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# Which Hierarchical Levels of Value Description of Design Concepts Enhance Anticipated UX? Effects of Product Type on User Expectations

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**Abstract:** This study investigates the effects of the description of design concepts and the ease of anticipating how to use products on users' subjective evaluation before use. The findings of this study contribute to considerations of a method of value transmission to be used to enhance the anticipated UX. Usefulness, usableness, desirableness, and willingness to use were compared among four conditions with different levels of value evaluation structure (product attributes, functional benefits, emotional benefits, essential value). The results reveal that the participants experienced a greater expectation of product attributes when they more easily imagined using them. On the other hand, participants felt a high expectation of emotional benefit when they found it difficult to anticipate how to use a product.

**Keywords:** user experience (UX); anticipated UX; design concept; user expectation

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## 1. Introduction

When designing a product or service, user requirements are often explained based on Maslow's hierarchy of needs [1]. Hancock et al. [2] proposed a five-level hierarchy of design requirements (1st: safety, 2nd: functionality, 3rd: usability, 4th: pleasurable experience, and 5th: individuation) based on Maslow's hierarchy of needs. In the 20th century, mass production and consumption became typical, and designers sought to emphasize functionality and safety; this they termed function-centered design [3]. However, in the 21st century, the growing overabundance of goods brings a greater need to sell products with good functionality and design. It is also increasingly necessary to decommoditize products and services [4,5]. Recently, this trend has become more pronounced, and the importance of the perspectives of "pleasurable experience" and "individuation", as described by Hancock et al. [2], has increased. In other words, users do not simply consume products and services, but find value in experiences (experience value) that give them pleasure and satisfaction through their interactions; products and services should also seek to generate empathy by aligning with users' values [6]. For this reason, design concepts should not focus only on product quality, such as style and function, but also on the quality of the user's experience (UX) and satisfaction [7–9].

This approach, focused on improving UX, is termed "UX design" and is considered necessary in the industry [10,11]. The process of UX design consists of three main stages: "discovery of the experience value to be provided", "realization of the method to provide that value", and "communication of the value to the user" [12]. UX-related research mainly focuses on understanding and organizing the concept of UX [13–15], examining methods for measuring and evaluating UX and user satisfaction [16–18], and practical study regarding UX design [19–22]. Most of such research focuses on "value discovery"

and "value realization" [23]. In contrast, limited efforts have been made to assure "value communication".

Roto et al. [24] classified UX into four categories (anticipated UX, momentary UX, episodic UX, and cumulative UX) from a temporal perspective according to the timing of the use of products and services. Anticipated UX refers to the prediction and expectation of an experience prior to use, based on information about the object [24,25]. In other words, enhancing the anticipated UX is considered to lead to actual purchase and use; for this purpose, it is important to appropriately communicate the experience value to users. However, although anticipated UX is considered in UX design, more knowledge development about "when and how to communicate value to increase the anticipated UX" must be attained. For example, Noborio et al. [26] examined the method of concept testing during the proof-of-concept phase of the UX design, showing that the results of participant evaluation differed depending on the method of concept presentation. However, the purpose of this study was to examine appropriate expressions in concept testing, and it remains to be discovered in what situations and how we may convey values to enhance anticipated UX. Ando [27] typified the mental models of users at the time of product purchase, and investigated what kind of information each type of user obtained at the time of purchase and how their evaluation of a product changed over a long period of subsequent use. The results of this study suggest that each user type has a value communication strategy; however, the relationship between the specific method of value communication and expectations remains to be clarified. Therefore, the current study aimed to gain insight into the methods of communicating design concepts that influence the goodness of the anticipated UX.

During the UX design process, there are many cases [12,28–31] in which experience value is represented by multiple hierarchical structures reflecting the means-end chain model of Reynolds et al. [32]. A typical case in which values are expressed in a hierarchical structure is the idea of hierarchical structures in the evaluation grid method proposed by Sanai et al. [31]. As shown in Figure 1, the hierarchical structure is divided into "intrinsic value", "emotional benefit", "functional benefit", "product attribute", and "product attribute", starting from the highest point of the hierarchy. Higher points of the hierarchy are associated with more abstract and subjective concepts; lower hierarchy concepts tend to be more concrete and objective. Although some differences in the means of expression exist, in most cases, the hierarchical structure of experience value is expressed as such a concrete–abstract (purpose–measure) relationship. Information at each hierarchical level is a term that expresses the value provided by the target product or service and provides important information for communicating value to the user.

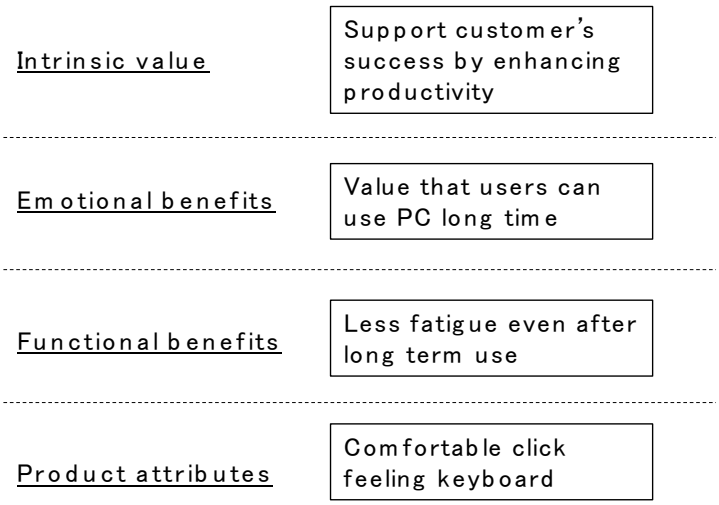


**Figure 1.** An example of a part of the hierarchical structure of the design concept (notebook PC).

Users' assumptions and expectations differ depending on which hierarchical level of information is conveyed. For example, information at higher levels is required to be more abstract, making it difficult to understand which functions are realized, whereas information at lower levels is closer to concrete product specifications; as such, it is more difficult to imagine the usage scenarios that will result in a particular kind of experience. This is also expected to vary depending on the characteristics of the product and the user's level of involvement. For example, based on practical experience, Ueda [33] considered that intrinsic value and emotional benefits are preferred as messages in advertising and sales during the introductory phase of a product, whereas functional benefits and product attributes are preferred during the mature phase. This is because in the case of a product in the introductory stage, users are required to better learn what kind of product it is. It is challenging to imagine a usage scenario with only objective information such as product attributes.

In contrast, for a product in the mature stage, the type of product is already well-known to the public, and its usage method and scenario can be easily imagined. Thus, more concrete and objective information is required. In the FCB grid, an advertising communication model proposed by Vaughn [34], products are classified into four categories based on a $2 \times 2$ matrix of information processing (thinking-type or emotional-type) and the level of involvement at the time of purchase, such that different customer communication strategies are appropriate for each category. The FCB grid demonstrates that different customer communication strategies are suitable for each of the four classifications.

