

Using a virtual grocery store to simulate shopping behaviour

E. van Herpen¹, T. Yu², E. van den Broek³, & H.C.M. van Trijp⁴

¹Marketing and Consumer Behaviour Group, Wageningen University, Wageningen, the Netherlands,
erica.vanherpen@wur.nl

²Noldus Information Technology and Essensor (at the time this research was undertaken), Wageningen / Ede, the Netherlands, tianna.yue@gmail.com

³Wageningen UR, Wageningen, the Netherlands, e.vandenbroek@wur.nl

⁴Marketing and Consumer Behaviour Group, Wageningen University, Wageningen, the Netherlands,
hans.vantrijp@wur.nl

Introduction

Simulating a store environment by using virtual reality techniques offers important potential advantages for research into consumer behaviour. Through the use of virtual reality, the store can be simulated in a realistic and cost-efficient way [1,9]. This allows researchers to collect data in a tightly controlled but realistic store environment, at relatively low cost and high flexibility [3]. Virtual supermarket systems are being used to study consumers' reactions to price changes of food products [12], emotional responses to retail environments [6], and responses to emptied shelf space [4].

In order to fulfil its promise, a good understanding of which types of responses in a virtual environment resemble real-life behaviour, and which do not, is vital. Identifying areas where caution is needed can prevent unjustified generalizations of virtual reality outcomes [3]. At the same time, it is important to understand what the added realism of virtual reality has to offer, over and above the use of simpler pictorial stimulus materials. For instance, prior research has shown that an increase in visual realism can enhance spatial learning of a virtual layout [7] and effectiveness and efficiency in navigation tasks [8]. The present study builds on and extends this work by comparing a choice task using virtual reality to both a shopping trip in a real brick-and-mortar supermarket (with a similar choice task) and a choice task using product pictures. The key question is in which ways the choice behaviour of consumers is well represented in a virtual supermarket, and on which variables there are deviations from reality.

A few prior studies have examined how consumer choices in a virtual store environment compare to actual sales data (e.g., [2,3]). Yet, there are many reasons why market shares may differ from choices made in a virtual environment, and not all are related to the use of virtual reality as such. Benchmarking against existing methodologies is important to gain insight into the relative strengths and weaknesses of these methods. In virtual reality, as opposed to a pictorial representation, people have a better view of individual products from all angles, have a better feel for the shelf space assigned to products and the way shelves are organized, can manoeuvre through the store, and get a better feel for the overall store atmosphere. Taken together, this should increase people's sense of being present in the virtual store and possibly allow for more habitual consumer behaviour to occur.

The virtual supermarket

The virtual supermarket was displayed using a PC with three LCD screens of 42 inch each, which resulted in a 180 degree field-of-view. The shopping simulation software was developed in collaboration with Green Dino BV (www.greendino.nl), and the research conducted was part of the FOCOM project (<http://www.focom-project.net/>). Participants could navigate through the virtual supermarket using keyboard and mouse. Eye-level was set according to the average adult height. Participants could examine a product in more detail by double clicking on it when standing in its vicinity. This provided them with an enlarged front view of the product itself, and an enlarged view of the shelf tag, which contained a description of the product and its price. The software kept track of the products chosen, the time at which products were selected, and the time that participants spent scrutinizing specific products.

Pretest

Before conducting the main experiment, we performed a pretest ($N = 90$). The objective of this pretest was to examine whether a virtual supermarket environment could engage people to feel more present in the store than a more traditional approach (i.e., using product pictures) would. A sense of “presence” is often considered key to virtual reality experiences [5,10,11,13]. It implies that a person has a sense of being in the virtual environment (rather than being in the research lab). The pretest compared a mock shelf display, a representation of this shelf display in virtual reality and a picture of the same shelf display. Results indicate that the use of a virtual environment can indeed increase the perceived level of presence compared to a pictorial display.

