On the Importance of UX Quality Aspects for Different Product Categories

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Abstract

User experience (UX) is a holistic concept. We conceptualize UX as a set of semantically distinct quality aspects. These quality aspects relate subjectively perceived properties of the user interaction with a product to the psychological needs of users. Not all possible UX quality aspects are equally important for all products. The main use case of a product can determine the relative importance of UX aspects for the overall impression of the UX. In this paper, the authors present several studies that investigate this dependency between the product category and the importance of several well-known UX aspects. A method to measure the importance of such UX aspects is presented. In addition, the authors show that the observed importance ratings are stable, i.e., reproducible, and hardly influenced by demographic factors or cultural background. Thus, the ratings reported in our studies can be reused by UX professionals to find out which aspects of UX they should concentrate on in product design and evaluation.

Keywords

Questionnaires, User Experience, UX Quality Aspects, UX Measurement, UX Scales.

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I. Introduction

Due to the availability of highly efficient development environments and agile deployment processes, it is increasingly difficult to position a product based on its superior functionality alone. Competitors can catch up fast concerning functions and features and it is easy for customers to switch from one cloud-based product to another. Thus, to be successful in the long run and build a loyal customer base, an interactive product needs to provide a high level of UX quality. Otherwise, the user base will decrease fast. This creates the need to measure the UX quality of a product continuously and compare the results to the UX of competing products [1].

But what do we exactly mean by the term UX? A UX definition that supports design decisions must relate the psychological needs [2]–[4] and goals of users to concrete properties of the user interface of a product [5]. We need a clear conceptualization of UX to enable different persons and roles (UX designers, software developers or product owners) in the development process of a product to contribute to efficient design discussions. If it stays unclear what UX means and which UX aspects are important for a product, there will always be misunderstandings that may cause long and useless discussions about the impact of specific design decisions on overall UX quality [6].

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Since UX is undoubtedly a highly subjective impression, meaning that crucial aspects of the experience can only be ascertained during the first-hand perception by one (or more) user(s) and can consequently only be described by them, it is required to ask users about their experience of using a product [5]. In this sense, there is no objective method to measure the UX of a product. Thus, researchers need a conceptualization of UX that can be communicated easily to users.

Of course, we cannot simply ask "*How do you judge the user experience of this product?*", because this term will be interpreted inconsistently by end users. But concrete UX aspects can be easily transformed into questions or items in a UX questionnaire, so a clear understanding of relevant UX aspects is also a basis for UX measurement by using questionnaires.

Certainly, UX is a heterogeneous concept. If we review the research literature and existing UX questionnaires we will find aspects such as *Efficiency*, *Ease of learning*, *Dependability*, *Adaptability*, *Fun of use*, *Aesthetics*, *Loyalty*, etc. Which of these aspects are important for a specific product depends firstly on the user group (personal preferences and experience) and secondly on the product type [7]–[10].

This paper describes a set of UX quality aspects that relate properties of a product with the needs and expectations of users. Such a list of semantically distinct aspects should help UX designers and researchers to develop a better understanding of UX. It also helps to streamline design discussions by providing a common understanding of the relevant UX quality aspects [6] and can even be helpful when the final design is evaluated, for example with a questionnaire [11], [12].

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In this paper, we present 5 independent studies with a total of 361 participants who have submitted nearly 70,000 ratings during the years 2015–2021. We clarify how important the described UX quality aspects are for different types of products. This provides some guidance for UX practitioners and researchers on which aspects of a design they should focus on during the design phase of new products and when evaluating interactive products.

II. Concepts of UX and Usability

In this section, we elaborate on some basic concepts that are important for the general reasoning in this paper.

One important point is the distinction between usability and UX. A well-known definition of usability is provided by ISO 9241-110 [13]. Usability is defined here as "*the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use*".

In contrast, ISO 9241-210 [14] defines UX as "*a person's perceptions and responses that result from the use or anticipated use of a product, system or service*".

There are some fundamental differences between these two concepts. Firstly, usability is focused on tasks or goals of a user. Properties like efficiency, error tolerance, and dependability are commonly known criteria for usability. In contrast, UX is not restricted to achieving specified goals with the help of a product. It covers many more properties, such as beauty of the design, fun of use, or novelty of the design.

Secondly, usability only includes experiences related to the actual use of a system. In contrast, UX also encompasses impressions before (anticipated use) and after using the system (episodic and remembered use) [15].

Thirdly, the usability definition does not state if usability is an objective or subjective concept, but there is indication that usability and UX are differentiable in terms of subjectivity. For example, objective measures, such as the number of failed tasks in a usability test [16] or the average time needed to finish a task (sometimes such averages are also estimated from models, for example GOMS [17]), are commonly used to measure the usability of a product. These metrics are highly product-dependent, i.e., are not necessarily user-specific. In contrast, UX is a purely subjective concept, meaning that UX can only be explored as the individual, unique perspective of one (or more) user(s). Furthermore, as with any experience, the meaning and thus an assessment of UX is conceived in intersubjective exchange and co-understanding between individuals [18].

Let us illustrate this with an example. Assume that we have a new product, and that this product is evaluated in a usability test which covers all the main tasks that can be performed with the product. Now, also assume that we find 80% of the users fail to finish these tasks without assistance. We will most likely conclude that the product has poor usability. Assume now that we hand over a UX questionnaire after the test and the results indicate that the users judge the UX of the product quite high (for example, because most of them attribute their failure not to the poor product design, but to a lack of skills or knowledge). In this case, we would conclude that the product has a good UX, that is, the subjective impressions of the users are good, even though most of them have failed to use the product successfully. Of course, this is a hypothetical example, since in practice, high failure rates concerning the tasks will nearly always result in bad UX ratings in a UX questionnaire.

There are two other conceptualizations of UX which need to be mentioned here. In [19] the product qualities that are related to the UX perception of users are distinguished into two categories. *Usability goals* are related to product qualities with respect to the tasks users must perform with the product. They correspond to the classical dialog principles of the ISO 9241-110 [13]. *User experience goals* relate to the impression of users towards the interaction with the product that are not directly related to the tasks, for example the aesthetic impression of the product.

A nearly identical distinction by using a different terminology is introduced in [20]. *Pragmatic qualities* describe how well users can perform the tasks necessary to reach their goals with the product. *Hedonic qualities* are all other product qualities that are not directly related to tasks.

This distinction into hedonic and pragmatic qualities (respectively *usability goals* and *user experience goals*) has some inherent problems.

The pragmatic qualities share some underlying concept: They are aspects of an interaction related to tasks. The hedonic qualities do not share such a common concept, they are simply defined as all non-task related UX aspects. This immediately raises the question whether they can be further split into some meaningful sub-groups. In addition, it is not so easy for some natural qualities to be defined as pragmatic or hedonic. For example, the quality of content of a web page can be classified as pragmatic (if the user searches for a detailed information on the page a good content quality helps him or her to reach the goal efficiently) or hedonic (if a user just browses the web and finds an interesting page by chance). Thus, for some qualities of interactive products it depends on the concrete usage situation if they are hedonic or pragmatic.

In this paper, we follow the approach to define UX by a set of semantically distinct quality aspects. It has some clear advantages.

As stated above, we understand UX as a purely subjective concept. Thus, we need to ask users when we want to measure their impression of the UX of a product. Concrete UX quality aspects relate the psychological needs of users to properties of the interaction of a user with a product. Therefore, they can be used to formulate questions that are detailed enough to be answered by users. In addition, designers need clearly described qualities to guide them during the design phase and to evaluate their prototypes.

