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Wood or Laminate?—Psychological Research of Customer Expectations

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Abstract: Wood is generally associated with being practical, aesthetic and economy-friendly. Using wood in interior settings also can be based on psychological expectations and assumptions, as wood is attributed as warmer, more homely, more relaxing and more inviting. However, when investigating psychological differences, wood is usually compared to carpets, glass, leather, stone, or plastic but is not compared to a visually similar material such as laminate. The aim of this study is to analyze and compare the various psychological characteristics related to wooden and laminate materials in interior settings. The experimental design was a 2 × 2 design (material, sequence) with repeated measures for material. Forty participants were asked to evaluate a framed piece of wood floor and a framed piece of laminate floor regarding technical, practical, and psychological aspects. Further, three questions about one's purchase decision were asked. The results show that the wooden floor was evaluated significantly better than the laminate floor regarding "materials and processing", "atmosphere", and "values and symbolic functions". For the criterion "health", a tendency in favor of wood could be found. In addition, the participants would more likely recommend and purchase wooden products and also accept more deficiencies in wooden products.

Keywords: floor; laminate; psychological characteristics; purchase decision; wood

1. Introduction

Using wood for construction and interior design has a long tradition especially in countries like Austria, Canada, Estonia, Finland, Japan, Norway, Sweden and the US [1]. The main reasons for choosing wood in interior settings are aesthetics, a good atmosphere, healthy climate, hygienic factors and reducing the risk of allergies [2]. Additionally, wood products are preferred as wood has a more favorable environmental profile, contributes less to the greenhouse effect and has less solid waste than other materials [3]. However, the choice of using wood as indoor material depends not only on environmental, hygienic and aesthetic reasons; psychological or emotional attributes of wood also come into play, as wood is perceived as warmer, more attractive, more homely, more relaxing and inviting [4–6]. In these studies, wood is usually compared to other materials like ceramics, glass, paper, leather, stone, and plastic. Different surface structures or color preferences might have an effect on the psychological perception of different materials [7,8]. Hence, a question arises if wood is assigned different psychological attributes when compared to a material that appears visually equal.

A similar material to wood is laminate. Previous studies analyzing the psychological perception of laminate and wood did not specify which kind of laminate product was used. In the present study, we use the term laminate as a short term for recycled wood (plywood) composed of laminations. Laminate has a similar appearance and is commonly used as a substitute for wood. Modern techniques in the manufacture of laminate make it difficult to detect visual differences between laminate and wood. Nevertheless, studies show that by haptic evaluation, wood and laminate are perceived differently [9]. Therefore, the aim of the present study is to compare wooden and laminate materials with visual and haptic evaluation to investigate which psychological criteria are able to differentiate between wood and laminate.

1.1. Psychological Attributes of Materials

The majority of product evaluation studies investigate practical functions or aesthetics of the product, such as design, workmanship, value, assemblage or security [10–12]. Psychological aspects of the products are usually not focused on, with the exception of symbolic values. Symbolic values refer to socially determined symbolic meanings that may evoke thoughts, feelings and associations which are linked to the product [13]. Symbolic values include aspects like modern, simple, expensive, businesslike, sympathetic, creative or captivating [14–16]. Symbolic values like being elegant, innovative, luxurious or prestigious also show stronger relationships with customer satisfaction than other non-symbolic attributes like functionality or aesthetics [17]. Another important symbolic value is eco-friendliness, which can also be found in different studies [10,18].

In addition to symbolic values, products can evoke emotional responses. Products can be intentionally designed to create an emotional response (affective engineering; "kansei") in order to captivate people at an emotional level and improve the value of the product [19]. In this sense, products can be perceived as pleasurable, joyful, satisfying, surprising, trustworthy or even as shady, disappointing or disgusting [20–22].