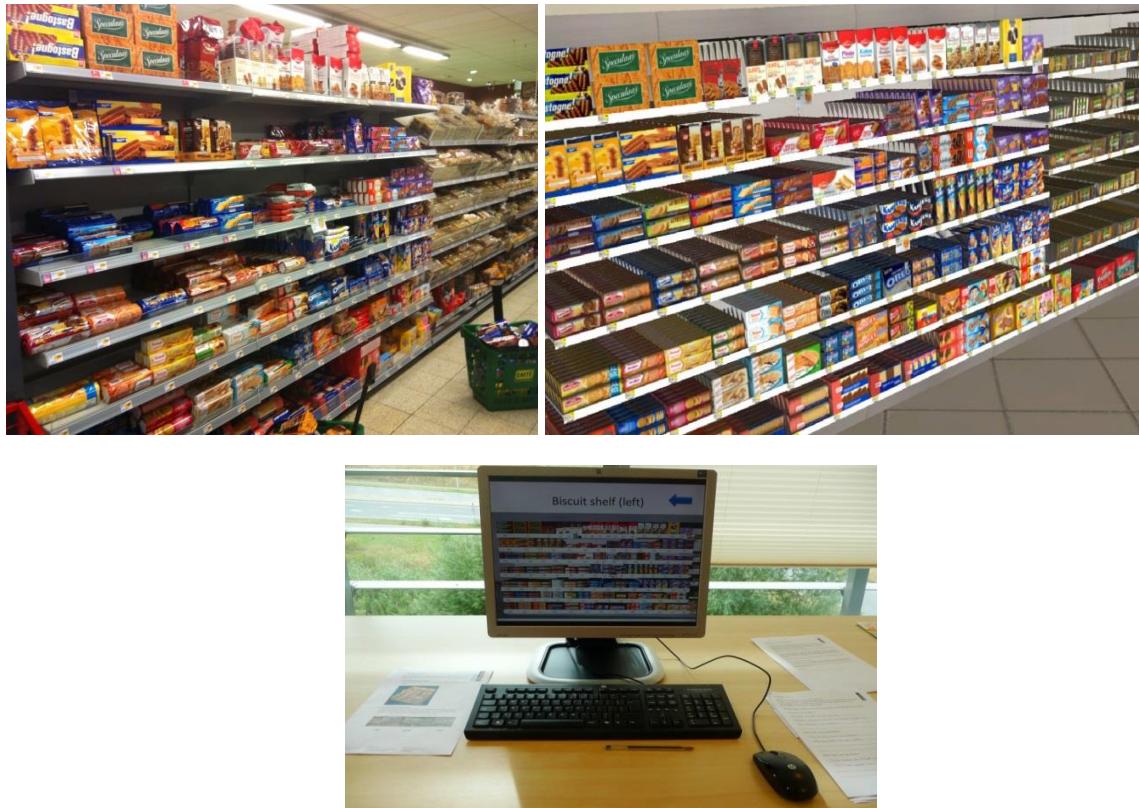
Main experiment

The objective of the main experiment is to examine how consumer behaviour in a virtual environment compares to behaviour in a real-life store and to behaviour when pictorial stimuli are used. Participants ($N = 100$) were recruited by telephone from a consumer panel, and randomly assigned to one of three conditions in a three group design. The pictorial and virtual reality conditions were constructed to match the assortments of fruit/vegetables, biscuits, and milk of a local supermarket. Data collection in the real life store took place one week prior to the data collection using representations of this store, in order to allow for the pictorial and virtual reality representations to be matched closely to the real life situation (e.g., sales promotion material). Examples of the biscuits aisle are provided in Figure 1.

Data collection in the physical store condition took place in a local supermarket. This supermarket contained 31 milk products (none of which had a promotional offering during the data collection period), 32 fruit/vegetable products (five of which were on sale), and 230 biscuits (nine of which were on sale during the week of data collection). In this condition, participants were greeted by a first research assistant at the entrance of the supermarket. They received a brief task instruction and a shopping list containing the three focal product categories. The procedure in the other two conditions was as similar as possible, with the exception that participants in the virtual reality condition could first practice in a virtual store for as long as they needed to feel comfortable with the setup. Participants received the same instruction and shopping list. The virtual supermarket showed a realistic simulation of the actual store. All products from the product categories were presented, in the same shelf position as in the actual supermarket and participants could walk around in the virtual environment using a predefined shopping route and scrutinize products by using the keyboard and mouse. The picture condition showed static screenshots of the virtual store on a regular desktop screen (19 inch). Screenshots showed (a) a view of the whole virtual store, (b) an overall view of the target aisles, (c) a closer view of the shelves with index numbers assigned to the products, and (d) pictures of the each individual product as well as its shelf tag. These were connected using hyperlinks, so that participants could switch from product to product, or from shelf to shelf.