Another advantage is that a clear understanding of the important quality aspects helps UX researchers to decide which UX questionnaire should be used to evaluate a product. Scales of a questionnaire typically map such quality aspects [5]. Another potential application is the definition of new UX questionnaires tailored to the specific needs of a project.

III. UX Quality Aspects

In the following, we describe the UX quality aspects used in this paper. But first we need to define how we conceptualize the term *UX quality aspect*. Here, we follow a definition given in [5]: "*A UX quality aspect describes the subjective impression of users towards a semantically clearly described aspect of product usage or product design.*"

Let us look at some examples to clarify this definition. Learnability (how easy it is to learn how to use a product) is clearly a UX quality aspect. Product design elements, for example, using an easy-to-understand terminology on the user interface, can of course influence this impression. The same is true, for example, for the efficiency of the interaction, dependability of the interaction, fun of use or beauty of the design. Satisfaction with the product price or with the service provided are not considered as UX quality aspects. They are part of the more general concept of customer experience or short CX. These impressions of a user are not influenced by the design of the product itself.

The UEQ+ [11] is a modular framework that allows one to combine predefined UX scales to create a concrete UX questionnaire. Currently, the framework contains 20 UX scales, but they can be extended as needed. In [21], the construction of the clarity scale can be read as an example. It is built on the ideas described in this paper. The descriptions of the following UX quality aspects are oriented towards the descriptions of the corresponding UEQ+ scales [11]. See ueqplus.ueq-research.org or the UEQ+ handbook [12] for more information. A more detailed description of different UX quality aspects, including some UX aspects that are not contained in the list below or in the UEQ+, can be found in [5]. In this paper, we limit the description to UX quality aspects to those aspects that are used in our studies.

The UX quality aspects described below have been extracted by an analysis of existing UX questionnaires and a detailed investigation of UX research literature. Some of the UX quality aspects appear under different labels in research literature. In these cases, alternative names are shown in brackets.

- **Perspicuity (Learnability):** Is it easy to get familiar with the product and to learn how to use it?
- **Efficiency:** Can users solve their tasks without unnecessary effort? Does the product react fast?
- **Dependability (Controllability):** Does the user feel in control of the interaction? Does the product react predictably and consistently to user commands?
- **Usefulness:** Does using the product bring advantages to the user? Does using the product save time and effort?
- **Intuitive use:** Can the product be used immediately without any training or help?
- **Adaptability (Customization):** Can the product be adapted to personal preferences or personal working styles?
- **Novelty (Originality):** Is the design of the product creative? Does it catch the interest of users?
- **Stimulation (Fun of use):** Is it exciting and motivating to use the product? Is it fun to use?
- **Clarity:** Does the user interface of the product look ordered, tidy, and clear?
- **Quality of Content:** Is the information provided by the product always actual and of good quality?
- **Immersion:** Does the user forget time and sink completely into the interaction with the product?
- **Aesthetics (Beauty):** Does the product look beautiful and appealing?
- **Identity:** Does the product help the user to socialize and to present themselves positively to other people?
- **Loyalty:** Do people stick with the product even if there are alternative products for the same task?
- **Trust:** Do users think that their data is in safe hands and not misused to harm them?
- **Value:** Does the product design look professional and of high quality?

Of course, this is not an exhaustive list of all possible UX quality aspects. Nor will there ever be such a list. New products introduce new interaction paradigms and, therefore, new UX quality aspects become important [5]. For example, voice interaction introduces new UX quality aspects that need to be measurable, for example *response behavior* (Does a voice assistant behave respectfully, politely, and in a trustworthy manner?) or *comprehensibility* (Does a voice assistant correctly understand the user's instructions and questions using natural language?) [22].

For most of the aspects mentioned above, corresponding scales are available in the UEQ+ framework [11]. However, the framework also contains several other scales that are not used in the context of our studies and are, therefore, not mentioned in the above list, for example: the scales for voice interaction as well as haptics, and acoustics. See ueqplus.ueq-research.org or the UEQ+ handbook [12] for further and actual information.

It is easy to see that not every UX quality aspect mentioned is relevant in all situations. It depends on demographic factors or simply personal preferences how a specific user judges the importance of a UX factor for a given product. The mean importance rating over all users will also vary considerably between products, that is, the same user will find some of these aspects important for one product, but unimportant for another.

For some of the quality aspects mentioned above, it is also obvious that they are only important for certain products. Of course, *clarity* makes sense for products with a graphical user interface but is pointless for voice interaction. *Identity* describes the user's perception that using a product helps them to create a positive impression and increase their reputation. This only comes into full effect if the user makes the decision to use a product or can significantly contribute to it. In the case of business software, which is used professionally and usually procured by the company, this aspect plays a subordinate role. For a smartphone or usage of certain social platforms *identity* is quite important.

In these examples it is intuitively clear that some UX quality aspects are not important for certain types of products. But this is not always the case. The goal of this paper is to investigate the dependency between product and the importance of certain UX quality aspects.

IV. Research Questions

We address the following research questions in this paper:

- RQ 1: How important are the UX quality aspects described in the previous section for different types of products?
- RQ 2: How can we measure the importance of UX quality aspects for product types in a replicable and stable form?
- RQ 3: How big is the impact of demographic variables and the cultural background on the importance rating of UX quality aspects?
- RQ 4: How accurate is the prediction of the importance rating of a UX quality aspect for a concrete product from the rating of the corresponding product type?

To answer these questions, we summarize the results from some published studies and enrich them with some unpublished new results. In the following we present 5 studies with a total of 361 participants who have submitted nearly 70,000 ratings during the years 2015–2021.

In study 1, we define and test a method to measure the importance of UX aspects for given products or product categories. Study 2 captures the relative importance of a set of well-known UX quality aspects for a larger number of important product categories. Study 3 is a replication of study 2. The goal of this replication is to investigate how stable the results are. Study 4 answers the question if we can infer the relative importance of UX aspects for a concrete product from the corresponding product category. Study 5 replicates study 2 with participants from a different cultural background. The goal of this study is to check if the results are replicable in different countries or cultures.

V. Study 1: How to Measure the Importance of UX Aspects?

A. Introduction

The main goal of this first study was to define a technique to evaluate how important different UX quality aspects were for different types of products.

B. Participants

Participants were recruited over a distribution list. Fifty-one persons took part in the study (35 males, 15 females, 1 gender unknown). The average age was 35 years (minimum 20, maximum 55 years).

C. Method

Each participant was asked to evaluate a browser (Safari, Firefox, Internet Explorer, Chrome, Opera), a text-processing software (Word, Pages, Writer) and a communication tool (WhatsApp, Skype, Facebook, Me) in an online survey. Examples for each type were given according to the products in parentheses. Participants were instructed to skip a product type if they did not use it on a regular basis. Thus, some of the participants evaluated only one or two product categories.

The survey first asked for age, gender, and job title. After this, all the UX aspects described above were presented. Each UX aspect was described by a short text, and the participant should rate on a 7-point scale if the aspect was present in the product and how important this aspect was. Hence, each UX aspect was presented in a block containing two questions.

The following example shows the English translation of the two-items block for the UX aspect *Efficiency* and the product *WhatsApp*. The original study was done in German.

Efficiency	**Fully disagree**						**Fully agree**
I can finish my tasks with WhatsApp with minimal effort. No unnecessary steps are required.	○	○	○	○	○	○	○
Efficiency is important to me for products like WhatsApp	○	○	○	○	○	○	○

The 15 blocks for the UX quality aspects (*Quality of Content* was left out, since it does not make sense for the product types used in the study) were presented below each other.