According to Desmet and Hekkert [23], these emotions may result from product perception, e.g., playing with a kangaroo ball could lead to emotions such as enthusiasm or happiness; therefore, the kangaroo ball is rated as being able to raise enthusiasm and able to make one happy. Desmet and Hekkert [23] categorized three classes of product emotions: appealingness (which includes emotions such as love, attraction or disgust), praiseworthiness (emotions such as admiration, appreciation or disappointment), and desirability (emotions such as jealousy, enthusiasm, happiness). In a further adaptation, the three categories of product experience are distinguished into aesthetic pleasure, attribution of meaning, and emotional response [24]. All three product experiences are intertwined and can influence product evaluation.

These studies mainly focus on the emotional responses that products might induce. Other psychological attributes—such as stress-reducing, activating or able to raise performance or communication—are less often investigated. One notable example is the study of Harbich and Hassenzahl [25], where behavioral patterns of products are analyzed. In their study, products can be given attributes such as being able to enhance creativity or performance.

1.2. Psychological Attributes of Wood and Wood Products

Past research investigated the effects of wooden interiors on the individual: Wooden floors are perceived as more pleasant, attractive, healthy, durable, and ecological acceptable compared to carpets [6]. In addition, wooden materials are described as warmer, more natural, more homely, more relaxing and more inviting than ceramics, glass, paper, leather, stone, and plastic materials [4]. Further, rooms with wooden interior stimulate participants to relax or lie down, whereas interiors without wood induce activities such as working or exercising [5].

Wood is also associated with health-promoting characteristics such being stress-reducing: Kelz, Grote and Moser [26] showed that wooden floors, ceilings, cupboards, and wall panels have a positive effect on the individual's stress level, indicated by a lower heart rate and higher heart rate variability.

A similar result could be found in another study where a room with a wooden floor and walls partly covered with wood increased the individuals' heart rate variability and lowered the individuals' diastolic blood pressure [27]. Furthermore, a wood equipped bedroom enhances the quality of sleep and wooden equipment in offices and classrooms reduces stress and strain [9,28].

Reasons why wood has health-beneficial effects on the human organism have not yet been investigated in detail. One explanation could be that wood is related to indoor climate, where natural, untreated wood used in indoors has a positive effect on acoustics and air quality, thus creating a more comfortable indoor climate [29]. Another theory—attention restoration theory (ART; [30])—indicates that watching nature stimulates a restoration process, as natural settings require less attention to the surroundings, thus allowing the individual to recover. This restoration process is also possible for nature-based indoor environments, such as potted plants and windows with a view of trees, and therefore can be transferred to wooden indoor settings [31].

These results suggest that primarily the appearance of wood is connected to these positive psychological attributes. However, even when different wood surfaces are compared to each other, color, structure and grain leads to different psychological perceptions. Wood with a rough or untreated surface is perceived as warmer, whereas wood with a smooth surface is evaluated as cooler [8]. Wood is also evaluated differently when different wood species are used [7]. Therefore, it is crucial to compare wood with a material that is visually as similar as possible. By comparing wood to a material with similar color, surface structure and grain the risk of wrongly evaluating color and structure of the material instead of the material itself can be minimized.

1.3. Psychological Differences between Wood and Laminate

A material with similar appearance and surface is laminate, which is therefore used as a popular substitute for wood products. Jiménez et al. [32] compared the psychological effects of wood and laminate products with photographs. Wood products are rated as significantly more warm and cozy as well as healthier and physically and mentally more stimulating than laminate products. However, research has shown that natural products are usually preferred over synthetic products, as natural products are perceived as healthier, sensory more attractive, purer, safer and morally justifiable [33]. This so-called "green consumer behavior" motivates consumers to seek and buy green products [34]. In line with these beliefs, consumers are more likely to purchase wood products and are more willing to pay additional money [35,36]. Compared to laminate, wood is labelled as a more natural material and therefore this assumption might influence this preference of wood over synthetic materials [37].

