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*Poster*

# Influence of Pseudo-haptic Weight on Product Rarity Valuation

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**Abstract**

*There has been an increasing number of online shopping services that employ VR technologies so that they give customers more realistic experiences and amplify purchase intention. Meanwhile, it is known that the actual product's weight perception affects its valuation. However, verification of this phenomenon in virtual environments has rarely been reported. This study investigated the influence of weight perception generated by pseudo-haptics on product rarity valuation and purchase intention in virtual environments. The results suggest that, although individual and product differences were observed, the overall trend was that product rarity valuation was higher when the user's perceived weight was heavier than when the perceived weight was lighter.*

**CCS Concepts**

• ***Methods and Applications*** → *Haptics;*

## 1. Introduction

In recent years, more and more cases of sensory marketing using virtual reality (VR) have been introduced in online shopping. By stimulating various senses via VR, it is becoming possible to provide not only the realistic appearance of products, but also realistic experiences, stimulating the customers desire to buy.

Embodied cognition is one of the most frequently discussed theories in the field of sensory marketing. According to past research on embodied cognition, the sensation of 'weight' activates abstract concepts such as 'valuable' and 'important', and influences their judgments and behaviours [JLS09].

We also focus on the pseudo-haptics which is an illusory technique to elicit weight perception without some devices. Specifically, when a user lifts an object in virtual environments, it is possible to present a heavier (lighter) perception to the user than the actual hand by presenting a smaller (larger) amount of movement of the hand or object visible in virtual environments than the actual hand movement [SGH*19].

It is assumed that a combination of two theory can improve product valuation. However, this has not yet been fully tested. Therefore, this study examines the influence of weight perception generated by pseudo-haptics on customers' product valuation and purchase intention in VR shopping experiences.

## 2. Method

Participants wore an HMD (Oculus Rift S) and controllers and repeatedly performed the task of lifting a product with their hands to a certain height in virtual environments, releasing it, and then answering the questions. A total of six questions were prepared to measure product rarity, purchase intention, and psychological ownership, and each was rated on a seven-point Likert scale. (1: strongly disagree - 7: strongly agree). We explained them that they were shopping online in virtual environments and that the actual product they purchased would be delivered to their homes. There were 15 participants (13 males and 2 females, aged 21-25 years, mean age 23.2 years). All participants had no prior knowledge of the experiment.

In this experiment, the following $5 \times 8 = 40$ conditions were presented to the participants in random order. We prepared five conditions (0.6, 0.8, 1.0, 1.2, and 1.4) for the control / display (CD) ratio of pseudo-haptics in order to vary the weight perceived by the participants. While the user was grasping the product, the 3D models of the hand and the product in virtual environments were rendered at the position of the real distance of the raised hand × CD ratio. To examine the differences in effectiveness between products, we prepared 3D models of eight different products (Watch, Gold Ring, Shoes, Cap, Hammer, Speaker, Pen, and Knife). The products that seemed to differ in two product valuation criteria were selected: "Do you think the heavier or lighter the product is, the more valuable it is?" and "When purchasing the product, which do you think is more important, emotional value or functional value?" Emotional value is "a value related to emotions such as pleasure and excitement that can be obtained from a product," and functional value is "a value related to performance such as problem solving and practicality that can be obtained from a product." After the experiment, participants were asked to rate the two product valuation criteria on a seven-point Likert scale. The average values of the ratings are shown in Figure 1.

Based on the hypothesis that Need for Touch (NFT) is a factor in the difference in effectiveness among users, we measured partic-



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ipants' NFT in a post-experiment questionnaire. NFT is a measure of the extent to which consumers require contact with a product when they make a decision to purchase it [PC03].