D. Results

The mean importance ratings over all participants are shown in Fig. 1. To focus mainly on the important UX quality aspects, the corresponding bars are highlighted in color. Accordingly, the irrelevant factors per product category are greyed out.

We also checked the impact of the demographic variables such as age and gender, on the importance ratings. Age seems to have no real impact. The correlations between the age of a participant and the importance rating for the UX aspects are all very small. They are all in the range from -0.20 to +0.17.

Concerning gender, we only found a significant impact (t-test, two-tailed, $p<.05$) for *Novelty* and *Aesthetics*. In both cases the importance ratings from females were a bit higher than those from males. But in general, we can conclude that gender does not have a big impact on perceived importance of UX quality aspects.

The results demonstrate that the ratings for the UX aspects show clear differences. Hence, the method can uncover different levels of importance for the different UX aspects. The impact of the product type is not so clearly visible in this study. Especially, the importance ratings for the pragmatic UX aspects (for example, *Usefulness*, *Dependability*, *Intuitive use*, *Perspicuity* and *Efficiency*) do not differ too much between the three investigated product types.

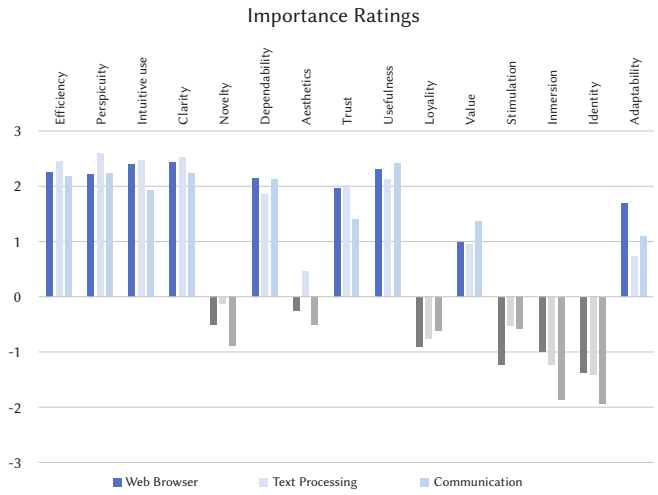

Fig. 1. Mean importance ratings for the UX quality aspects per product category. Scale ranges from -3 to +3.

E. Limitations

The number of participants was small. In addition, since one participant rated several products, it was possible that these ratings were not fully independent. Also, different concrete products were summarized under a category which might have impacted the results.

VI. Study 2: Product Type and Importance of UX Quality Aspects

A. Introduction

The goal of study 2 was to investigate the dependency of product type and the importance of UX quality aspects in a broader context. To avoid the possibility that different products were rated to form a rating for a particular product type, we used abstract product types explained by several examples in this study.

B. Participants

Fifty-eight students from the University of Applied Sciences Emden/Leer were recruited for this study. They received some course credits for participating.

C. Method

The study was conducted in German. The participants were asked to provide their judgements regarding the importance of the UX aspects described above for several software product categories. The UX quality aspects were described by short texts as shown in section III. Each product type was described by a name and several examples:

- *Word processing:* Microsoft Word, Microsoft Power Point, Latex, LibreOffice Writer
- *Spreadsheet:* Microsoft Excel, OpenOffice Calc
- *Messenger:* WhatsApp, Facebook Messenger, SnapChat
- *Social Network:* Facebook, Xing, LinkedIn
- *Video Conferencing:* Skype, Facebook Video Call
- *Web Shops:* Amazon, Conrad, Redcoon, eBay
- *News Portals:* Spiegel.de, Zeit.de, Sueddeutsche.de
- *Booking Systems:* Bahn.de, Lufthansa.de, Booking.com, Hrs.de
- *Info web pages:* Club web site, web site of hometown
- *Learning platforms:* Moodle, Open Elms

- *Programming tools:* Microsoft Visual Studio, Eclipse
- *Image Processing:* Photoshop, Gimp
- *Online Banking:* Online portal of own bank, Starmoney
- *Video Portals:* YouTube, Netflix, Amazon Prime Video
- *Games:* World of Warcraft, Minecraft

Students received a Microsoft Excel list which contained the UX aspects as rows and the product categories as column headers. They were asked to fill out the Excel list and send it back within one week.

Each cell could be filled with the following answer options: *Extremely unimportant* (-3), *Somewhat unimportant* (-2), *Slightly unimportant* (-1), *Neutral* (0), *Slightly important* (1), *Somewhat important* (2), and *Extremely important* (3). Also, the option *Meaningless* could be selected if the UX aspect did not make sense for a product category.

Overall, the Microsoft Excel list consisted of 16 UX aspects and 15 software product categories. The participants had to provide their judgements by filling 240 cells, i.e. making 240 decisions.

D. Results

Let us first look at the mean importance ratings for the UX quality aspects per product type. These data are shown in Fig. 2. The numerical mean values can be found in Table A in the Appendix (German data set, upper values).

As we can see in Fig. 2, the different product types differ clearly in terms of the participants' assessments of the importance of the different UX quality aspects.

Similar to Fig. 1, Fig. 2 is intended to highlight the relevant UX quality aspects. To make cross-category similarities more recognizable, the irrelevant aspects have been lightened.

For related product types (e.g., word processing and spreadsheets, see Fig. 2 first and second row) there are also very similar patterns of importance ratings.

Regarding the inter-individual differences, it can be stated that the observed standard deviations are between 0.46 and 1.99. The average of all standard deviations is 1.32. This means that there are large differences in the assessment by the test participants, and the size of the standard deviation also depends on the product type and UX quality aspect.

E. Limitations

The number of participants is relatively small. They are all German students and, therefore, quite homogeneous as far as demographic factors are concerned. It is therefore questionable if the results can be generalized to other user groups. In addition, only abstract product categories are used. Thus, it must be clarified if results of a particular product category can be used to predict the ratings for concrete products from this category.

VII. Study 3: Checking Stability of the Results of Study 2

A. Introduction

The goal of study 3 was to check how stable the results of study 2 were. So, the study 2 was replicated one year later with a new cohort of students. To keep the effort for the students somewhat lower, only 10 of the former 15 product categories were used. A more detailed description of the study is given in [10].

B. Participants

Sixty-three students from a German university were recruited for the study. They received some course credits for taking part in the study.

C. Method

The study was also conducted in German. The method was completely identical to the method used in the second study.

The product categories *Spreadsheet*, *Video Conferencing*, *Image Processing*, *Info Web Pages*, and *Games* were not used in this study. Thus, we only had 10 product types but the full list of UX aspects.