Based on the above considerations, the hierarchical level of value that should be presented to users to enhance their anticipated UX differs depending on product type; however, there is no clear experimental evidence to address this point. Therefore, in this study, we focus on the hierarchical structure of product value expressions to investigate the hierarchical level of value expressions of design concept that should be communicated in order to raise user expectations in multiple product categories. As noted above, it is possible that the level of product penetration among users, the information processing method at the time of purchase consideration, and the level of product involvement may have an influence; as such, differences arising from these influences were examined. The following hypotheses, H1 and H2, were formulated to determine the influence of these factors on users' anticipated UX:

**H1:** *More concrete and objective concept expressions enhance users' expectations for products that are well-known and for which the method of use may be easily imagined.*

**H2:** *Objective functions enhance users' expectations for thought-oriented products, whereas subjective benefits allowing users to imagine the experience of usage scenes enhance users' expectations for emotion-oriented products.*

For H1, we considered that the concept expressions that raise expectations differ depending on whether a user can easily imagine specific experiences, such as methods of use and usage scenarios. For H2, in the case of emotionally oriented products (e.g., products that reflect one's tastes in home life), a subjective quality of experience, including emotional aspects, is required, and subjective expressions that allow one to imagine usage scenarios are considered to raise expectations easily. On the other hand, objective expressions of function are preferred when selecting products after careful consideration of their effectiveness and efficiency, such as devices used for work. The FCB grid classifies a wide range of products, including home appliances, cosmetics, and food products, but is influenced by concerns about the confounding effects of such large differences in product categories. Therefore, we chose to focus on ICT devices of particular interest in UX design, and for which much interaction with users is generated.

## 2. Methods

### *2.1. Participants*

Fifty-two participants (male: 31, female: 19, mean: 38.94 years old, SD: 6.30) participated in the experiment. Participants were recruited via a crowdsourcing website and were asked to respond to a web-based questionnaire (Google form). The purpose and procedures of the experiment were fully explained in writing in advance, and written informed consent was obtained.

### *2.2. Tasks*

Participants were asked to assume that they were considering the purchase of a particular product and were therefore comparing various products. Four product cards were presented per product category. Figure 2 shows an example of the cards presented; all four product cards contained the same product picture and four different design concepts for the product's features. The design concepts differ in terms of the hierarchy of the value evaluation structure, although the functions characterizing the products are equivalent. The value evaluation structure assumed in Figure 2 is shown in Figure 3. Herein, based on the hierarchical structure of value evaluation expressed using an evaluation grid method [31], four hierarchical levels were assumed (in the following order) from the lower concepts: product attributes, functional benefits, emotional benefits, and intrinsic value. The value expressions at each level were written on each card as design concepts. The definitions of each hierarchy are shown in Table 1. Lower hierarchies are associated with more concrete and objective expressions, whereas higher hierarchies are more abstract and subjective in expression. Participants were asked to compare the four product cards and rank them in order from 1 to 4 in terms of their usefulness, usableness, desirableness, and willingness to use, with 1 being the most promising and 4 being the least promising. Participants were not allowed to rank the products equally and were instructed to rank the products by the smallest difference.

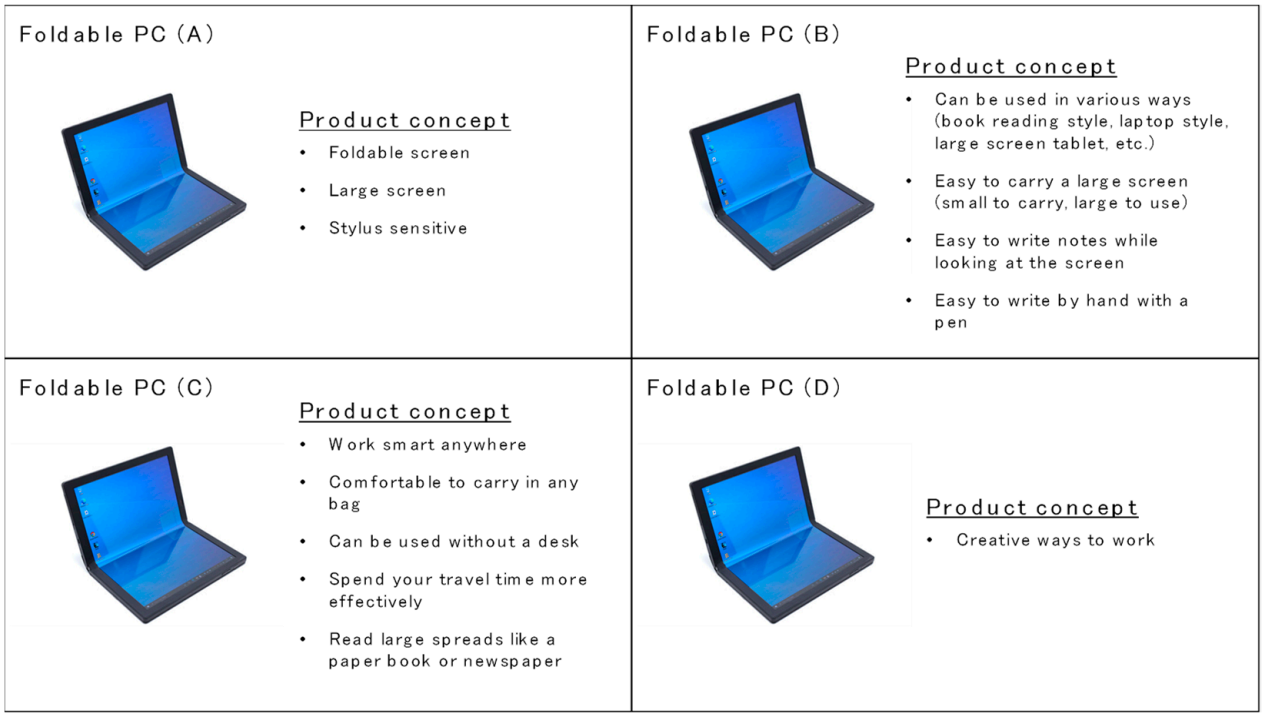


**Figure 2.** The product card of a foldable PC (original provided in Japanese). (**A**) product attributes, (**B**) functional benefits, (**C**) emotional benefits, (**D**) intrinsic value.