But even without knowing the type of the material, wood is perceived differently, as shown in the study of Berger et al. [9]. They compared wood and laminate only by haptic perception, without telling their participants the differences between the materials. The results showed that even without knowing the difference between the materials, each material was attributed differently. Untreated wood appeared warmer, rougher and softer, whereas its laminate counterpart was described as colder, smoother and harder. These results suggest that wood is given more positive psychological attributes than laminate, even if participants are not aware of the composition and appearance of both materials. This result indicates that even without being aware of the type and composition of the material, individuals unconsciously assign other psychological attributes to wood compared with laminate products.

This perception might be related to the surface structure, which is different for wood and laminate products. When touching a rough material, the effective contact area is smaller compared to smooth materials. Therefore, smooth surfaces have greater heat transport, causing a colder feeling when touching them [38]. This is in line with other studies, where rough materials are rated as more warm, soft and pleasant [39]. Wood is perceived as a rough material and therefore this perception might influence other psychological attributes such as warm, soft and pleasant attributes. Laminate, on the contrary, feels smoother and therefore, attributes such as cold and hard seem to be more common.

Study designs including only haptic perception are not able to differentiate all aspects of the evaluated material, as color or contrast can only be evaluated visually. Roughness can be perceived visually and tactically and therefore can be considered as one of the most apparent criteria, next to color and contrast. However, both visual and haptic perception should be considered when evaluating a product, as separating both perception methods leads to differences in evaluation [40].

1.4. Research Aims

The aim of this study was to investigate the psychological differences between similar looking wood and laminate by visual and haptic perception. Specifically, various kinds of psychological characteristics are measured to obtain detailed differentiation between wood and laminate. In line with recent literature, we expect that wood in interior applications, e.g., a wooden floor, will be attributed different psychological characteristics than a laminate floor. For this comparison, eleven criteria will be evaluated: (1) sustainability; (2) materials and processing; (3) technical and practical function; (4) repair and maintenance; (5) perception; (6) atmosphere; (7) mobility and combinability; (8) health; (9) physical and mental stimulation; (10) performance enhancement; and (11) values and symbolic functions. In particular, we state that wood is evaluated as more positive in psychological criteria, specifically in atmosphere, health, physical and mental stimulation, performance enhancement, and values and symbolic functions. As for the other criteria, no differences are expected, as both materials should visually appear as equal. Further, we hypothesize that wooden materials, e.g., a wooden floor, are preferred over laminate materials, e.g., a laminate floor, and are more likely to be purchased.

2. Materials and Methods

2.1. Research Design

The participants had to evaluate two different framed floors (80 cm × 80 cm). One floor consisted of oak hardwood and the other floor consisted of laminate (plywood composed of laminations) covered with a print of oak wood. The chosen material for wood and laminate was of high quality. Both floors were visually similar (color and pattern) and were laid vertically, to avoid possible confounding variables such as color or aesthetic preferences (see Figure 1).

Figure 1. Framed floor pieces. (**Left**) oak hardwood (floor A); (**right**) laminate with oak optic (floor B).

The experimental design was a 2 × 2 within-between-subject design with repeated measures of the first factor. The first factor was the material of the product, which was subdivided into two groups; wood and laminate. The second factor was the sequence of presentation. It was randomized, i.e., whether the participants had to evaluate the wooden material first and then the laminate material or the other way round. Participants had no information about the aim and the sequence of the presented materials (similar to a blind study). Accordingly, both materials were shown to each participant, but in randomized order.

2.2. Participants

The total sample consisted of 40 participants, including 12 men (30%) and 28 women (70%). Their ages ranged from 20 to 74 years (M = 28.03; SD = 12.69). The majority of the participants (30 persons) had passed the general qualification for university entrance. About half of the sample was employed (45%) and the other half was unemployed (55%), meaning that they were full-time students. The sample mainly included non-professionals (92.5%), e.g., participants not working with the material wood in their profession. A total of 42.5% of the sample said they paid attention to conscious use of ecological materials and 32.5% had already purchased a floor themselves.