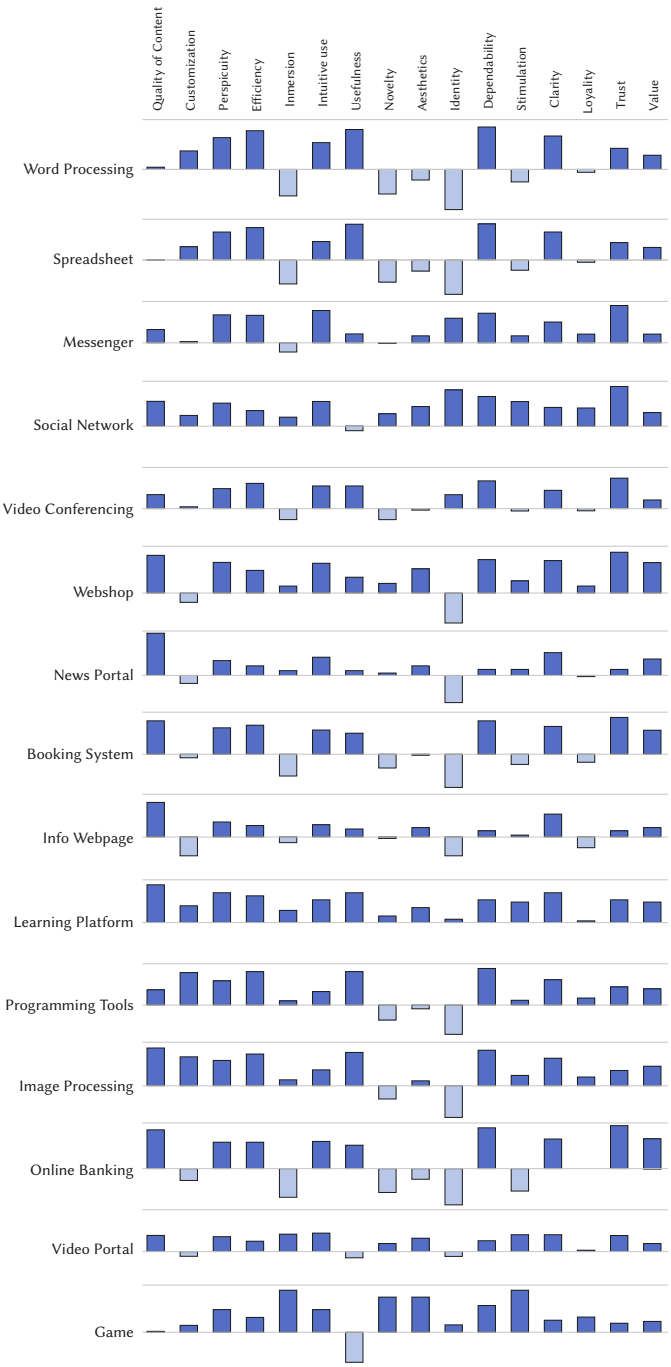

Fig. 2. Means of the importance ratings for the UX quality aspects per product category. Scale ranges from -3 to +3.

D. Results

We were able to compare the 160 mean importance ratings (10 product categories and 16 UX aspects) from both studies. 160 t-Tests (equal variances assumed, $p < .05$) were performed to compare the observed rating in study 2 with the corresponding rating in study

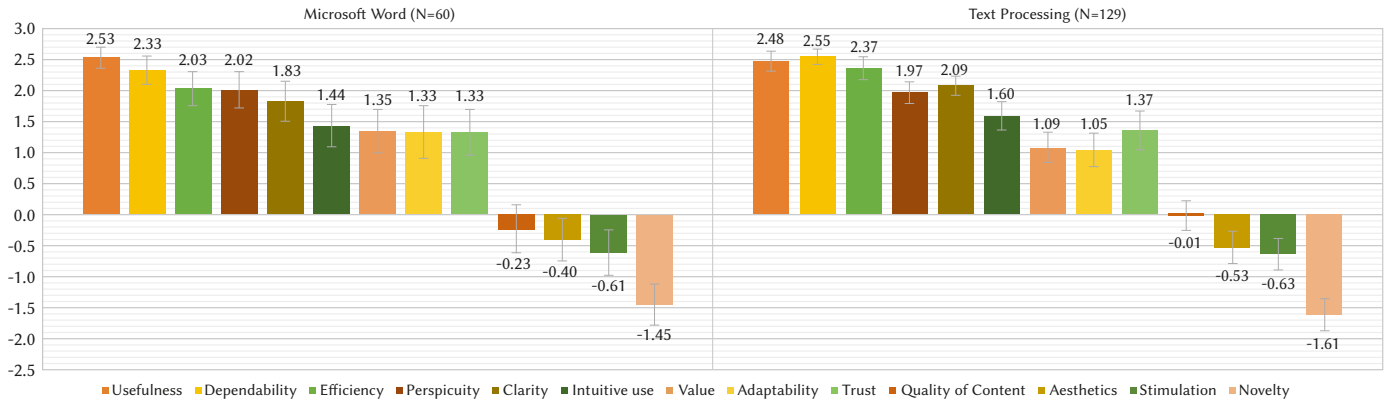

Fig. 3. Importance ratings for the product MS Word and the product type Word Processing.

3. For 154 of these 160 tests the null hypothesis that there were no differences could not be rejected. Only in 6 cases could a statistically significant difference be detected which could be expected with 160 tests and an error probability of .05. Thus, the ratings obtained in study 2 could be reproduced very well.

In addition, we calculated the rank correlations per product category between the two studies. We first transferred the mean importance ratings per product category to ranks from 1 (highest) to 16 (lowest). Then we correlated the ranks for the two studies per product category. The results are shown in Table I.

TABLE I. Rank Correlations Between the Importance Ratings From Study 2 and Study 3

Product category	Rank correlation
Text Processing	0.99
Messengers	0.94
Social Networks	0.88
Webshops	0.97
News Portals	0.94
Booking Systems	0.97
Learning Platforms	0.98
Development Tools	0.98
Online banking	0.99
Video Portals	0.92

The correlations are all extremely high. Thus, the relative importance of a UX aspect for a product category seems to be nearly identical for both data sets. More practically speaking, if we choose, for example, the five most important UX aspects for a product category, it will not make much of a difference if we use the results from study 2 or study 3 for our selection.

In conclusion, the results from study 2 could be reproduced very well. The importance ratings of the UX aspects seemed to be very stable, which provided a positive answer to our research question 2.

E. Limitations

The study showed that the results from study 2 could be reproduced very well. The replication study was conducted with the same target group: German students. Thus, this study does not allow one to conclude that the results also apply to groups with different demographic parameters or from different cultural backgrounds.

VIII. Study 4: Importance of UX Aspects for Specific Products

A. Introduction

In studies 2 and 3, the participants judged the importance of UX quality aspects for product categories. These categories were described by a category name and several examples. In practical projects, however, we are interested to use this knowledge for specific products. Thus, it is very important for us to infer the importance of UX aspects for such a concrete product from the corresponding product category. Study 4 investigated if this is possible. A more in-depth discussion of the study can be found in [9].

B. Participants

Sixty-two master's students in the course User Experience at University of Applied Sciences Emden/Leer participated in this survey. 36 indicated that they were female, 21 identified as male, and 5 did not specify. The average age was 29.6 years, with the youngest participant reporting their age as 23 and the oldest as 48.

C. Method

The method was nearly identical to the previous studies. However, only a subset of the UX aspects was used: *Quality of Content, Adaptability, Perspicuity, Efficiency, Intuitive Use, Usefulness, Novelty, Visual Aesthetics, Dependability, Stimulation, Clarity, Trust,* and *Value.*

Instead of product categories the participants rated the importance of these aspects for specific products (*Google Maps*, *Microsoft Word*, *WhatsApp*, *Instagram*, *Microsoft Teams*, *Discord*, *Trello*, *Zalando.de*, *Tagesschau.de*, *Netflix*, *Spotify*, and *YouTube*). Participants were instructed to rate only products they used and, therefore, not every participant rated every product.

