Don't Make Me Puke

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Influential articles are rarely the first treatment of a topic. They often appear in the midst of research and development, explaining the aspects of a technology that work and those that might need fixing.

It was an email that promised hope. A big conference in Singapore. Free tickets for "influencers," a category that apparently included me. Insight into the next big computing technology. Connections to leaders in the industry. That's what the email promised. I followed the links only because the topic of the conference was the same as the subject of this month's "Body of Knowledge" column: virtual reality. As I probed the offer, I found some ideas that I would have expected and some that reminded me of the important role that *Computer* plays in our field.

Virtual reality is one of those technologies that seem to have been sitting on the cusp of importance for nearly 30 years. The basic idea of creating a virtual environment—using small stereoscopic displays to convince viewers that they are in an alternative space—dates back to the initial work on computer graphics in the 1960s. However, the technology had been hampered by a variety of technological, economic, and social limitations. The literature on the subject shows that it has progressed as we have been able to produce higher speed processors, larger memories, smaller displays, cheaper cameras, simpler studios, and better editing techniques.

Yet even without these things, virtual reality has held a powerful grasp on our imagination. By all reports, it dominated the 1991 SIGGRAPH, an early public display of virtual reality technology. "Virtual reality was the loudest buzzword among many," remarked one participant at the 1991 conference. "Marketeers and some members of the media are acting as if virtual reality is exploding in its

ARTICLE FACTS

- » Article: "Virtual Reality: How Much Immersion Is Enough?"
- » Authors: Doug A. Bowman and Ryan P. McMahan
- » Citation: *Computer*, vol. 40, no. 7, pp. 36–43, July 2007
- » *Computer* influence rank: #25 with 13,197 views and 410 citations

popularity and usefulness," he continued. But that did not seem to be the case.[2]

One of the fundamental questions about virtual reality, one that is addressed in our current choice for the "Body of Knowledge" column, was this: Why should anyone use virtual reality? Why should anyone invest the effort and expense to develop virtual reality applications when they could achieve the same goals with a simpler technology? Software pioneer Fred Brooks, always an insightful critic of his own field, made that very point when he was asked to look at early virtual reality systems. Separating viable applications "from prototype systems and feasibility demos is not always easy, but it has been instructive," he wrote. He was able to identify a number of useful applications in vehicle simulations, entertainment, training, and medicine that might successfully utilize virtual reality. However, he ended his comments by saying that he hazarded only a few predictions.[3]

Our current article, Doug Bowman and Ryan McMahan's "Virtual Reality: How Much Immersion Is Enough?,"[1] gets at the fundamental question. It looked at applications in medicine, military training, and entertainment and assessed their success. The authors were particularly interested in the immersive virtual reality environment, the one that makes users feel as if they are in a different place and time. They argued that these applications were successful when they fulfilled the promise of the technology. "They require the user's experience in the virtual world to match, as closely as possible, the simulated real-world experience," the pair wrote. "Specifically, they require a high level of sensory fidelity—visual, auditory, and other sensory cues similar to those experienced in the real world."[1]

It is, of course, that quality of "sensory fidelity" that is important to our readers and the work that we do.

Bowman and McMahan's article involved a number of careful scientific studies of successful applications. From this work, they were able to identify the elements of successful virtual reality to produce the most successful article on that topic ever published by *Computer*. It ranks 25th on our list of most influential articles, with 13,197 views and 410 citations (see "Article Facts").

This article was not the first treatment of virtual reality published in this magazine. The first was an overview by computer graphics pioneers Aaron Marcus and Andries van Dam that was published in 1991, the year when the technology dominated the SIGGRAPH conference.[4] However, Bowman and McMahan were able to outshine the early pieces on virtual reality by identifying a key set of questions that would need to be addressed. They acknowledged that immersive virtual reality was perhaps not for all applications but that it would become more widely utilized "as we understand more about immersion's benefits."[1]

If we look at the articles that have followed the one by Bowman and McMahan, we find that there is a substantial literature on how people respond to virtual reality. Researchers are working on how virtual reality can induce motion sickness, sensory conflict, and a new illness called *cybersickness*. After all, virtual reality is lying to our senses. Our senses, being self-important entities, accept being fed lies, and, under the right circumstances, they can even enjoy the apparent reality of falsehoods. But they can be decidedly touchy when they realize that one sense is being told one thing and another sense is experiencing something different. Hence, IEEE is concluding a major effort to improve a major restriction on virtual reality by introducing a standard that attempts to reduce one of the sources of nausea from wearing immersive and other virtual reality headsets.[5]

So when we recall the article by Bowman and McMahan and ask why it deserves to be a highly influential contribution, we return to what *Computer* and the other IEEE magazines do well. We're not here to promote a product or service. We're here to tell you what works about a technology, what doesn't work, and what might need to be fixed to keep its users from getting sick. ◨

REFERENCES
1. D. A. Bowman and R. P. McMahan, "Virtual reality: How much immersion is enough?" *Computer*, vol. 40, no. 7, pp. 36–43, 2007. doi: 10.1109/MC.2007.257.
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5. *IEEE Approved Draft Standard for Head Mounted Display (HMD) Based Virtual Reality (VR) Sickness Reduction Technology*, IEEE P3079/D02, Aug. 2020.

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