2.3. Measures

To measure the psychological aspects between wood and laminate, the Quality Criteria Catalog for Green Product Evaluation (QCC-green) was used [32]. The questionnaire has 35 items which comprise 11 subscales: (1) sustainability; (2) materials and processing; (3) technical and practical function; (4) repair and maintenance; (5) perception; (6) atmosphere; (7) mobility and combinability; (8) health; (9) physical and mental stimulation; (10) performance enhancement; and (11) values and symbolic functions. The items were to be answered on a five-point rating scale "not fulfilled (0 percent)" to "fulfilled (100 percent)" and are written as statements. All items, dimensions and the Cronbach's Alpha (α) for all dimensions can be found in Appendix A Table A1.

Aspects of the purchase decision were asked via three questions: (1) "Would you recommend the product?" (2) "Would you buy the product?" and (3) "Would you accept deficiencies (for example availability, cost, etc.) related to the purchase of the product?" These questions could be rated on a five-point rating scale from "very likely" to "unlikely". Finally, the participants were asked what floor they would prefer to buy if both had the same price ("the first one", "rather the first one", "rather the second one", "the second one").

2.4. Procedure

The study was performed in spring. The study was advertised at the University of Graz by leaving notes on bulletin boards. Interested persons could make an appointment flexibly with the examiner via e-mail or telephone. The participants were not paid or given any other incentive for taking part in the study. On the arranged date, the participants were first briefly introduced to the topic and took a seat at the examination room. They were all seated on the exact same spot. Then, the participants answered the socio-demographic questionnaire. After this, the first floor, either wood or laminate, was presented by putting the piece of floor on the ground. To ensure that the participants only examined the piece of floor and not the floor covering beneath, the floor was put down on a piece of white cloth. Previously, the sequence of the floor material was randomized (AB or BA), of which the participants were not informed. Further, the participants and the examiner were not given any information about the material of the floors, leaving them unaware about the difference between the floors. However, it is very likely that by examining the floors carefully, the participants recognized that the difference was in the material (e.g., wood and laminate). The participants were allowed to look and to touch the floor for as long as they wanted. On average, this phase took about one minute. Afterwards the participants filled out two questionnaires to evaluate the first floor: (1) the QCC-green and (2) questions regarding the purchase decision. Then, the second floor was presented in the exact same way as the first floor. The participants had to evaluate this one with the same questionnaires. Finally, both floors were presented side by side and each participant had to decide which floor he/she would buy. The entire examination procedure took about 30 min. After the study, the participants were informed about the differences between the floors and the aim of the study. All examinations were undertaken during April and May in the same room. During the entire study, the design and decoration of the examination room was kept constant.

2.5. Statistical Methods

Data analyses were carried out using SPSS Statistics for Windows, Version 20.0 (IBM Corp., Armonk, NY). The significance level was set to five percent. To analyze the results of the questionnaires, univariate and multivariate analyses of variance with repeated measures were performed.

3. Results

3.1. Quality Criteria of Green Products (QCC-Green)

First, potential sequence effects were analyzed. The multivariate analyses of variance did not reveal significant sequence effects ($F(11, 28) = 1.449$, ns). This speaks to the fact that the sequence in which the materials were presented (wood-laminate or laminate-wood) did not influence the evaluation of the wooden or laminate floor.

Significant differences were found in the evaluation of the material (Wilks' $\lambda = 0.394$, $F(11, 28) = 3.918$, $p < 0.01$). The wooden floor was rated better than the laminate floor in three of eleven subscales (see Figure 2): "materials and processing", "atmosphere", and "values and symbolic functions". Only the single criterion "repair and maintenance" was rated better for the laminate floor. For the other subscales, no significant difference could be found. For the criterion "health", a tendency favoring the wooden floor could be found. All *F*-values, DF, and *p*-values for the univariate tests are listed in Table 1.