TABLE II. Assignment of Products and Product Categories

Software Product	Product Category
Discord	Video Conference Tools & Messengers
Microsoft Teams	Video Conference Tools & Messengers
WhatsApp	Messengers
Netflix	Video Portals
YouTube	Video Portals
Instagram	Social Networks
Microsoft Word	Text Processing
Tagesschau.de	News Portals
Zalando.de	Web Shops

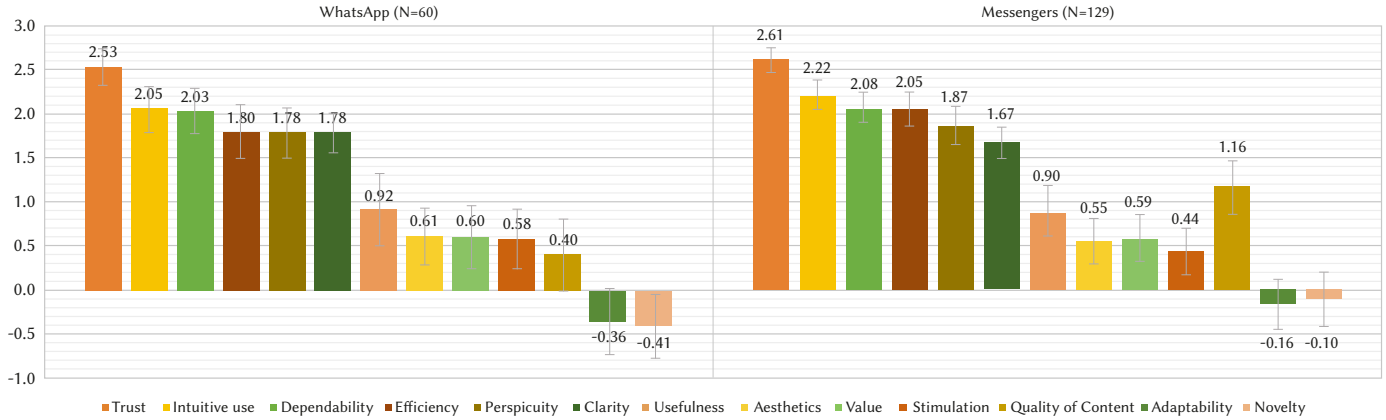

Fig. 4. Importance ratings for the product WhatsApp and the product type Messengers.

Products and product categories were assigned as mentioned in Table II. Notice that both *Discord* and *Microsoft Teams* were assigned to the categories V*ideo Conference Tools* and *Messengers*, which were assumed to cover their main use cases.

D. Results

An overview of all the importance ratings used in the analysis is given in Table C in the Appendix. A detailed description of all the results from this study can be found in two research reports that are available online [23], [24] and in-depth analysis is given in [9]. Exemplary insights into rankings and rank correlations are given in the following.

The importance ratings for the products correspond in most cases quite well to the ratings of the corresponding categories (see examples in Fig. 3 and Fig. 4). The latter are calculated by combining the results of study 2 and study 3; so, they come from independent studies. Hence, we can answer our research question RQ 4 positively: It is possible to use the product category to infer the importance of UX aspects for a concrete product. In the following two examples, we show the comparison of two products to the corresponding categories.

The correspondence between the ratings of the products and the corresponding ratings for the product categories becomes even more evident when we look at the rank orders of the importance ratings for product categories and products.

Table III shows the rank correlations for the importance ratings for the products and the corresponding categories. These correlations are all extremely high. Thus, if a UX aspect is judged as important for a product category, this is also the case for products of this category. Therefore, we can infer the importance of a UX aspect for a single product from the values obtained for the corresponding category.

TABLE III. Rank Correlations for the Importance Ratings of Products and Corresponding Product Categories

Software Product	Product Category	Rank Corr.
Discord	Video Conference Tools	0.88
Discord	Messengers	0.75
Microsoft Teams	Video Conference Tools	0.94
Microsoft Teams	Messengers	0.78
WhatsApp	Messengers	0.93
Netflix	Video Portals	0.86
YouTube	Video Portals	0.83
Instagram	Social Networks	0.64
Microsoft Word	Text Processing	0.97
Tagesschau.de	News Portals	0.96
Zalando.de	Web Shops	0.60

E. Limitations

In this study, only a subset of the product categories and UX aspects from the previous studies was used. Of course, it makes sense to repeat this study for all the categories and UX aspects that are not considered in this study. In addition, if we look at the correlations in Table 3, we see that they vary between 0.97 for Microsoft Word & Text Processing and 0.6 for Zalando.de & Web Shops. Although 0.6 is a very high correlation, it would be an interesting follow-up study to find out why the correspondence is higher for some combinations of product categories and concrete products than for others.

IX. Study 5: A Replication in a Different Culture

A. Introduction

In the previous studies, we investigated how the product type influenced the importance rating of different UX quality aspects. The participants of these studies were German students. This immediately raises the question if the results can be replicated in other countries, that is, with participants that have a different cultural background.

Several papers show a cultural influence on the concrete elements of a user interface design. In [25] the cross-cultural use of computing metaphors is investigated, and they are often deeply rooted in culture. Such metaphors are, for example, the basis for icon design; and clearly, icons based on a metaphor not known in the culture of the users are very difficult for them to understand. Other papers deal with the cultural use of colors [26].

Design teams are usually small and often quite homogeneous in terms of cultural background. Is the design created from such a team acceptable in all cultures? Several research papers deal with this question, which is of high practical relevance, for example [27], [28], [29].

On a more abstract level, the impact of culture on UX was investigated in a number of papers. [30] showed that users performed better if the user interface was designed to match their cultural profile (in the sense of Hofstede's model [31]). [32] found that users' cultural profile impacted their acceptance of specific technologies, and [33] demonstrated that the perceived usability of a web site was higher if it was originally designed in the users' native language.

But there are also papers that doubt the influence of culture on UX. In [34] it was argued that the goals of users when they used a product or web site were the main influence on UX. Due to the increasing globalization people get used to products designed by designers from a different cultural background. Thus, typical interaction patterns become more and more important, and the impact of cultural background should decrease over time [35].

B. How to Define Culture?

Intuitively, we all believe to understand what culture, or the cultural background of a person means. However, it is not easy to give culture a clear and scientific definition. Several theories try to explain differences between cultural groups over sets of cultural dimensions [36]–[40]. The most popular of these theories is the model of cultural dimensions by Hofstede [31], which is based on extensive empirical data. In this paper, we rely on Hofstede's model.

Hofstede assumes that culture is a set of learned traits. These traits make certain behaviors or reactions towards specific situations occur more often in some cultures than in others. This model contains six distinct cultural dimensions (adapted from [31]):

- *Power distance:* Level of acceptance of an unequal power distribution in a country.
- *Individualism vs. Collectivism:* Extent to which members of a culture prioritize their individual goals over the goals of the group.
- *Masculine vs. Feminine:* A masculine culture is mainly driven by competition, while in a feminine culture cooperation and caring for others are the more important values.
- *Uncertainty avoidance:* Desire to accept or avoid uncertain situations.
- *Long-term orientation:* If planning and action are based more on long- or short-term goals.
- *Indulgence vs. Restraint:* Extent to which people try to control their desires and impulses.

The strength of Hofstede's model is that it provides concrete scores for these dimensions in several cultures. According to these scores, Germany and Indonesia are quite different [41]. Indonesia is described as strongly collectivistic and shows a high level of power distance. In contrast, Germany is described as highly individualistic and shows a relatively low level of power distance. For the dimension *Indulgence vs. Restraint*, both countries show nearly the same value. The other dimensions scores for Germany are moderately higher than those for Indonesia. Due to these differences Germany and Indonesia are good candidates for investigation if different cultures cause a different importance rating for UX quality aspects.