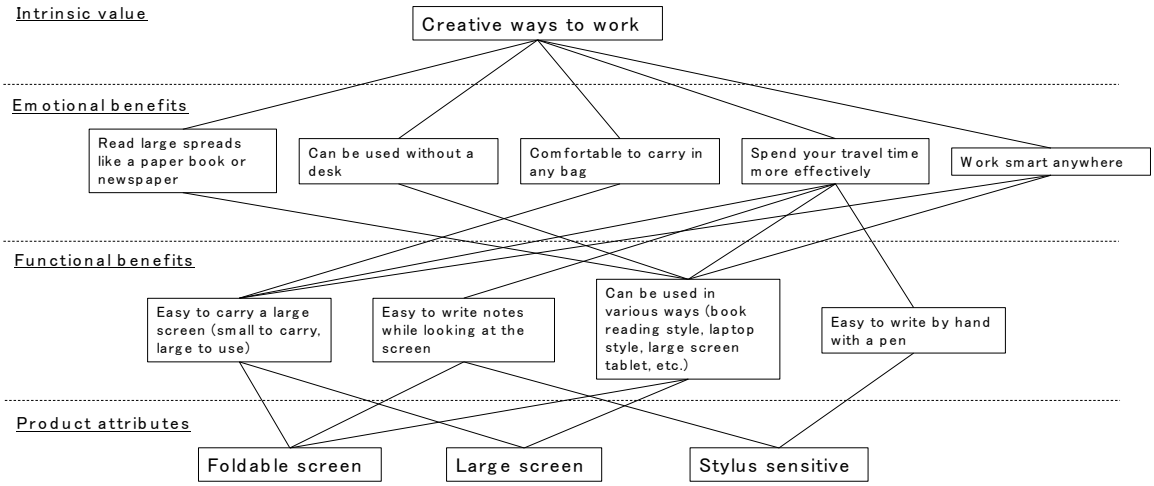


**Figure 3.** An example of the value evaluation structure for a foldable PC.

**Table 1.** Definition of each value expression level.

| Value Expression Level | Definition |
|---|---|
| Product attribute | Physical characteristics of the product |
| Functional benefit | Objective and functional utility related to the function of the product derived directly from its attributes |
| Emotional benefit | Subjective utility of the user as perceived by objective benefits |
| Intrinsic value | Intrinsic needs of the user |

### *2.3. Design and Procedure*

The experimental factors included the expression of the design concept (four levels: product attributes, functional benefits, emotional benefits, and intrinsic value) and the product category (four levels: foldable PC, notebook PC, smart speaker, and smartphone), both of which were within-participant factors. To verify hypotheses H1 and H2, we selected four product categories considered representative of each quadrant based on the two axes of Table 2. First, we selected notebook PCs and smartphones as products that are already in widespread use, are well-known to the general public, and are part of a mature market with a high penetration rate, such that users can easily imagine how to use them. For comparison, a foldable PC and smart speaker were selected as innovative products that have yet to be widely adopted and are still in the introduction phase. The comparison of these products will be used to verify H1. Foldable and notebook PCs are primarily used for business purposes and are considered thinking-type products in the FCB grid. In contrast, smart speakers and smartphones are often used in the home and are considered to be emotional-type products. By comparing these products, we evaluated H2. The product cards presented in this experiment, except foldable PCs (Figure 2), are shown in Figures 4–6.

**Table 2.** Positioning of each product category in this study.

| | **Introductory Phase** | **Mature Phase** |
|---|---|---|
| Mainly business use (thinking type) | Foldable PC | Notebook PC |
| Mainly home life use (emotional type) | Smart speaker | Smartphone |

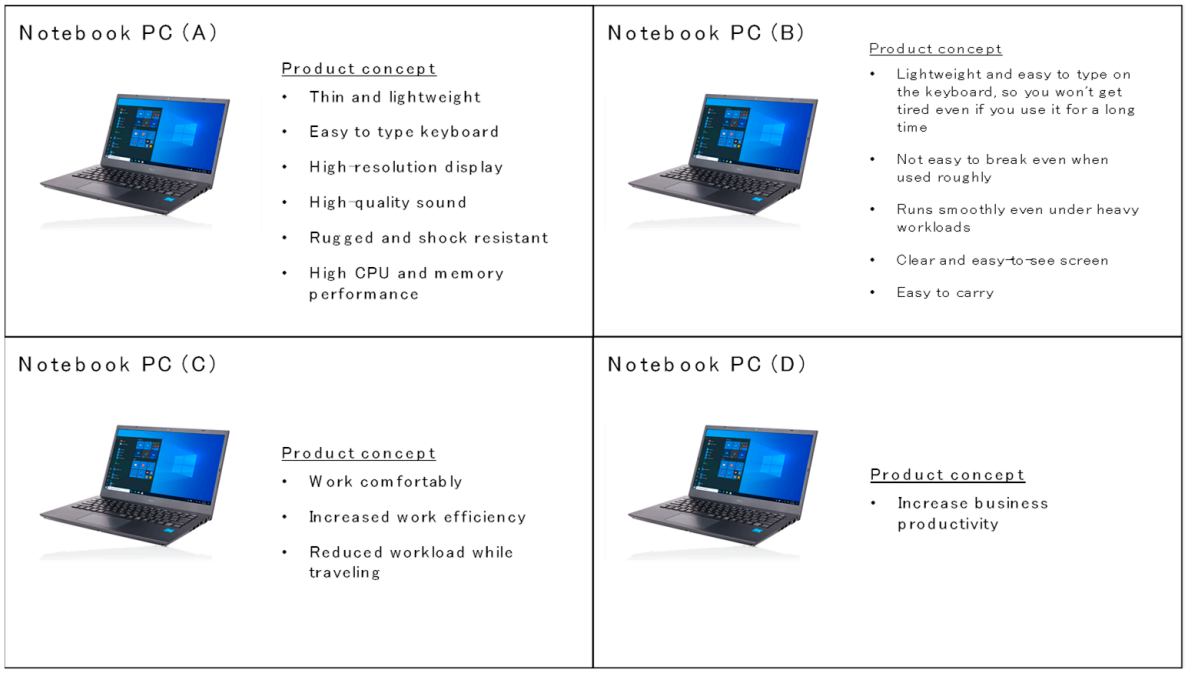


**Figure 4.** The product card of a notebook PC (original provided in Japanese). (**A**) product attributes, (**B**) functional benefits, (**C**) emotional benefits, (**D**) intrinsic value.