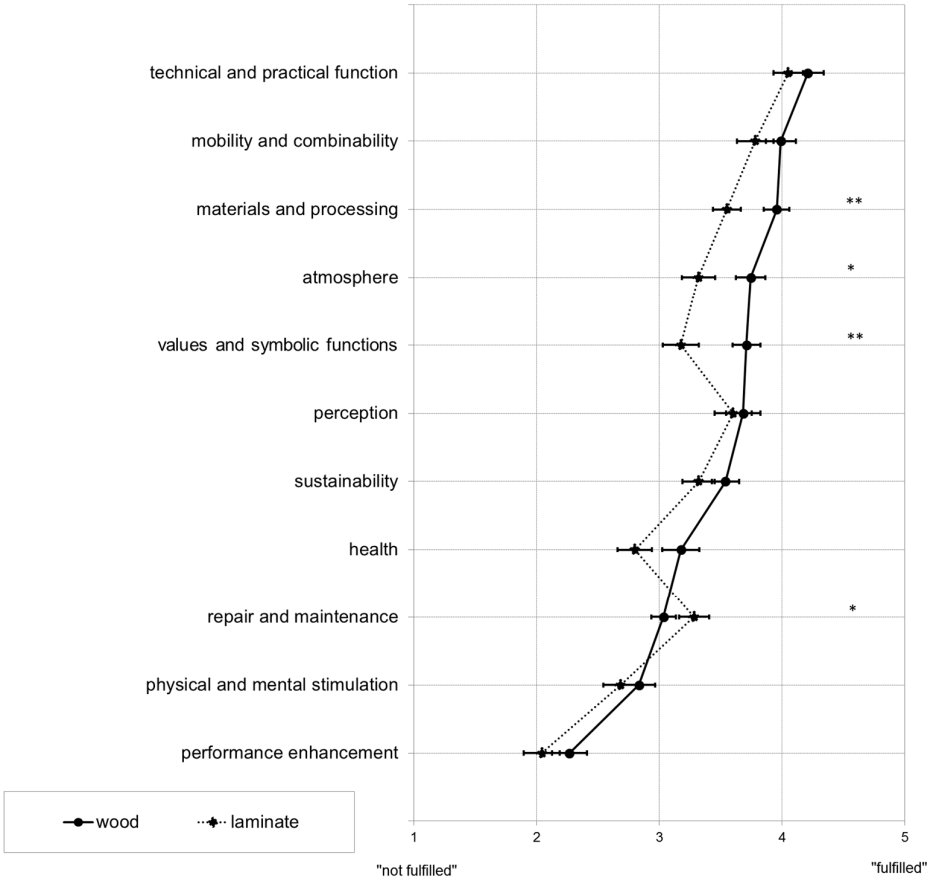

Figure 2. Evaluation of the quality criteria scales (QCC-green) for wood and laminate floor with mean and standard error for all subscales. Note: ** significant at $p < 0.01$; * significant at $p < 0.05$.

Table 1. *F*-values and *p*-values of the QCC-green for wood and laminate floor *.

Variable	*F*	*p*
sustainability	2.451	0.126
materials and processing	7.761	0.008
technical and practical function	1.441	0.237
repair and maintenance	5.374	0.026
perception	0.134	0.716
atmosphere	5.940	0.020
mobility and combinability	2.136	0.152
health	3.774	0.059
physical and mental stimulation	0.899	0.349
performance enhancement	3.017	0.090
values and symbolic functions	8.951	0.005

* Degrees of freedom = 1, error degrees of freedom = 38; answer scale ranges from 1 "not fulfilled" to 5 "fulfilled".