Of course, there are also other models of culture [42]–[44] and there is also some critique that the Hofstede model is too stereotypical [45]. But this model is clearly the best investigated cultural model with respect to usability and UX. See, for example, the studies on the connection of the Hofstede dimensions to user interface design elements of web sites [28], [45]. In [39] it was shown that the cultural dimensions defined by Hofstede [31] had dramatic correlations to the development of e-government in countries.

C. Participants

The study was conducted at a large Indonesian university. The 114 participants (average age 21.34 years, 64 males, 50 females) enrolled in a human-computer interaction course and got some credit points for their participation.

D. Method

The study was planned as an exact replication of study 2. Thus, the experimental procedure was completely identical. Of course, all texts were translated carefully into Indonesian language. Some of the examples for the product types were unfamiliar to the Indonesian participants and, therefore, had to be changed. Otherwise, the procedure was exactly as described in study 2.

E. Results

Fig. 5 shows the mean importance ratings for the Indonesian (green bars) and the German sample (blue bars). Just as in Fig. 2, the irrelevant UX quality aspects have been lightened to put the focus on cross-category similarities. The exact values can be found in Table A in the Appendix.

Again, each product type has a typical pattern of importance ratings. In addition, similar product types (see Fig. 2, for example the productivity-oriented tools such as *Word Processing*, *Spreadsheet*, *Programming Tools* and *Image Processing* or the communication tools like *Messenger* and *Video Conferencing*) show quite similar patterns.

If we compare the importance ratings, we see some differences in their values. Especially, the hedonic UX quality aspects are rated a bit higher in the Indonesian sample. If we compare the mean importance ratings per product type and the UX quality aspect, we see that in 156 out of 240 cases the ratings differ significantly (t-test, $p < .05$, two-tailed).

But we cannot simply infer cultural differences from this simple comparison of mean importance ratings. There is an overall answer tendency that must be considered. The average rating over all UX quality aspects and product types is 4.85 for the German and 5.51 for the Indonesian sample. Thus, Indonesian participants in general use higher ratings than German participants do.

If we look only at the relative importance of the UX quality aspects, we see that the judgements in both samples are quite similar. This is also confirmed by the very high correlations between importance ratings for both groups (see last column in Table A in the Appendix).

To show this in greater detail, we transformed the mean importance ratings to ranks. Rank 1 is assigned to the UX quality aspect with highest mean importance rating for a product type, rank 2 to the UX quality aspect with the second highest mean importance rating, and so on. Table B in the Appendix shows these ranks. If we compare the ranks for both samples per product type, we see that they are quite similar. This is also confirmed by the correlations in the last column of Table B.

How big is the impact of culture compared to the impact of individual differences between persons in one cultural group? To answer our research question RQ 3, an analysis of variance was performed. For each combination of product type and UX quality aspects, the total variance VAR over the complete data set that included the German and Indonesian participants was calculated. The variance explained by the two cultural groups $VAR(G,I)$ was then calculated by the formula:

$$VAR(G,I) = \left(n_G * \sum_{1}^{n_G} (\bar{x}_G - \bar{x})^2 + n_I * \sum_{1}^{n_I} (\bar{x}_I - \bar{x})^2 \right) \Big/ (n_G + n_I)$$

where n_G, n_I are the sample sizes for the German and Indonesian groups of students, and $\bar{x}_G$, $\bar{x}_{GI}$, and $\bar{x}$ are the mean values in both samples and the complete data set. This is the variance we would expect if all persons in one cultural group show the same importance rating, that is, if the importance ratings are completely dependent on culture.

The value $\frac{VAR(G,I)}{VAR}$ can be interpreted as the relative amount of variance explained by the two groups compared to the total variance. The results show that that the proportion of variance explained by culture is very small compared to the impact of individual preferences (for detailed results, see Table V in [46]). Thus, the cultural background of the users only seems to play a minor role concerning the importance of UX aspects for the overall UX impression for products. The product type and the main usage scenarios for a product are the main factors here.

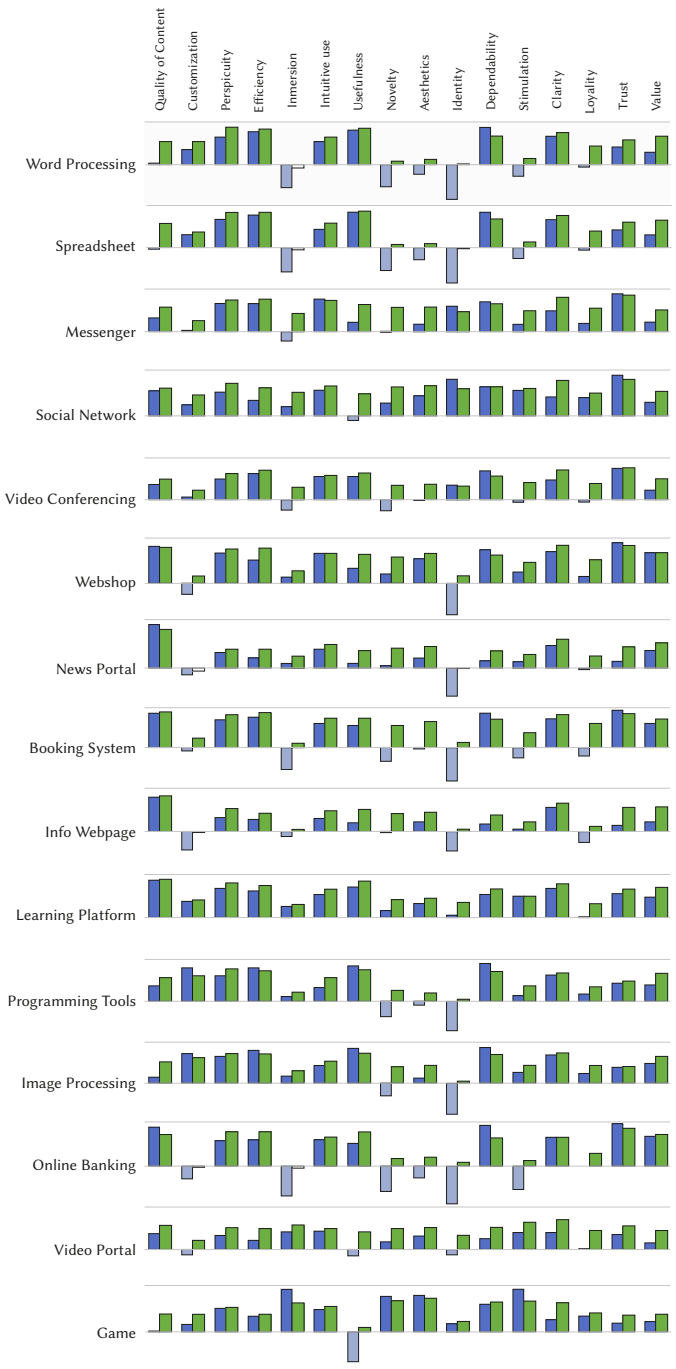

Fig. 5. Means of the importance ratings for the UX quality aspects per product category. The values for the German sample are shown as blue bars and those for the Indonesian sample as green bars.

F. Limitations

Our results indicate that the impact of the cultural background of a person on the importance rating of UX quality aspects is relatively small. Of course, we compared data from only two different countries. German and Indonesian cultural values differ quite substantially according to an established model of cultural differences. If there are no substantial differences between such different cultures, then it is very likely that this also applies to other cases. But similar studies in other countries are required to check if the findings can really be generalized.

X. What Are the Most Important UX Aspects for A Project?

In our studies it has shown that the importance of UX aspects for the overall UX impression of users differs with the product category. We have also presented a simple rating method that can be used to get valid data which are replicable and do not depend too much on demographic data or cultural background of users.