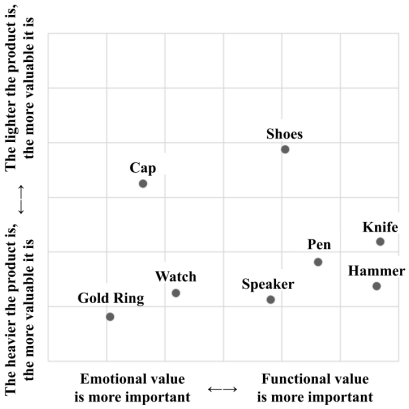


**Figure 1:** *Matrix of product valuation criteria*

## 3. Result & Discussion

For each of the two questions on rarity, a two-way analysis of variance was conducted after an Aligned Rank Transform (ART) was performed on the ratings answered by all participants for each product. As a result, significant differences were found for the main effects of the product and CD ratio conditions ($p$<.0001 for product, $p$<.0001 for CD ratio). However, since it is natural that different products have different values, we omitted the analysis of the main effect of the product condition. No significant differences were found for the interaction effects. For the main effect of the CD ratio condition, a Tukey test was conducted as a subtest (Figure 2). Compared to the baseline (i.e., 1.0 of CD ratio), two questions had higher rarity ratings when the CD ratio was 0.6, and only one question had higher rarity ratings when the CD ratio was 0.8. In contrast, there was no significant difference in rarity ratings in the high CD ratio (lighter perceived weight) condition compared to baseline. In comparison with the non-baseline condition, the rarity rating was higher in the CD ratio of 0.6 than in any other condition, and in the CD ratio of 0.8, the rarity rating was sometimes higher than in the other conditions, depending on the question. These results indicate that the product valuation is enhanced by the weight perceived by pseudo-haptics when holding a product in virtual environments.

For the main effect of the CD ratio condition per user, a main effect was observed in six of the fifteen participants. These results indicate that there are individual differences in the effect of perceived weight on product valuation. On the other hand, no correlation was found with the user's NFT. This suggests that individual characteristics of NFT do not have a significant effect on the effect. Likewise, the psychological ownership also none of interaction with product valuation.

For the main effects of the CD ratio condition for each product, watch, gold ring, speaker, and pen showed main effects for the two questions on rarity, while hammer and knife showed main effects for only one of the questions. No main effects were found for cap and shoes. This result suggests that the effect of weight presentation may be lower for items for which lighter weight is more valuable (e.g., cap, shoes) and for items for which functional value is strongly given importance to (e.g., hammer, knife).

Although certain findings were obtained regarding individual and product characteristics related to the effects of improving product valuation, there is still room for further study, and we would like to address this issue in the future.

No significant differences in purchase intention were found in this experiment. This result suggests that there is no or small effect of embodied cognition by weight perception on purchase intention. As several participants commented that they made their decision based on their current level of need and their preference for the appearance of the product, it can be assumed that factors related to purchase intention were not only rarity valuation, and therefore did not appear in the results. Our future work include investigating other factors that have stronger influence on purchase intention.

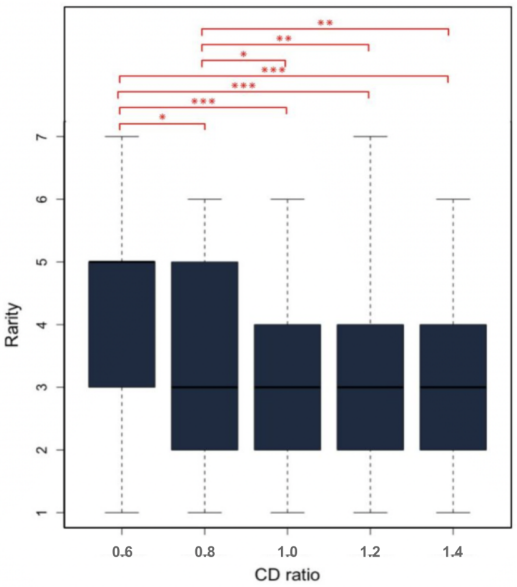


**Figure 2:** *Subjective ratings of rarity across CD ratio.*

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