3.2. Purchase Decision with Wood and Laminate Products

The multivariate analyses of variance showed no significant sequence effects of presentation sequence on the purchase decision ($F(3, 36) = 1.884$, ns). Next, the differences between the materials were analyzed. The multivariate analyses of variance showed a non-significant result (Wilks' $\lambda = 0.864$, $F(3, 36) = 1.882$, ns), but looking at the univariate tests, significant differences for two of the three questions regarding the purchase decision were found: the participants were more likely to recommend the wooden floor than the laminate floor ($F(1, 38) = 5.621$, $p < 0.05$) and would accept more deficiencies in a wooden floor than in a laminate floor ($F(1, 38) = 4.240$, $p < 0.05$). Regarding the question "Would you buy this product?" there was no significant difference ($F(1, 38) = 3.882$, ns), but a tendency that the wooden floor would be bought more often than the laminate floor could be detected. The results of the univariate tests are presented in Table 2. However, the results have to be interpreted with caution as the result of the multivariate analysis of variances was not significant.

As described in the procedure, at the end of the test sessions, both floors were presented simultaneously and participants had to decide which floor they would buy. The result shows that the wooden floor (60%) was preferred over the laminate floor (40%).

Table 2. Means (M), standard deviations (SD), *F*-values, *p*-values of the purchase decision for wood and laminate products *.

Variable	Wood		Laminate		*F*	*p*	Sig.
	Mean	SD	Mean	SD			
Would you recommend this product?	2.32	0.94	1.82	0.96	5.621	0.023	*
Would you buy this product?	2.00	1.01	1.50	1.22	3.882	0.056	
Would you accept more deficiencies for the purchase of this product?	1.52	1.01	1.10	1.01	4.240	0.046	*

* Result significant (Sig.) at p<.05; degrees of freedom = 1, error degrees of freedom = 38; answer scale ranges from 1 "unlikely" to 5 "very likely".

4. Discussion

The aim of this study was to analyze the different psychological characteristics related to two materials: wood and laminate, and additionally, the preference and purchase decision for both materials. The participants had to evaluate two framed floors in randomized order. These framed floors looked as similar as possible and only differed in the material (wood and laminate). We choose a design similar to a double-blind design, meaning that the participants and examiner were unaware of the aim of the study and the difference between the framed floors. However, it is very likely that by

touching the floors, the participants recognized that the difference lay in the material and knew which floors were made of wood or laminate.

The results of the present study verify that wood in interior applications, e.g., the wooden floor, was rated more positively than the laminate floor in three of eleven criteria of the QCC-green: "materials and processing", "atmosphere", and "values and symbolic functions". Furthermore, there was a tendency for superior evaluation for the wood floor for the criterion "health". The more positive rating in "materials and processing" means that the material wood was regarded as more stable, resistant and having higher quality than the laminate counterpart. Furthermore, the wooden floor had more symbolic functions and values than the laminate floor. Specifically, this means that the wooden floor was perceived as more natural, modern, and exclusive than the laminate floor. With this result we support recent research, where wooden products in general are attributed with an excellent quality [1,2].

The wooden floor was rated significantly more positive in the criterion "atmosphere", which includes the items "warming" and "comfortable". In the literature, wood is also very often associated with the properties warm and cozy [6], including a positive influence on the indoor climate [41]. Our findings support this assumption, as the participants rated the wooden floor as warmer, more comfortable and creating a much more pleasant indoor climate.

Although not significant, a tendency could be detected for the criterion "health". The participants believed that the wooden floor was more likely to reduce stress, raise well-being and increase the quality of life than the laminate floor. Recent findings show that wooden materials in indoor settings have beneficial effects on humans [1,26,27].

For the criterion "repair and maintenance", the laminate product was preferred. In detail, participants rated the laminate floor as much easier to repair and maintain than the wooden floor. The sophistication and quality of the wooden product might play a role in this. As the wood floor was perceived as more exclusive in the QCC-green, the consequence might be special treatment or more careful handling of the wooden floor to maintain the high quality of the material. Therefore, a greater effort in repairing and maintaining the material would be accepted if the product was regarded as more exclusive.