To summarize the illustrations and tables that have been provided, especially the complete overviews in Tables A and B in the Appendix, important UX quality aspects have clearly been assigned to certain product types.

Accordingly, the following most important UX aspects should be considered when launching or evaluating the corresponding product types:

- **Word Processing, Spreadsheet, Programming Tool, and Image Processing:** The most important aspects, as shown in all studies, are *Usefulness* and *Dependability*. In addition, UX quality aspects such as *Efficiency*, *Perspicuity* and *Clarity* are also important for these categories.
- **Booking System and Online Banking**: For these two categories, the aspects *Trust* and *Dependability* are most important. As can be seen in Table B in the Appendix, the aspects *Quality of Content* and *Clarity* are not to be neglected either.
- **WebShop, Messenger, Social Network, and Video Conferencing Tool**: While *Trust* is most important for these four categories, *Dependability* and *Intuitive use* should also be considered.
- **Learning Platform, News Portal, Info Web Page**: Clearly, *Quality of Content* is the most important in these three categories. But the aspects *Clarity*, *Intuitive use* and *Perspicuity* should also be considered.
- **Video Portal**: Only in this category, the most important aspect is *Intuitive use*. But *Immersion*, *Stimulation* and *Clarity* are also scoring highly.
- **Game**: The UX quality aspects *Immersion* and *Stimulation* should be considered most important for this category.

The presented data can be used to determine what the most important aspects are for the design of a new product or evaluating an existing one. Table B shows the importance ranks for the UX aspects and can be used to determine which UX aspects are likely to be the most important ones for the overall UX judgement for a product from this category.

A quite simple method to pick which aspects to focus on for a product would be to order the corresponding UX aspects by their ratings and then to consider the top 5 (or any other number). However, in practice things are typically not so easy. Our data shows what is most likely important for the users of a product. But in real design projects other interests must be considered as well, that is, what is most important for the users of a product may not completely cover the design goals of a project.

Let us illustrate this with a simple example. Assume that a new user interface for a programming environment should be designed and implemented. If we look at Table A in the Appendix, we see that the most important aspects are *Dependability*, *Usefulness*, *Efficiency*, *Customization* and *Clarity* (it is not surprising that these are the tools used in a working context). *Visual aesthetics* or *Beauty* of the design does not play a role for users (this aspect is ranked on position 12 of 16). However, aesthetics of the design may be highly relevant to

the marketing of the new user interface. Hence, it may be a highly relevant UX aspect, even though users report not caring about it.

Thus, our results will help designers and product owners to identify which UX aspects are important for the real users, but it is not wise to rely solely on this data when it comes to executing real projects.

XI. Summary of the Results

In this section we will summarize the results of our studies and answer the research questions described above.

A. RQ 1: Importance of UX Aspects

One of the goals of the research was to find out how important the different UX quality aspects were for different product types.

As we described in the last section, our results could help designers and product owners to get an idea about which UX aspects they should focus on during designing and for the later evaluation of the finished product. Here, the obtained ratings from our studies can be used to determine the most relevant aspects for a product from a given product category.

B. RQ 2: Measurement Method

We showed in several studies how the importance of UX quality aspects for product types or products could be measured by a simple rating mechanism. The results proved to be replicable and stable. The method can be used to get ratings for product categories and for concrete products.

1. RQ 3: Impact of Demographic Variables or Cultural Background

For the practical applicability of our findings concerning the importance of UX aspects for the overall UX impression, it was important to clarify if they were greatly influenced by the cultural background of the users. This is especially essential for products that are developed for international markets.

In study 5 we compared the importance ratings obtained from persons living in countries with a quite different culture according to the cultural dimension of Hofstede. The results indicate that the impact of culture on the importance of UX aspects for the different product categories is small. The type of the product defines which UX quality aspects are important for a concrete product and the cultural background only seems to have a limited impact here.

C. RQ 4: Prediction From the Product Category

Another important question for the practical applicability of our findings was if it is possible to predict the importance rating of a UX quality aspect for a concrete product from the rating of this aspect in the corresponding product type.

As the results of study 4 show, this seems to be the case. The ratings obtained for concrete products are very similar to those obtained for the corresponding product categories. The rank correlations between the importance ratings for the product categories and specific products from these categories are extremely high. Hence, if a UX aspect is important for a product category it is also important for concrete products from that category and vice versa.

XII. Practical Implications

In this section, we will focus on the practical implications of our work. How can our results be applied by UX designers and UX researchers?

The design process of a product is a complex series of detailed design decisions. For a designer, it is beneficial to know which aspects of a design are important for the potential users of the product and which UX quality aspects are less important or completely irrelevant. In the design process, this helps to concentrate on those decisions that have an impact on the important UX quality aspects. Typically, a larger team of designers, developers or product owners collaborate in a design process. To streamline the discussion, it is crucial that all members of the team share the same understanding about the UX quality aspects that are important for the users.

Changes to an existing design or the introduction of new features to an existing product often have positive and negative effects on various UX quality aspects. If it is not clear how important these UX quality aspects are, this can lead to endless discussions.

For example, assume that a new feature should be added to a product that makes data entry much more efficient but adds conceptual complexity and therefore makes it more difficult to understand how to operate the product. If the product is used often during a workday, efficiency is of great importance to users. For such tools, typically, some short learning phase will be required and therefore, perspicuity will not be equally important. Thus, introducing the new feature is in this case a good idea. If, on the other hand, the product is a rarely used self-service (for example for requesting holidays), then things are different. Due to the rare product usage, efficiency will be not very important, but the tool must be usable intuitively since the user may not remember how to operate it. Therefore, in this case the introduction of the new feature would be a bad idea.

Of course, things are trivial in this example. For other UX quality aspects it is ultimately not clear how important they are for a particular product. Our results provide guidance to UX designers about the importance of UX quality aspects in different situations. If the new product belongs to one of our investigated product types, the results shown above can be used to determine the UX quality aspects that are most likely important for the product.

Our results are also helpful when evaluating already existing products: Questionnaires are a popular method to do so. They allow collecting data of larger target groups with little effort. In addition, standard questionnaires allow one to compare different products or product versions by the measured scale values. But which questionnaire should be used for such an evaluation? A large number of UX standard questionnaires are available [2]. All of them offer a different combination of UX scales that represent different UX quality aspects. Being interested in evaluating how our users like the UX with the product, we should measure exactly the UX quality aspects that users consider important to the overall quality of the UX. The results reported in this paper can help UX researchers to select the best questionnaire (or a combination of questionnaires) for their product evaluation.

This knowledge about the importance of UX quality aspects for a certain product is also required to select the right scales in modular approaches, for example the UEQ+ [11]. The use of UEQ+ requires the researcher to choose the most relevant scales out of a catalogue of the currently 20 available scales in the framework. To keep the length of the questionnaire within a reasonable limit it is recommended to use not more than six scales in a single product evaluation. Thus, the knowledge of how important the underlying UX quality aspects are for the overall UX impression is crucial to making a good selection.