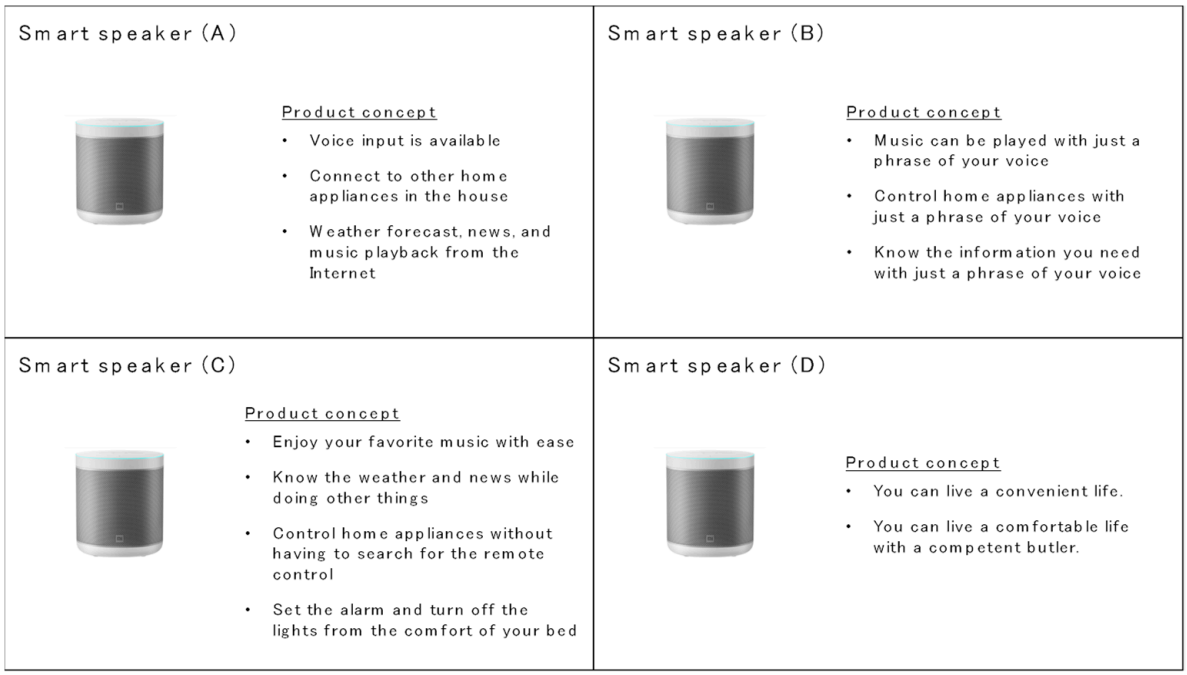


**Figure 5.** The product card of a smart speaker PC (original provided in Japanese). (**A**) product attributes, (**B**) functional benefits, (**C**) emotional benefits, (**D**) intrinsic value.

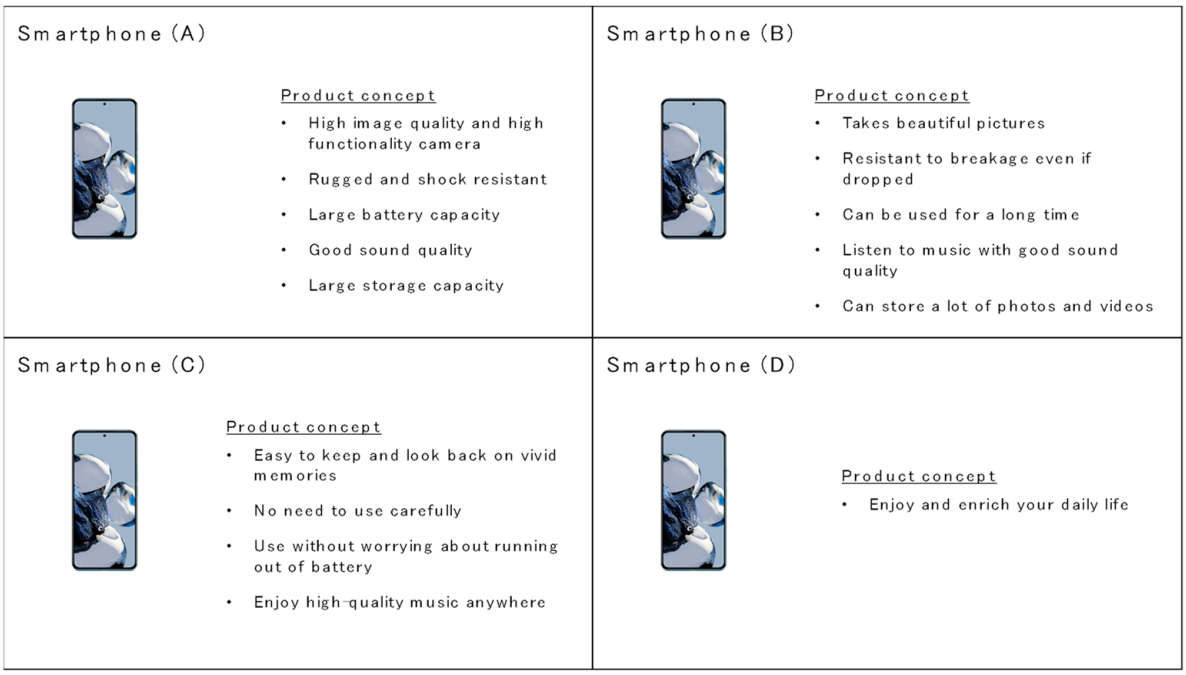


**Figure 6.** The product card of a smartphone PC (original provided in Japanese). (**A**) product attributes, (**B**) functional benefits, (**C**) emotional benefits, (**D**) intrinsic value.

The product categories targeted in this study were all ICT devices, because according to the FCB grid, ICT devices are considered to have a strong thinking-type aspect. Nonetheless, when completely different product categories (e.g., food and cosmetics) were included, there was concern that factors other than H1 and H2 might need to be clarified for the results. The FCB grid also mentions differences in the degree of involvement. Ando et al. [35] suggested that the level of product involvement influences UX evaluation. Therefore, in this study, we measured the degree of product involvement in ICT equipment as a covariate.

After obtaining informed consent on the web screen, the participants were asked to answer questions using a Google form. The questionnaire was presented in the order of (1) foldable PC, (2) notebook PC, (3) smart speaker, and (4) smartphone. For each product, the product card was first presented. After the participants carefully read the card, they were asked to rank each product in usableness, usefulness, desirableness, and willingness to use. After all the questions for a product were completed, the participants were asked about the following product, and the presentation of the product cards and the questions were repeated similarly. The order in which the product cards were presented was the same for all participants in this study, because this experiment used a questionnaire format and the products were not related to each other, so the order effect of the order of the product cards was not considered necessary.

### *2.4. Measurement Items*

#### 2.4.1. Estimated Index of the Degree of Anticipated UX

Four product cards were evaluated for each product category in terms of usefulness, usableness, desirableness, and willingness to use. The participants were asked to compare and rank the product cards in the order in which they perceived each aspect. Null and Cherry listed usefulness, usableness, and desirableness as the three attributes of a product [36], and Yamazaki et al. [37] stated that evaluation based on these three perspectives is effective when comprehensively evaluating a product. Since anticipated UX involves predicting, imagining, and expecting the experience of using a product when imagining the experience before using it, we considered these three attributes, together with imagined willingness to use the product when looking at its product card, to be

indicators that could be used to estimate the quality of an anticipated UX. An example of the questionnaire items is shown in Table 3.

**Table 3.** Examples of the questionnaire items for foldable PCs (original provided in Japanese).

| |
|---|
| Please rank the above Foldable PCs (A)~(D) in order of their usableness to you, with #1 being the most usable product. |
| Please rank the above Foldable PCs (A)~(D) in order of their usefulness to you, with #1 being the most useful product. |
| Please rank the above Foldable PCs (A)~(D) in order of their desirableness to you, with #1 being the most desirable product. |
| Please rank the above Foldable PCs (A)~(D) in order of your willingness to use them, with #1 being the product you feel most motivated to use. |

#### 2.4.2. Ease of Imagining Usage

The participants were asked how well they could visualize the use of each product category on a five-point Likert scale (1: could not visualize at all, 5: could visualize well).

