

Evaluation of a Virtual Reality-based Buffet to Address Challenges in Health Research and Practice

Chris Fortney

Social & Behavioral Research Branch, NHGRI/NIH,
Bethesda, MD 20817
Christopher.fortney@nih.gov

Susan Persky

Social & Behavioral Research Branch, NHGRI/NIH,
Bethesda, MD 20817
perskys@mail.nih.gov

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1 EVALUATION OF A VIRTUAL REALITY-BASED BUFFET TO ADDRESS CHALLENGES IN HEALTH RESEARCH AND PRACTICE

The Immersive Virtual Environment Testing Area (IVETA) is a behavioral science laboratory offering tools and expert support for virtual reality (VR)-based health research at the National Institutes of Health. We design VR tools to tackle methodological and communication challenges in the domain of health research and practice, with a specialty in genomics. One of our most useful VR tools is a custom virtual reality application intended to simulate a buffet food choice experience in a typical cafeteria setting.

Food choice practices are a crucial research topic, but it remains difficult to assess as few methods exist to measure choices and their nutritional content accurately in real-time. The simulation is typically used to conduct experiments on child feeding, involving parents of children between the ages of 3 and 7. Participants walk freely around the buffet, navigating food choices in an environment designed specifically to fit in the bounds of our lab space.

The VR buffet was designed initially for legacy virtual reality hardware but has since been through several iterations and is primarily to be used with the readily available HTC Vive system. Given that most of our study participants lacked any experience with virtual reality, and our goal was to simulate a familiar, real world activity, important design decisions for ease of use needed to be made from the start. Therefore, the input mapping for the Vive controllers was made to be dead simple: with a single click, participants could either add or subtract one portion of food to or from their plate.

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Figure 1: Development of food scale and caloric content.



Figure 2: Virtual pasta vs. real pasta from validation study.

The virtual buffet was created in collaboration with WorldViz, a software development company that specializes in building virtual environments for scientific and technical application. Rather than an artistic approach to graphical fidelity, it was important that the environment and food items appear extremely clear. The IVETA team also worked closely with a dietician at NIH to form a realistic selection of both healthy and unhealthy food options, as well as the caloric content of each food item. The cubic size of the virtual food needed to match the actual calories of real food, and further, the size and appearance of the virtual food also needed to match its real-world equivalent. Therefore, WorldViz explored several approaches for mapping food nutritional content onto 3D virtual foods, ensuring that the food scale matched our specific needs.

The IVETA team conducted a validation study to ensure that the VR buffet was scientifically sound. Our primary concern was to determine if the choices that parents made in virtual reality were correlated to choices made in real life. The validation study found that there is a high correlation between parent food choices for their children in virtual reality and in the real world.

In addition to counting calories from food selection, the VR buffet also provides the ability to collect a subject's physical activity data several times a second, automatically. From this wealth of tracking information, several secondary data analysis-based studies were conducted by both IVETA team members and colleagues at NIH. In an effort to quantify the behavioral process in the context of food choice, one such exploratory study examined parent's translational

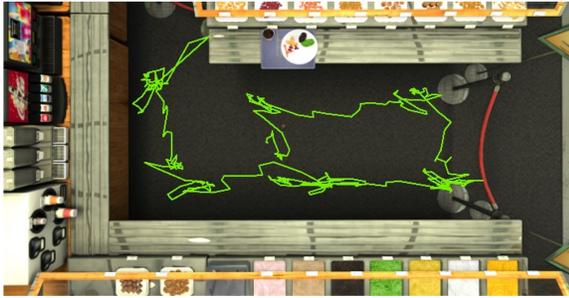


Figure 3: Visualization of path tortuosity in the VR buffet.

movement data as they navigated the virtual buffet. Results suggested that users' path tortuosity (curviness vs straightness of the walked path) may serve as an implicit measure of effort that parents put into food selection. With other exploratory studies having been conducted and more in the pipeline, the team has seen the value of data collected from participants during a long-term trial greatly increased.

Now that several major studies have been conducted using the VR buffet, IVETA has its sights set on the future for this virtual environment. Through the years of development and subsequent experimental trials, we often demoed the virtual buffet to colleagues who have shown a great interest in utilizing it for their own research. With open access in mind, IVETA has begun translating the VR buffet to the increasingly popular Unity engine. Our goal is to provide the buffet for researchers to use and modify as they'd like, and to also open the virtual buffet up for further experiments and applications.

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