**Response to the comments of Reviewer 1.**

We would first like to thank you for your constructive suggestions which have helped us to improve the quality of the manuscript. We reply to all of your comments (repeated in italics), in the risen order.

***Comment1:*** *This is an interesting paper and clearly about a new and promising way of carrying out in-store experiments. I am convinced it has great potentials as a research tool.*

**Authors’ response:** We appreciate your positive feedback.

***Comment2:*** *But the structure needs to be improved. For instance Line 72 to 114 is a making a good case of the promise of the technology already before the start of the paper is getting started.*

*\*It would fit better in the discussion with pros and cons listed - strengths and weaknesses. A table might help do the trick. But discussion rather than intro.*

*\*My main concern is that the paper is mainly attempting to make case - that is demonstrating the promise of the VR technology to study consumer behaviour.*

**Authors’ response:** In response to the reviewer’s comments, we accordingly moved the discussion of the benefits of VS to the discussion section of the paper (line 631 - 647) in revised manuscript).

***Comment3:*** *In that sense the paper is primarily descriptive in the way that it goes through the different steps in an experiment. I consider it more a "recipe" book and users manual - a very good one though - than a proof of the reach of the technology.*

**Authors’ response:** We have taken this comments into account by focusing on one specific procedure (as can be seen in the revised protocol and description of example experiment). This example shows how researchers can apply the desktop virtual supermarket in consumer research.

***Comment4:*** *The weakness is that the paper in its present form is a sort of - with all due respect - "lets tell everything that we know about the thing". The lack of a clear paper structure becomes clear in the introduction that fails to state a clear purpose of the paper. Why is this paper needed - besides describing an interesting and novel technology.*

**Authors’ response:** Thank you for pointing out this weakness. We have strengthened our paper by explicitly stating the importance of our paper in line 126 - 132 as shown below:

Even though the virtual store has been regarded as a promising tool for in-store consumers’ behavior research, expertise in how to use such a virtual store is required to ensure timely and correct preparation and implementation of experiments. Yet, up to now, reported studies that comprehensively describe the procedure to conduct virtual store experiments are very scarce. Therefore, our work aims to describe a protocol for conducting consumer research with the desktop virtual store, which is of vital importance.

***Comment5:*** *The paper could be improved by giving an example on how the tool can be used to understand and maybe even to test a virtual intervention. A fair attempt is given in line 336 and on but it is not completely clear what new insight that this experiment showed*

**Authors’ response:** We apologize for the unclear experimental description. More details of the experimental conditions, store pictures in each condition, the procedure, and a summary of findings have been added to the paper (line 443 - 473). This additional information is expected to clarify the new insights gained from VS experiments. Basically, the representative results support that in-store consumer behavior research (e.g., effects of shelf arrangements), which may not be convenient to do in the real store, can flexibly be conducted in the virtual store.

***Comment6:*** *Needless to say writing papers in this field is difficult since the technology needs to be "sensed" in real life rather than in a paper. But I think the authors could do more to "walk the reader through". References are done in parenthesis but could be made more active by using phrasing such a "as can be seen in the first picture ………".*

**Authors’ response:** Thank you for your understanding and suggestions. The references of figures throughout the revised paper have been changed according to your suggestion.

**Response to the comments of Reviewer 2.**

We would like to thank the reviewer for the time and feedback to improve our paper. We will respond to the comments (repeated in italics), in the order in which these are risen.

***Comment1:*** *This is an interesting article and it is a great idea to publish the virtual supermarket method as a video! Overall, the manuscript is well written,*

**Authors’ response:** Thank you for your encouraging words.

***Comment2:*** *however, it reads more like a normal paper rather than an outline that could directly be used to produce a video.*

**Authors’ response:** We agree with your comment that the paper should be used as an outline to run an experiment and to produce a video. This video should enable researchers to replicate our protocol. Accordingly, the protocol has thus been rewritten in more specific steps that can be used to produce a video (in page 4 - 12). Some more general suggestions from the previous version of the protocol have been moved to the discussion section (see line 608 - 630).