#### 2.4.3. Product Involvement

In order to understand the level of product involvement of the participants in general, the product involvement scale for interactive products proposed by Ando [38] was administered on a five-point Likert scale (1: not at all applicable, 5: very applicable). The ten-item scale is shown in Table 4. According to Ando [38], a total score of the ten items was used as a score of product involvement.

**Table 4.** Ando's product involvement scale for interactive products (*: inverted item, original provided in Japanese).

| | |
|---|---|
| Q1 | I find this product a pleasure to use. |
| Q2 | This product is related to my hobbies and interests. |
| Q3 | I can imagine myself actively using the product. |
| Q4 | This product reflects my personality. |
| Q5 | I would like to have a new model when it is released. |
| Q6 | I am very interested in new models when they are released. |
| Q7 | I have a general knowledge of the functions of new models. |
| Q8 * | I cannot imagine what effect this product will have on my life. |
| Q9 * | I do not know how to use this product. |
| Q10 * | I cannot imagine how to use this product for my own benefit. |

### *2.5. Statistical Analysis*

The ranking results of the product cards for each product category are ordinal scales, but they were converted into normalized scores for interval scales according to the normalized ranking method [39], then analyzed as quantitative data. A higher normalized score indicates a higher evaluation value (rank). Then, a two-way repeated-measures ANCOVA was conducted for each index of usefulness, usableness, desirableness, and willingness to use, with the method of expression of the design concept and product category as factors, and the degree of product involvement as a covariate. A simple main effect test was conducted because the effect of product involvement was found to be very small for all indicators. The interaction between the expression method and product category was significant. Additionally, to confirm the position of the product category, differences in the ease of use imagining among different product categories were investigated by a repeated-measures one-way ANOVA and post hoc tests. The Holm method was used for

multiple comparisons. HAD 18.0 [40] was used as statistical analysis software. As for the sample size, the required sample size was calculated by GPower 3.1 for an effect size f = 0.25, $\alpha = 0.05$, and power (1-β) = 0.95 in the one-way repeated measures ANOVA, as a simple main effect test which provides the main findings in the analysis of this experiment. The result was $n = 36$. Additionally, the power (1-β) was calculated by GPower 3.1 as the post hoc test, and was found to be high, at 0.994. Therefore, the authors judged that $n = 52$ met the minimum sample size required to discuss the findings of this study.

## 3. Results

### *3.1. Degree of Usableness*

A two-way repeated-measures ANCOVA was conducted using expressions of the design concept (four levels: product attributes, objective benefits, subjective benefits, and intrinsic value) and product category (four levels: foldable PC, notebook PC, smart speaker, and smartphone) as factors, and product involvement as a covariate. A two-way repeated-measures ANCOVA with product involvement as a covariate revealed no significant effect arising from the covariate product involvement, but a significant effect from the method of expression ($F(3, 153) = 327.10$, $p < 0.01$) and interaction between the method of expression and product category ($F(9, 459) = 44.08$, $p < 0.01$). Since the interaction was significant, a simple main effect test was conducted. One-way repeated-measures ANOVAs were conducted for each product (foldable PC: $F(3, 153) = 100.80$, $p < 0.01$, notebook PC: $F(3, 153) = 203.04$, $p < 0.01$, smart speaker: $F(3, 153) = 111.26$, $p < 0.01$, smartphone: $F(3, 153) = 170.78$, $p < 0.01$). Because the significant main effect was confirmed in all products by the ANOVAs, Holm's multiple comparisons were performed for each product. The results of the multiple comparison tests are shown in Figure 7. These results help to evaluate differences in presentation content at each product category level.

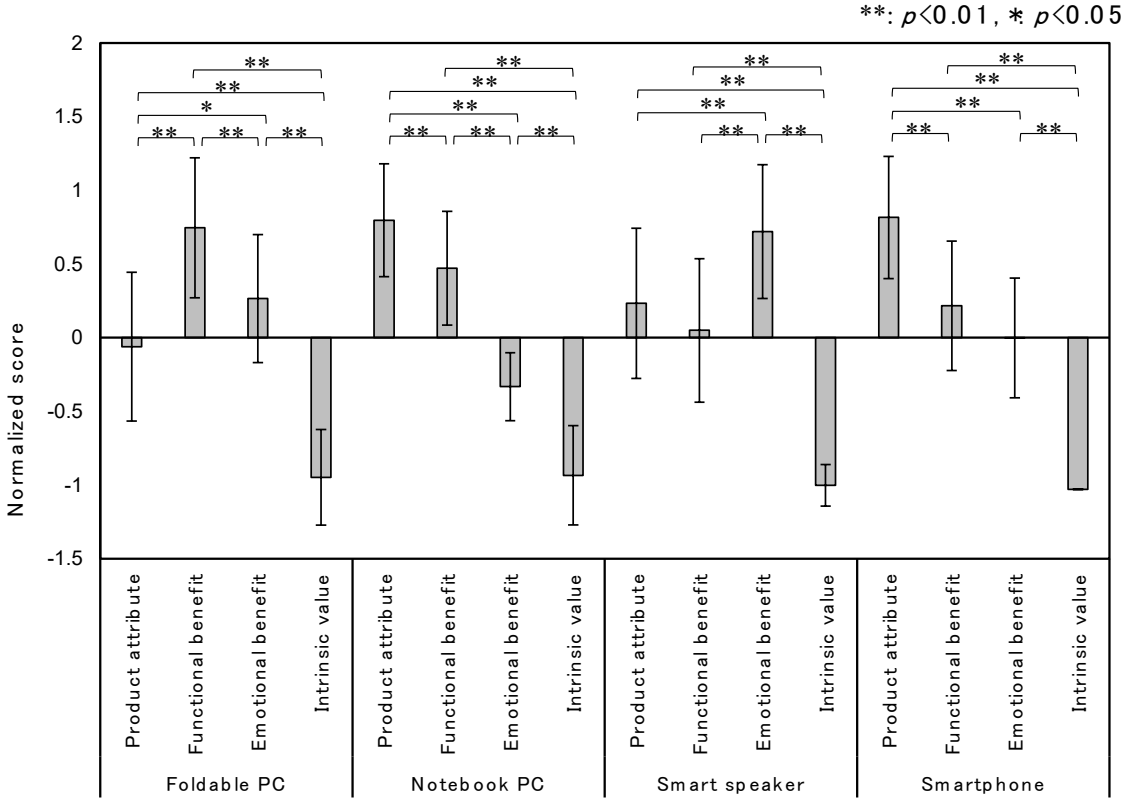


**Figure 7.** Mean normalized score of usableness as a function of the method of expression and product category.

### 3.2. Degree of Usefulness

A two-way repeated-measures ANCOVA was conducted, as in Section 3.1. The analysis revealed no significant effects arising from the involvement of the covariate product, but a significant effect resulting from the method of expression ($F(3, 153) = 417.08$, $p < 0.01$) and interaction between the method of expression and product category ($F(9, 459) = 34.01$, $p < 0.01$). Since this interaction was significant, a simple main effect test was conducted. One-way repeated-measures ANOVAs were conducted for each product (foldable PC: $F(3, 153) = 164.09$, $p < 0.01$, notebook PC: $F(3, 153) = 267.95$, $p < 0.01$, smart speaker: $F(3, 153) = 89.98$, $p < 0.01$, smartphone: $F(3, 153) = 116.10$, $p < 0.01$). Because the significant main effect was confirmed in all products by the ANOVAs, Holm's multiple comparisons were performed for each product. The results of the multiple comparison tests are shown in Figure 8.

