodies? What does it need to better understand and co-



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shape technology in which users and computing together form closely coupled systems?

Traditional HCI also focuses on just designing the interface (this little layer between user and computing). Notions such as augmented humans and human-computer integration are rather new as they deal with redefining and extending our bodies [3].

### FROM PROBLEM SOLVING TO EXPRESSING POSSIBILITIES

We often get inspiration from narratives. Stories in books, movies, games, etc. influence us. The obvious influences for an augmenting humans issue might have been cyberpunk-themed novels and media.

**Even though there is a lot of potential in the technology overlapping with our bodies to advance accessibility on a very personal level, there is also the danger...**

Yet, we decided to open the issue with impressions of performance artist Stelarc discussing what it means to have the human body merge with technology. We continue with explorations on novel systems that have the potential to be integrated closely with our senses such as olfactory wearables for cognitive enhancement and well-being. This is followed by an article that reflects on the use of data in textiles to enable a cybernetic future. In another article, we look into what is socially acceptable in terms of wearability and form factor. Even though there is a lot of potential in the technology overlapping with our bodies to advance accessibility on a very personal level, there is also the danger that comes with all innovations—they might broaden societal division into haves and have-nots. Another article in this issue will explore a kind of parallel agency for people with disabilities working remotely in a cafe in Tokyo using multiple robotic avatars. And we close things out with an expert user of a wearable computing system reporting on his experiences during the pandemic.

We hope you enjoy this issue. It might inspire you and present new, alternative ideas to think about embodiment, the use of tools, and your relationship with technology.

Technology is often used as a tool for problem solving, yet it's also an expression of what is possible.

#### References

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- [3] Mueller, F. F. et al. Next steps for human-computer integration. In *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems*. ACM, New York, 2020.

#### Biographies

Katia Vega is an assistant professor of the Department of Design at the University of California, Davis, where she founded and directs the Interactive Organisms Lab. She was a Postdoc Associate at MIT Media Lab [USA]. She got her Ph.D. and master's degree in computer science at PUC-Rio [Brazil]. She was a researcher in the Fine Arts Department at HKBU (Hong Kong). Her undergraduate studies were done in computer science at UNMSM [Peru]. She publishes at top-tier academic computer science conferences and journals including CHI, ISWC, TEI, DIS, IUI, and *IEEE Computer*. Her work has been featured by BBC, *Vice*, *New Scientist*, *Wired*, *Discovery*, *CNN*, *Fast Company*, and *Mashable*, among others. Her academic contributions were awarded by NSF CAREER, SXSW, *Ars Electronica*, Johnson & Johnson, and CNET, among others. Springer published her book: *Beauty Technology: Designing Seamless Interfaces for Wearable Computing*.

Kai Kunze works as a professor at the Graduate School of Media Design, Keio University, Yokohama, Japan where he leads an interdisciplinary research group "Geist," focusing on augmented humans and applied wearable computing research. Together with Prof. Kristof Van Laerhoven (Siegen University), he serves as the co-chair of the International Wearable Computing Academic Research Community. Previously, he held an assistant professorship working for Prof. Koichi Kise at Osaka Prefecture University, Japan. His work experience includes research visits at MIT (Cambridge, US), at the Palo Alto Research Center (Palo Alto, US), and Sunlabs Europe (Grenoble, France). He received a summa cum laude for his Ph.D. thesis (advisor: Prof. Paul Lukowicz, secondary advisor: Prof. Hans Gellersen) from Passau University. Some of his works were featured in the *New Scientist*, *Spiegel*, *Heise*, *Engadget*, *Gizmodo*, and *Smithsonian Magazine*. His current interests include building accessibility toolkits, affective feedback loops/spirals in dance performances/music concerts, and eyewear computing.

DOI: 10.1145/3571293  
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“I am  
human...  
just like  
you.”

For the first  
time, the AI  
had asserted  
its claim on  
humanity.

At that moment, the AI  
and I had become one...

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