***Comment3:*** *The highlights in the protocol section are useful, but it is unclear which sections of the example results or the discussions would be included. The format of the video is not specified and at this stage it is not clear, which information will be in it. E.g. Will the example results be discussed in the video or are they just for illustration. If they are just for illustration, I suggest to only present the relevant information in this protocol and refer to a paper for the details.*

**Authors’ response:** We apologize for the unclear information. We plan to present a table and several figures to illustrate the results that researchers can acquire from the virtual store and the data management program. Specifically, after presenting how to export the data, Table 1 then illustrates the results from the data management program. Then Figure 8 - 10 show the effect of store layouts on products examined and products bough. The examples demonstrate how to interpret and present data from the VS. In addition, a brief discussion will be presented in a video.

However we have contacted the editor and we have been informed that the introduction, results and discussion will be part of the video but parts of those do not need highlighting.

***Comment4:*** *Results*  
*The aim of the study should be clearly stated at the beginning of this section - e.g. Testing the effect of different store layouts on the number of product purchases.*

**Authors’ response:** Thank you for pointing this out. The aim of the study has now been explicitly stated in the revised paper (line 443 - 446). We additionally provide more details of the experiment to clarify the representative results.

***Comment5:*** *If these results are presented as example in the video, this should be mentioned in the extended abstract.*

**Authors’ response:** A brief explanation about the example experiment and the representative results has been added to the extended abstract in a revised paper as follows:

The protocol is illustrated by example of a store layout experiment showing that shelf length and shelf orientation influence shopping and movement related behaviors.

***Comment6:*** *There are no blue highlights in the 'Representative Results' section, but as I understand, parts of the study will be presented in the video. Highlights in this section would be helpful to decide whether the sections would be useful for inclusion in the video.*

**Authors’ response:** We agree with you that highlighting other section will be useful. We however have contacted the editor and we are informed that parts of the introduction, results and discussion do not need highlighting.

***Comment7:*** *It is unclear whether the presented results will be published in full detail in a separate paper. If so, a reference to this should be made.*

**Authors’ response:** The results presented in this paper are original and have not yet been published in a paper. Consequently, we did not cite such a paper.

***Comment8:*** *The authors mention that participants were provided with a utilitarian or a hedonic shopping motivation, but results regarding this manipulation were not presented.*

**Authors’ response:** We originally excluded the results of shopping motivation because there are no significant interaction effects of shopping motivation and store layout, and including this additional variable does not add to the illustration. However, you are right that we should make this point clear to readers. We accordingly now briefly mention the effects of shopping motivation (line 512 - 517), in the following text:

In addition to the effects of shelf attributes, the current research also focuses on shopping motivations to understand their influence on in-store shopping behaviors. The results reveal significant main effects of shopping motivations on all in-store behavioral variables. Consumers with a hedonic motivation searched for (clicked on) and purchased more products than consumers with a utilitarian motivation. They also spent more time and walked a longer distance. The interaction effect of shopping motivation and store shelf attributes was not significant.

***Comment9:*** *Detailed statistical results, which will not be presented in the video, could be omitted in this manuscript.*

**Authors’ response:** Detailed statistical results have been erased to improve the representative results.

***Comment10:*** *Figures, Figure 6*  
*It would be great if significant differences and interactions can be indicated/highlighted in the video.*

**Authors’ response:** We fully agree with you, and these significant interactions in the graph are currently indicated by the \* sign which will be included in the video.

***Comment11:*** *Images: the screenshots are too blurry to be read, especially 4 and 5.*

**Authors’ response:** We apologize for the blurriness of these screenshots. New screenshots with enhanced resolution have been added.

***Comment12:*** *Discussion*  
*The discussion is well-written. The advantages and disadvantages are addressed.*

**Authors’ response:** We appreciate and thank you for your positive feedback.

***Comment13:*** *It would be useful to have some practical advice for researchers who would want to work with the supermarket. E.g. Is this a single license, does the supermarket company offer support with programming,*

**Authors’ response:** We agree that practical advice is useful. Licensing agreements (including technical support) can be made on an individual basis through the research company stated in the table of materials/reagents for detailed information.

***Comment14:*** *Some more details on the cost effectiveness would be useful: What would a supermarket study with 200 participants cost, compared with a study in a real life setting? Or, how many virtual studies would one need run to make the initial investment in the equipment worthwhile. Do you do contract research? Can external researcher access the infrastructure.*

**Authors’ response:** The cost of research is very specific to each study, depending on the study objectives, the types of manipulations involved, and study design. We therefore suggest contacts for contract research / system purchase in the tables of materials/reagents for interested readers.