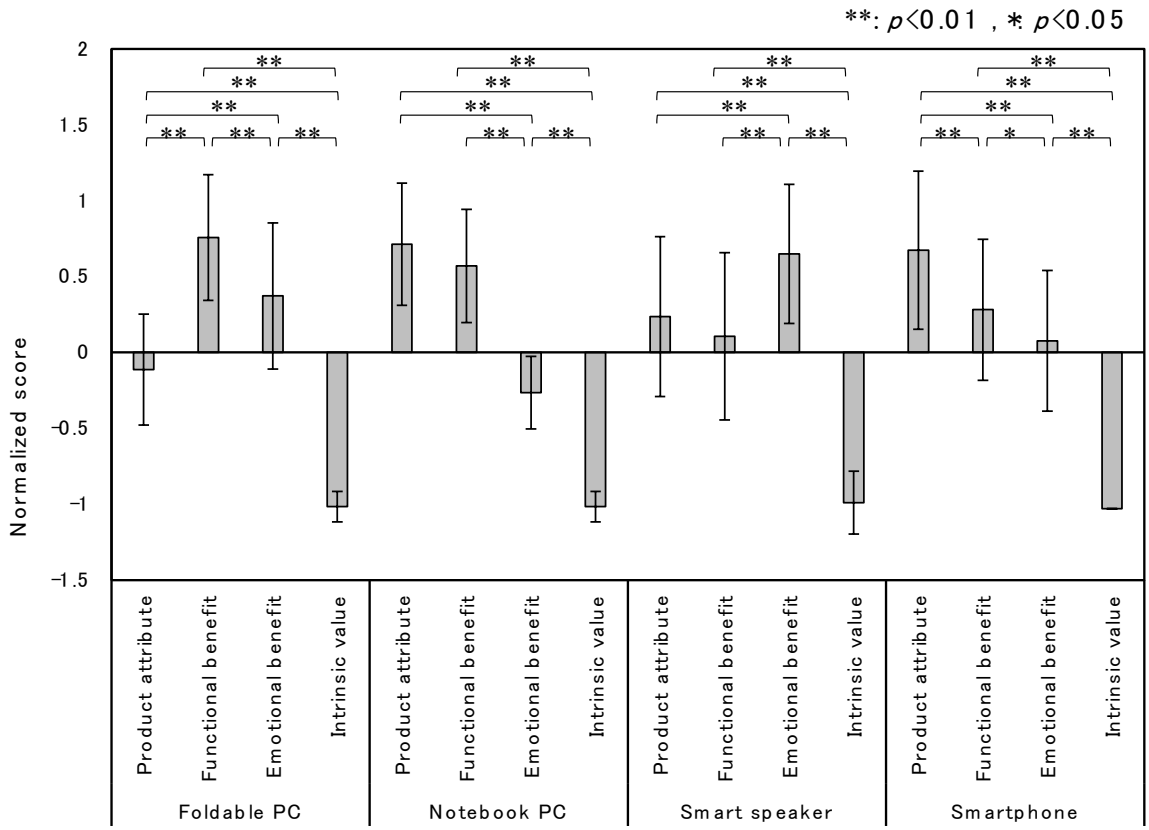


**Figure 8.** Mean normalized score of usefulness as a function of expression method and product category.

### 3.3. Degree of Desirableness

A two-way repeated-measures ANCOVA was conducted, as in Section 3.1. The analysis revealed no significant effect of the covariate product involvement, but a significant effect arising from the method of expression ($F(3, 153) = 303.71$, $p < 0.01$) and interaction between the method of expression and product category ($F(9, 459) = 30.72$, $p < 0.01$). Since this interaction was significant, a simple main effect test was conducted. One-way repeated-measures ANOVAs were conducted for each product (foldable PC: $F(3, 153) = 94.85$, $p < 0.01$, notebook PC: $F(3, 153) = 184.47$, $p < 0.01$, smart speaker: $F(3, 153) = 79.44$, $p < 0.01$, smartphone: $F(3, 153) = 133.05$, $p < 0.01$). Because the significant main effect was confirmed in all products by the ANOVAs, Holm's multiple comparisons were performed for each product. The results of the multiple comparison tests are shown in Figure 9.