In line with these results, the participants would rather recommend and accept more deficiencies for purchasing the wooden floor. There was also a tendency that the wooden floor would be preferred over the laminate floor with respect to a purchase decision. Again, the high value and quality of a wooden product goes hand-in-hand with these results. As wood was seen as more exclusive and modern, it seemed clear that the participants would recommend, buy and accept more deficiencies when purchasing a wood product. Another reason could be linked to the better ratings of the criteria "atmosphere". The wooden floor was rated as warmer, more comfortable, and able to create a much more pleasant indoor climate. Attributing such positive characteristics to a specific material may lead to a stronger preference of purchasing and recommending this material.

Framed floor pieces (80 cm $\times$ 80 cm) were used instead of rooms completely covered with wooden or laminate floors. Therefore, it could have been difficult for the participants to imagine the samples as a whole floor. Future studies, therefore, should evaluate the psychological effects of fully covered floors on the individual. Although the number of participants was small (N = 40), it was possible to detect significant results. Nevertheless, the results have to be interpreted carefully as small sample sizes tend to underestimate possible effects. Another limitation concerns the floor samples. Although care was taken to ensure that both floors looked as similar as possible, the wood and laminate floor showed differences in texture and contrast. Therefore, the results could have been affected by personal preferences for grain and contrast.

5. Conclusions

The results show that the participants would rather recommend buying a wooden floor and would also accept more deficiencies in wooden floors than in the laminate floor. The results further

show that the psychological aspects related to the wood material were evaluated significantly better than the material laminate. In particular, the wooden floor was seen as more stable, resistant, natural, modern, and exclusive than the laminate floor. Wood was also rated as significantly warmer and cozier than laminate and tended to be given attributes like stress-reducing and able to raise well-being. These results indicate that preferring a material over another is not only determined by practical and economical characteristics, but also determined by psychological characteristics like attributed atmosphere. Establishing an awareness of the positive psychological, emotional and health impacts of wood products could be essential in marketing efforts. Promoting wood products by highlighting their positive psychological associations and health-promoting effects replaces the current point of view of "without pathogenic ingredients".

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Author Contributions: This work was carried out in collaboration between all authors. Author P.J. designed the study, supervised the study, and managed the analyses and the outline of the manuscript. Author A.D. conducted the study, performed the statistical analysis, managed the literature searches and wrote the manuscript. Author E.D. managed the literature searches and wrote the first draft of the manuscript. Authors P.J., K.E., V.G., C.K. and M.M. developed the questionnaire. All authors read and approved the final manuscript.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Items, dimensions and Cronbach's Alpha of the QCC-green.

Dimension	α	Item
sustainability	0.81	The material used for this product has a good CO_2 balance. The material used for this product is environmentally friendly. The material used for this product can be easily reused. The product is durable.
materials and processing	0.79	The material used for this product is stable and resistant. Due to its properties, the used material is suited for this product. The material used for this product shows high quality. The product is produced with high standards of craftsmanship.
technical and practical function	0.84	The product is safe and harmless. The product is easy to manage and convenient. The product meets practical needs.
repair and maintenance	0.67	The product is easy to maintain. Even as a non-expert, the product can be fixed easily. Maintenance and care of this product requires little time.
perception	0.90	The design of the product is aesthetically appealing. The surface design is visually appealing. The product appears to be inviting.
atmosphere	0.85	The product appears to be warm and comfortable. The product creates a pleasant room atmosphere. The product blends harmoniously into the overall room design. The product positively influences the indoor climate (humidity, temperature, ...).
mobility and combinability	0.92	The product can be combined easily with other materials/products. The product also fits well into other rooms.
health	0.92	The product raises well-being. The product appears to be stress-reducing. The product improves life quality.

Table A1. *Cont.*

Dimension	α	Item
physical and mental stimulation	0.92	The product appears to be activating. The product appears to be calming. The product has a positive effect on the inner balance.
performance enhancement	0.93	The product supports productivity. The product promotes communication. The product stimulates creativity and imagination.
values and symbolic functions	0.75	The product appears to be natural. The product is modern. The product is exclusive.

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