**Response to the comments of Reviewer 3.**

We really appreciate the valuable suggestions. We will respond to your comments one-by-one (repeated in italics).

***Comment1:*** *Minor Concerns:  
The authors describe presence-theory by primarily Witmer and Singer, but there are quite many variations of presence and immersion. While Witmer and Singer has more of a perceptual view on immersion, e.g. Mel Slater views it as a property of the system i.e. the higher the fidelity of e.g. displays, tracking etc. all contribute to a greater level of immersion. The authors should consider at least mentioning some of the alternative definitions of immersion and presence (I can recommend "Slater (2009) - Place illusion and plausibility can lead to realistic behaviour in immersive virtual environments" (*[*http://rstb.royalsocietypublishing.org/content/364/1535/3549.short*](http://rstb.royalsocietypublishing.org/content/364/1535/3549.short)*)*

**Authors’ response:** In response to your feedback, we have consulted other definitions of immersion and presence. This topic has been included in the paper on line 92 – 105.

***Comment2:*** *This leads to the next concern. There's a consensus within the field that there is different levels of immersion depending on the VR-system. One somewhat crude categorisation classifies 3 states: 1. Non-immersive VR (Desktop VR), 2. Semi-immersive VR (projection e.g. CAVE-systems), 3. Fully-immersive (head-mounted displays e.g. tethered). It seems the authors are using primarily desktop VR (3 monitor setup), and I consider whether or not that may influence the level of immersion hence also effects the 'response-as-if-real' in the presented VE. Have the authors conducted, or are familiar with comparative studies to evaluate whether or not there's a significant effect of the different categories?*

**Authors’ response:** This is an interesting point. From our experience we would say that the VR-system would indeed influence the level of immersion. However, since the other VR-systems are in an early stage of development, there is no literature comparing their effects. Moreover, Slater (2009) stated that, currently, a comparison of immersion among different VR systems is problematic because each system is supported by different sensorimotor contingencies. We therefore suggest the comparison among different VR-system as an opportunity in future research, in the discussion section (line 696 - 700).   
***Comment3:*** *Additional Comments to Authors:  
The described application and the pipeline for conducting consumer behavior research in virtual reality is really thorough and interesting. I would like the to experience a demonstration if the opportunity should arise. The authors are welcome to contact me for additional inquiries and other recommended reading.*

**Authors’ response:** We really appreciate your offer. It would be our pleasure to host you and arrange a demonstration session if you come to our group. We will try to arrange this event and contact you back when we are ready.

**Response to the comments of Reviewer 4.**

We would like to thank this reviewer for the feedback to improve our manuscript. We have changed our manuscript according to these suggestions (repeated in italics).

***Comment1:*** *Major Concerns:*  
*The authors did not cover alternative Virtual Reality techniques that could have been adopted in order to obtain similar results.*

**Authors’ response:**

Thank you for pointing this out. We have added information about alternative virtual reality techniques in the discussion (line 669 - 700). Since the use of VR is in an early stage of development, studies describing and comparing different virtual reality technologies are scarce. The objective of the current study is to present one specific virtual store and provide detailed instructions on its use in consumer behavior studies, which is now more clearly stated in the abstracts and introduction. Given this objective, alternative techniques are mentioned but not explained in detail.

***Comment2:*** *On top of this, the issue of realism of the virtual models could have been addressed in a more extensive manner, taking into consideration presence and immersion principles.*

**Authors’ response:** In response to your feedback, we discuss the view of Slater on immersion in line 92 – 105. Slater argues that the fidelity of displays (which would relate to the realism of the 2D and 3D models) influences the experience of immersion. We now also mention our experience about the likely effects of these models on feelings of presence and immersion in the discussion (line 618 - 621). However, to our knowledge there is no empirical data available on this issue. We therefore suggest this for future research.

***Comment3:****Minor Concerns:*  
*A more extensive description of the conditions presented in the representative results could be addressed for clarity.*

**Authors’ response:** We apologize for this unclear description of the experimental conditions. A detailed description of the experimental conditions and pictures of the store in each condition have been added (line 450 - 453 and line 461 - 473) for clarification.