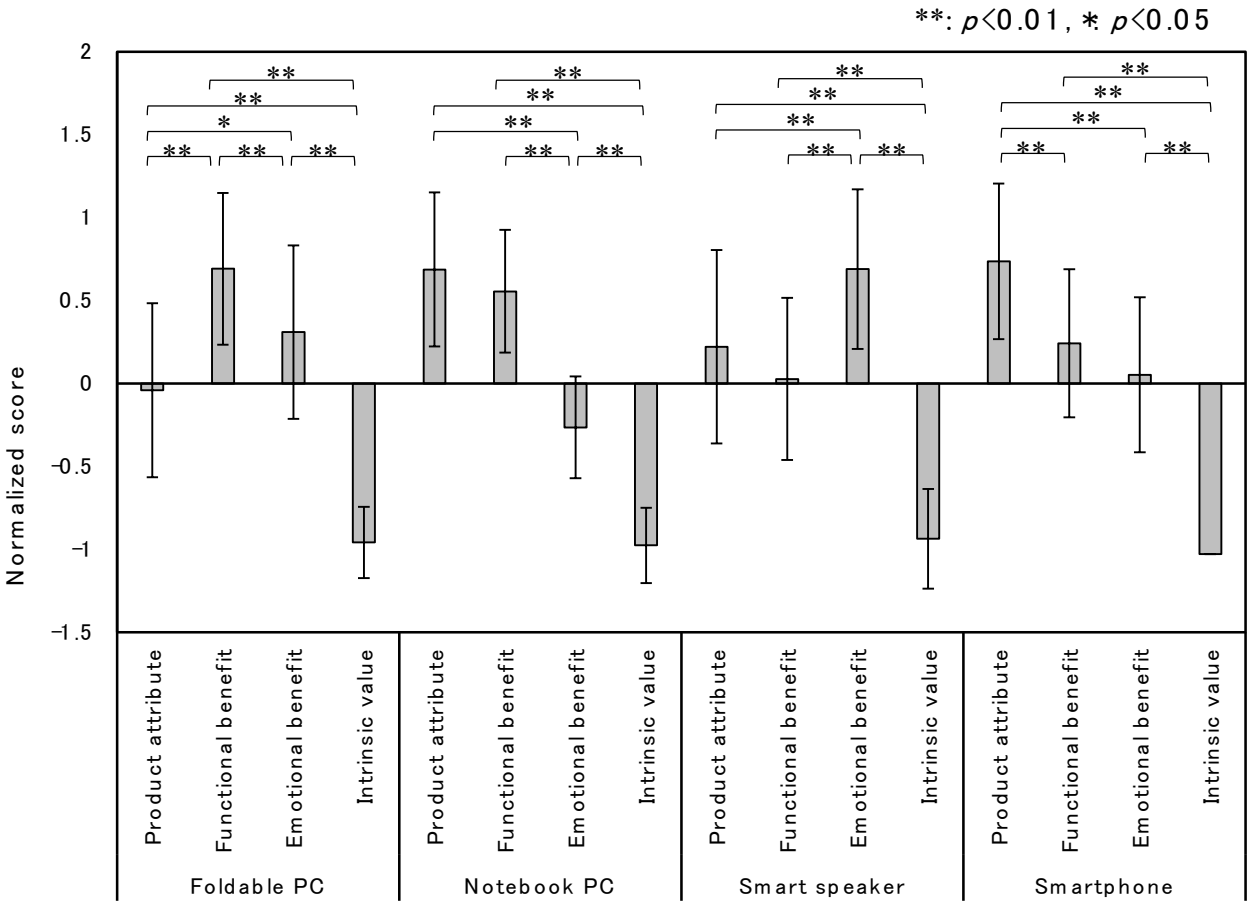


**Figure 9.** Mean normalized score of desirableness as a function of expression method and product category.

### *3.4. Degree of Willingness to Use*

A two-way repeated-measures ANCOVA was conducted, as in Section 3.1. The analysis revealed no significant effect of covariate product involvement, but a significant effect arising from the method of expression ($F(3, 153) = 366.68$, $p < 0.01$) and interactions between the method of expression and product category ($F(9, 459) = 22.96$, $p < 0.01$). Since this interaction was significant, a simple main effect test was conducted. One-way repeated-measures ANOVAs were conducted for each product (foldable PC: $F(3, 153) = 49.26$, $p < 0.01$, notebook PC: $F(3, 153) = 242.47$, $p < 0.01$, smart speaker: $F(3, 153) = 87.21$, $p < 0.01$, smartphone: $F(3, 153) = 142.70$, $p < 0.01$). Because the significant main effect was confirmed in all products by the ANOVAs, Holm's multiple comparisons were performed for each product. The results of the multiple comparison tests are shown in Figure 10.

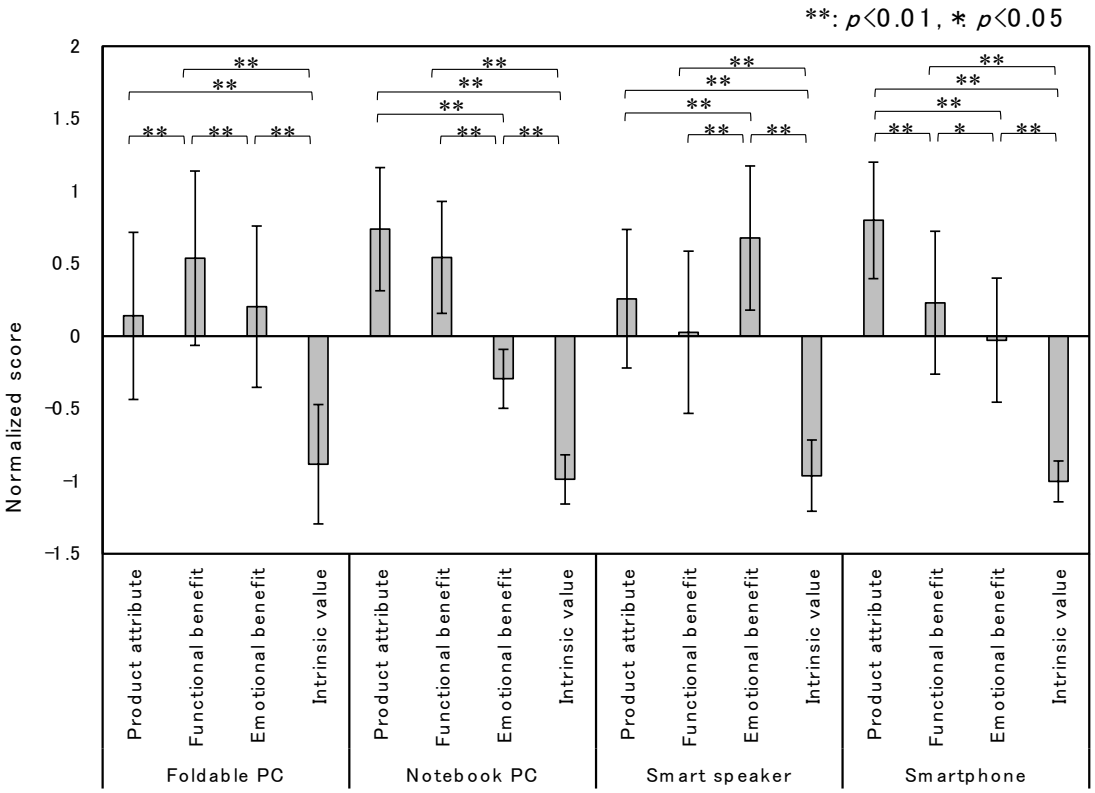


**Figure 10.** Mean normalized score of willingness to use as a function of method of expression and product category.

### *3.5. Ease of Imagining Usage*

A one-way repeated measures ANOVA of the degree to which participants could imagine using the products showed that the differences between product categories were significant ($F$ (3, 153) = 10.35, $p < 0.01$). Holm's multiple comparisons showed that notebook PCs and smartphones had significantly higher scores than foldable PCs and smart speakers ($p < 0.0.1$ for both). The means for each product category are shown in Figure 11.

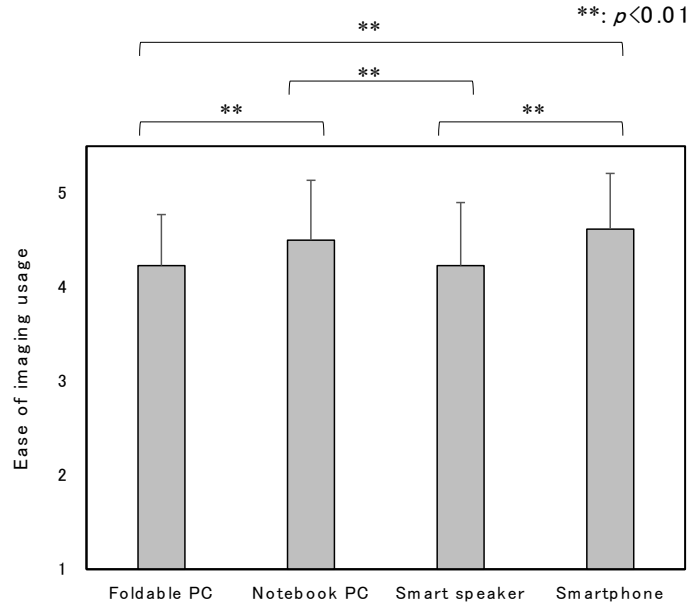


**Figure 11.** Mean ease of imagining usage as a function of method of expression and product category.

## 4. Discussion

In the indicators of usefulness, usableness, desirableness, and willingness to use, the order relationship was not changed by the difference in the method of expression for each product, and the same overall trend was obtained. Therefore, instead of examining each indicator separately, we now discuss the common trends in each indicator. It might be difficult for the participants to accurately distinguish between the usefulness, usableness, desirableness, and willingness to use products separately based on the information presented to them; however, it has also been suggested that products with high anticipation of post-purchase experience and highly anticipated UX were evaluated highly from all perspectives. Since the order of products in which users felt a high sense of anticipation did not differ between indicators, we consider that these results represent the overall degree of anticipated UX.

