Q&A: Can virtual reality help people eat a healthier diet?

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On the left, a member of the research team demonstrates the virtual reality headset and hand controllers used in the virtual buffet restaurant. On the right, a plate of food sits in the virtual restaurant. Credit: John Long and Travis Masterson

With heart disease and diabetes—which can be caused or worsened by poor diet—among the leading causes of death and illness for adults in the United States, researchers in the Penn State College of Health and Human Development are studying influences on human eating behavior.

There is a natural tension in eating-behavior research, according to Travis Masterson, assistant professor of nutritional sciences. Researchers want to observe people's typical behavior, so it is useful to observe research participants eating in a typical environment like their home or a restaurant which contains the sights, smells and other factors that can influence eating choices. Researchers also want to control their experiments tightly so that specific variables are well understood and results can be reproduced with accuracy, which is why eating studies are often conducted in laboratories.

To address this tension, Masterson and his graduate student, John Long, are exploring the potential of virtual reality (VR) technology to conduct eating-behavior research and help people make healthier choices when they eat. Their most recent research publication, available online now, will appear in the December issue of the journal *Appetite*.

Q: Why does eating behavior research need VR?

Masterson: There are different ways to study eating behavior, and I study what we call "cued behavior." The idea is that cues in the environment influence what and how people eat. These cues can range from advertising—which we know has a huge impact on what people eat—to the lighting or sounds where people are eating.

If we study eating in a laboratory, we can control the environment carefully, but the laboratory environment can be very sterile and remove many of the cues that influence people's behavior in their day-to-day lives.

On the other hand, if we study eating in a restaurant, we can expose people to all of the cues in the natural world, but we cannot control those cues. Will the lighting be the same from day to day? Will the food available at the restaurant change? In the natural world, researchers lack the ability to control the context, which also makes studying specific cues difficult or impossible.

Long: This is why we believe in the value of VR. In our studies, participants wear a VR headset that immerses them in a digital environment they can move through and interact with. In VR, we can simulate and control many of the cues present in the real world, so each participant has a similar experience, which is critical to a research study.

For our most recent study, we ran over 200 visits with research participants. In a real-world environment, we might not be able to keep the food, lighting and other factors identical over time. In VR, however, we can keep the environment exactly the same, which allows us to focus on what we specifically want to study.

Q: What are the pros and cons of using VR in eating studies?

Masterson: Developing a VR environment takes a lot of time and effort, but once it exists, the cost per research subject is very inexpensive. Compared to the cost of, say, building and running a simulated restaurant within a laboratory, VR can offer huge cost savings. And if we can answer our questions while reducing costs, that is important, right?

Even better, current eating-behavior studies often can only include people who are willing and able to drive to a university so they can participate. With VR, we will be able to take eating behavior studies out to people where they live—rural areas, low-income areas or anywhere

we want to understand a population—so that more diverse groups of people are included in our studies, and we get better results.

Just because we think this tool has great promise, that does not mean it is the right approach for every study. VR may not be able to simulate every experience, but we have been amazed at what it can do. Screenshots of VR have to be flattened when taken out of the three-dimensional VR environment, so they look a little grainy and phony. But participants have reported a truly immersive experience when in the virtual restaurant.

Q: To study eating, don't you need to use real food at some point?

Long: Absolutely, and our recent work is a testament to that. In a recent study, we created a restaurant in a mixed-reality environment where participants can see and interact with real food, as their actual hands and the meal in front of them are seamlessly integrated into the virtual space. This integration creates a sense of presence or "being there" by making the virtual restaurant feel as if it were a genuine restaurant environment.

That research demonstrated that people could comfortably interact with a virtual environment and eat real food. There are a lot of important questions that we can answer using virtual food, but being able to immerse participants in a mixed-reality restaurant while they consume real food allows researchers to answer a different set of research questions.

Q: Do people behave the same in a virtual restaurant as they do in a real restaurant?

Long: That is an important question, and more research is needed, but

our first attempt to answer this question suggests that people do.

Other research at Penn State and elsewhere has demonstrated that the "portion-size effect" is a robust phenomenon. This just means that people tend to eat more food when they are served more food. This is a visual phenomenon where we struggle to accurately estimate food volumes, so we do not notice that a portion is larger; it is just a portion to us.

In a recent study, which is available online now and will be published in the December issue of *Appetite*, we demonstrated that the portion-size effect occurs in a virtual-reality buffet [restaurant](#) where everything is completely virtual—even the food—in a way that is very similar to what we see in laboratories and in real life. We found that people's behavior in virtual environments mirrors their behavior in the [real world](#).

Masterson: We have demonstrated that these virtual environments are usable and that they accurately reflect human eating behavior, at least in terms of responses to portion size. But we are just scratching the surface of what this technology can do.

In the future we will be able to use VR to accurately and easily recreate a variety of eating environments from people's actual lives. This will continue to improve our understanding of people's personal eating behaviors under a variety of conditions. It also gives us new opportunities to provide personalized coaching and feedback.

Q: Much of the work in creating a VR restaurant is outside the realm of nutritional sciences. How are you getting the most out of this technology?

Masterson: We have a lot of fantastic collaborators! At Penn State,

researchers across every college have built collaborations to use VR in research through the Center for Immersive Experiences. Our affiliation with the center has enabled us to collaborate with architects, biostatisticians, computer scientists, artists, engineers and others to build and operate our virtual buffet. This, in turn, lets us answer questions about how to promote healthy eating.

Working on VR is very exciting. John and I are studying eating behavior, but other Penn Staters are using VR to answer questions and solve problems in surgery, engineering and many other fields. It is important to be in the right place, and Penn State is definitely the right place for this work.

More information: John W. Long et al, Portion size affects food selection in an immersive virtual reality buffet and is related to measured intake in laboratory meals varying in portion size, *Appetite* (2023). DOI: 10.1016/j.appet.2023.107052

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