Key dependent variables in this study are the amount of products selected from each product category, the amount of different products selected (as a measure of variety seeking), average price paid, proportion of products bought on sale, and proportion of products bought from top/middle/bottom shelves.

Figure 1. The biscuits aisle in reality, virtual reality, and as picture on screen



Results and discussion

ANOVA analyses were used to examine the amount of products bought for each product category, across the conditions. Results show that consumers tend to buy more products in lab conditions than in the actual store. Examining the amount of different types of products bought (a measure of variety) shows that the increased purchases in the virtual environment appear primarily due to increased variety seeking. Moreover, for several behavioural measures, the behaviour in the physical store is more closely resembled in the virtual environment than in the picture condition. For instance, in the milk category, the virtual supermarket was better able to simulate responses to vertical shelf position. Taken together, results indicate that although not all potential biases in behavioural responses disappear, the virtual supermarket has advantages over the use of pictures when attempting to simulate shopping behaviour.

This has important implications for the potential use of the virtual supermarket by retailers and manufacturers. A virtual store can be used to study a large variety of relevant issues regarding consumer food choices, at the product level (e.g., packaging, labelling), the assortment level (e.g., shelf space allocation) and the store level (e.g., store

layout). The current study indicates that a virtual store can provide insightful information on consumer behaviour, and can more accurately represent this behaviour than is accomplished with pictorial stimuli.

References

1. Berneburg, A. (2007). Interactive 3D simulations in measuring consumer preferences: Friend or foe to test results. *Journal of Interactive Advertising*, 8(1), 1-37.
2. Burke, R. R., Harlam, B. A., Kahn, B. E., & Lodish, L. M. (1992). Comparing dynamic consumer choice in real and computer-simulated environments. *Journal of Consumer Research*, 71-82.
3. Campo, K., Gijsbrechts, E., & Guerra, F. (1999). Computer simulated shopping experiments for analyzing dynamic purchasing patterns: validation and guidelines. *Journal of Empirical Generalisations in Marketing Science*, 4(2).
4. van Herpen, E., Pieters, R., & Zeelenberg, M. (2009). When demand accelerates demand: Trailing the bandwagon. *Journal of Consumer Psychology*, 19(3), 302-312.
5. Lessiter, J., Freeman, J., Keogh, E., & Davidoff, J. (2001). A cross-media presence questionnaire: The ITC-Sense of Presence Inventory. *Presence: Teleoperators and virtual environments*, 10(3), 282-297.
6. Massara, F., Liu, S. S., & Melara, R. D. (2010). Adapting to a retail environment: Modeling consumer-environment interactions. *Journal of Business Research*, 63(7), 673-681.
7. Meijer, F., Geudeke, B. L., & van den Broek, E. L. (2009). Navigating through virtual environments: Visual realism improves spatial cognition. *CyberPsychology & Behavior*, 12(5), 517-521.
8. Meng, F., Zhang, W., & Yang, R. (2014). The development of a panorama manifestation virtual reality system for navigation and a usability comparison with a desktop system. *Behaviour & Information Technology*, 33(2), 133-143.
9. Ruppert, B. (2011). New directions in the use of virtual reality for food shopping: marketing and education perspectives. *Journal of diabetes science and technology*, 5(2), 315-8.
10. Schuemie, M. J., Van Der Straaten, P., Krijn, M., & Van Der Mast, C. A. (2001). Research on presence in virtual reality: A survey. *CyberPsychology & Behavior*, 4(2), 183-201.
11. Steuer, J. (1992). Defining virtual reality: Dimensions determining telepresence. *Journal of communication*, 42(4), 73-93.
12. Waterlander, W., Scarpa, M., Lentz, D., & Steenhuis, I. (2011). The virtual supermarket: An innovative research tool to study consumer food purchasing behaviour. *BMC public health*, 11(1), 589.
13. Witmer, B. G., & Singer, M. J. (1998). Measuring presence in virtual environments: A presence questionnaire. *Presence*, 7(3), 225-240.