The ease of imagining usage was significantly higher for notebook PCs and smartphones than for foldable PCs and smart speakers. This can be attributed to the fact that notebook PCs and smartphones are mature products that are widely used and highly familiar to many users. As expected, the results indicate that the products could be classified into two groups: products in the introduction phase, which have not yet fully penetrated the market, and products that are more mature and have penetrated the market.

Interactions between product category and method of expression were observed in user expectations, suggesting that the expression method of highly evaluated design concepts differs by product. First, the rating of intrinsic value was extremely low for all products. This result may be due to the fact that the descriptions of intrinsic value were too abstract, and concrete images of use and benefits could not be understood. Notebook PCs and smartphones showed similar trends; both products were rated highly when product attributes and functional benefits were described, but lower when emotional benefits and intrinsic value were considered. In contrast, foldable PCs and smart speakers had lower ratings for product attributes, suggesting that more specific information is required for product categories with which users are familiar and can easily visualize how to use. On the other hand, since the product category of foldable PCs and smart speakers is not yet widespread and product attributes alone do not provide a concrete image of usage, it is difficult to imagine how to use the product; thus, expressions that help users to imagine the usage scenario are beneficial. Previous studies on consumer behavior have shown that consumers evaluate products more positively when they can easily imagine their use and utility [41,42]. Consequently, in the case of product categories that are generally well-known and for which use and utility are easily anticipated, concept presentation based on product attributes and functional benefits is the easiest to imagine. In the case of product categories such as foldable PCs and smart speakers, which are not yet familiar to users and are difficult to imagine using, expressions that can assume benefits that are easier to understand, rather than product attributes, are considered preferable.

Hernandez et al. [43] studied the relationship between construal level theory and appeal type (attribute or benefit). This study states that when the construal level is high, the persuasiveness of appeal by benefits is high, and when the construal level is low, the persuasiveness of appeal by attributes is high. Construal level theory [44] states that the object is perceived at an abstract, higher-order construal level when the psychological distance is far. When the psychological distance is close, the object is perceived at a concrete, lower-order construal level. In the current study, products that are in the mature stage and have penetrated users are considered to be close in the psychological distance and captured at a low interpretation level. In contrast, products in the new product introduction stage are considered to be far in the psychological distance and captured at a high interpretation level. In this way, the result that product attributes were preferred for mature products and functional and emotional benefits were preferred for new products in this study is consistent with the findings of Hernandez et al. [43]. Van den Hende et al. [45] investigated using narratives to communicate new product concepts to consumers. They found that consumers have a better image of the product when they are more likely to engage with

the narrative. This finding supports the current study's result that new products in the introduction phase should present benefits more easily assumed in the context of use than product attributes.

Based on the results described above, H1 is supported; however, when subjective benefits are abstracted to the point at which they can be termed intrinsic value, they become difficult for users to understand in any product category. However, there were differences between the products in the introduction phase, with foldable PCs rated highest for functional benefits and smart speakers rated highest for emotional benefits. The differences may have influenced whether the products were used for business or home applications related to H2.

Examining H2, we compared products primarily for business use against those primarily for home use. The products in this study are all ICT devices and can be categorized as having high involvement in the four quadrants of the FCB grid (involvement and brain specialization). In addition, products for business use were relatively considered the thinking type, while products for home use were relatively considered the emotional type. Comparing foldable PCs and smart speakers as products in the new category shows that functional benefits were most highly evaluated for foldable PCs. In contrast, emotional benefits were most highly evaluated for smart speakers. This may be because, as described in H2, business use products are often selected after careful consideration based on product attributes. In contrast, the quality of home use products is more subjectively evaluated in terms of user experience, including emotional aspects. Comparing notebook PCs and smartphones as popular products, product attributes were evaluated most highly, followed by functional benefits, emotional benefits, and intrinsic value, with similar evaluation results. These popular products are familiar to users, and their evaluation may be influenced by the factors discussed in the previous paragraphs. Nonetheless, the functional benefits of the notebook PC were ranked more highly, whereas the emotional benefits were higher for the smartphone. In the consumer behavior model for highly involved and thinking-type products in the FCB grid, "Learn" comes first, but in the case of highly involved and emotional products, "Feel" is said to come first [46]. The results of this experiment also showed that functional benefits were preferred in business-use products, which are considered to be of a relatively high involvement/thinking type, while emotional benefits were preferred in home-use products, which are considered to be of a relatively high involvement/feeling type. This result may reflect the difference between "learn" and "feel." Based on the above considerations, H2 is also considered to be supported. However, as Ruiz and Sicilia [47] reported, for example, there are individual differences in information processing, such as thinking-type or emotional-type. Then, they reported that it is preferable to match each individual's personality type with the properties of the appeal, so it should be noted that product type alone does not necessarily determine the preferred method of concept expression.

No significant effect was observed on product involvement in any of the indicators and product categories, and the effect on the evaluation of expectations is considered extremely small. However, product involvement was not obtained for each product; rather, it was measured in terms of the involvement with general ICT equipment. Some participants may have shown different involvement patterns for each product, which may have affected the results. As such, the influence of product involvement needs to be examined more carefully in the future. In addition, in order to obtain basic knowledge, the experiment was conducted in a simplified situation in which only one level in the hierarchy of values was presented to the users. In reality, however, it is most likely to be presented in combination with another factor, for example, "intrinsic value and functional benefit." In subsequent studies, it is therefore necessary to consider the effects of such a combination based on the findings of this study. In addition, this study did not examine the relationship with individual consumer characteristics such as age, experience, and preferences, which are important factors affecting anticipated UX. There is room for further research on the relationship between these individual characteristics and preferable expressions.

## 5. Conclusions

We investigated the effects of design concept expression and the ease of imagining how a product is used on subjective evaluations before product use as a means for communicating values that raise user expectations. Comparing usefulness, usableness, desirableness, and willingness to use under four conditions (product attributes, functional benefits, emotional benefits, and intrinsic value) in which the hierarchy of the value evaluation structure differs, it was found that product attributes were highly evaluated for products whose usage was more easily imagined. In contrast, products for which anticipating usage was more difficult were highly evaluated for emotional benefits. Emotional benefits were also highly evaluated for products designed mainly for home use, whereas functional benefits were more highly evaluated for products intended mainly for business use.

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