Appendix

TABLE A. Means of the Importance Ratings for the UX Quality Aspects for the 15 Product Categories and the German and Indonesian Samples. The Last Column Contains the Correlation Between the Importance Ratings for the German and Indonesian Samples. The Scale Ranges From-3 to+3

Category	Sample	Perspicuity	Efficiency	Dependability	Intuitive use	Usefulness	Adaptability	Clarity	Novelty	Aesthetics	Identity	Stimulation	Immersion	Value	Loyalty	Trust	Quality of Content	Correlation
Word Processing	**German**	1.91	2.31	2.60	1.60	2.45	1.07	2.00	-1.54	-0.67	-2.48	-0.76	-1.63	0.84	-0.16	1.26	0.10	**0.94**
	Indonesian	2.62	2.48	2.03	1.91	2.55	1.24	2.27	0.22	0.35	0.02	0.42	-0.25	1.98	1.30	1.75	1.64	
Spreadsheet	**German**	2.00	2.33	2.53	1.29	2.53	0.91	1.98	-1.61	-0.81	-2.52	-0.76	-1.75	0.88	-0.16	1.23	-0.05	**0.95**
	Indonesian	2.51	2.54	2.02	1.75	2.58	1.12	2.27	0.21	0.28	-0.05	0.39	-0.13	1.96	1.15	1.80	1.67	
Programming Tool	**German**	1.83	2.41	2.69	1.00	2.52	2.38	1.86	-1.09	-0.26	-2.11	0.38	0.35	1.21	0.50	1.31	1.11	**0.92**
	Indonesian	2.34	2.23	2.14	1.66	2.25	1.82	2.02	0.79	0.58	0.15	1.13	0.65	1.99	1.04	1.44	1.70	
Image Processing	**German**	1.79	2.22	2.43	1.14	2.34	2.00	1.88	-0.89	0.31	-2.22	0.70	0.41	1.33	0.63	1.02	0.36	**0.91**
	Indonesian	1.96	1.98	1.93	1.46	2.03	1.72	2.06	1.06	1.19	0.09	1.14	0.79	1.79	1.19	1.12	1.45	
Booking System	**German**	1.97	2.14	2.47	1.74	1.55	-0.24	2.03	-1.00	-0.07	-2.44	-0.78	-1.62	1.71	-0.60	2.70	2.44	**0.89**
	Indonesian	2.35	2.51	2.06	2.13	2.12	0.67	2.33	1.61	1.84	0.33	1.06	0.28	2.04	1.75	2.40	2.53	
Online Banking	**German**	1.79	1.84	2.83	1.83	1.59	-0.86	2.02	-1.71	-0.79	-2.62	-1.61	-2.02	2.10	0.00	2.98	2.68	**0.94**
	Indonesian	2.36	2.38	1.98	2.03	2.38	-0.07	2.03	0.50	0.61	0.26	0.36	-0.13	2.22	0.88	2.65	2.24	
Web-Shop	**German**	1.97	1.47	2.17	1.93	0.96	-0.69	2.07	0.60	1.59	-2.00	0.70	0.40	1.98	0.45	2.62	2.42	**0.91**
	Indonesian	2.24	2.29	1.82	1.92	1.86	0.47	2.44	1.72	1.94	0.50	1.33	0.86	2.00	1.56	2.46	2.36	
Messenger	**German**	1.95	1.98	2.09	2.28	0.60	0.03	1.45	-0.02	0.50	1.75	0.51	-0.65	0.60	0.58	2.67	0.93	**0.76**
	Indonesian	2.22	2.25	1.98	2.19	1.88	0.77	2.37	1.71	1.71	1.38	1.46	1.26	1.51	1.61	2.58	1.67	
Social Network	**German**	1.55	1.00	1.91	1.66	-0.27	0.69	1.26	0.84	1.31	2.39	1.65	0.58	0.90	1.19	2.66	1.67	**0.65**
	Indonesian	2.14	1.83	1.89	1.95	1.39	1.38	2.28	1.91	1.98	1.78	1.77	1.57	1.61	1.48	2.39	1.84	
Video Conferencing	**German**	1.48	1.86	2.07	1.67	1.64	0.16	1.36	-0.78	-0.05	1.04	-0.14	-0.76	0.66	-0.13	2.24	1.05	**0.83**
	Indonesian	1.83	2.12	1.68	1.74	1.91	0.65	2.06	1.03	1.10	0.92	1.19	0.88	1.50	1.11	2.19	1.44	
Learning Platforms	**German**	1.95	1.78	1.53	1.55	2.05	1.05	1.97	0.38	0.90	0.08	1.43	0.70	1.36	-0.04	1.56	2.53	**0.84**
	Indonesian	2.35	2.12	1.91	1.89	2.44	1.12	2.26	1.13	1.25	0.99	1.39	0.86	2.04	0.90	1.91	2.56	
Video Portal	**German**	1.00	0.65	0.72	1.28	-0.43	-0.33	1.16	0.53	0.93	-0.33	1.14	1.22	0.50	0.02	1.07	1.12	**0.84**
	Indonesian	1.57	1.46	1.54	1.47	1.22	0.63	2.11	1.50	1.54	0.99	1.92	1.74	1.38	1.33	1.68	1.75	
News Portal	**German**	0.98	0.66	0.43	1.23	0.30	-0.46	1.50	0.12	0.66	-1.85	0.42	0.27	1.14	-0.07	0.39	2.88	**0.91**
	Indonesian	1.26	1.26	1.09	1.51	1.14	-0.22	1.90	1.29	1.39	-0.01	0.85	0.74	1.68	0.76	1.38	2.53	
Info Web Page	**German**	0.97	0.79	0.41	0.86	0.56	-1.33	1.60	-0.07	0.64	-1.37	0.11	-0.36	0.60	-0.75	0.35	2.41	**0.93**
	Indonesian	1.57	1.26	1.15	1.45	1.50	-0.08	1.96	1.23	1.31	0.12	0.61	0.08	1.71	0.31	1.61	2.45	
Game	**German**	1.53	1.02	1.82	1.48	-1.94	0.47	0.81	2.33	2.38	0.50	2.84	2.84	0.67	1.06	0.56	0.04	**0.89**
	Indonesian	1.64	1.14	1.96	1.67	0.22	1.17	1.95	2.03	2.22	0.70	2.03	1.92	1.15	1.30	1.08	1.15	

TABLE B. RANKS OF THE IMPORTANCE RATINGS FOR THE UX QUALITY ASPECTS FOR THE 15 PRODUCT CATEGORIES AND THE GERMAN AND INDONESIAN SAMPLES. THE LAST COLUMN CONTAINS THE RANK CORRELATION FOR THE GERMAN AND INDONESIAN SAMPLES. THE FIVE MOST IMPORTANT UX ASPECTS ARE SHOWN IN BOLD FONT

Category	Sample	Perspicuity	Efficiency	Dependability	Intuitive use	Usefulness	Adaptability	Clarity	Novelty	Aesthetics	Identity	Stimulation	Immersion	Value	Loyalty	Trust	Quality of Content	Correlation
Word Processing	**German**	**5**	**3**	**1**	6	**2**	8	**4**	14	12	16	13	15	9	11	7	10	**0,91**
	Indonesian	**1**	**3**	**5**	7	**2**	11	**4**	14	13	15	12	16	6	10	8	9	
Spreadsheet	**German**	**4**	**3**	**1**	6	**1**	8	**5**	14	13	16	12	15	9	11	7	10	**0,94**
	Indonesian	**3**	**2**	**5**	8	**1**	11	**4**	14	13	15	12	16	6	10	7	9	
Programming Tool	**German**	6	**3**	**1**	10	**2**	**4**	**5**	15	14	16	12	13	8	11	7	9	**0,90**
	Indonesian	**1**	**3**	**4**	9	**2**	7	**5**	13	15	16	11	14	6	12	10	8	
Image Processing	**German**	6	**3**	**1**	8	**2**	**4**	**5**	15	14	16	10	12	7	11	9	13	**0,85**
	Indonesian	**4**	**3**	**5**	8	**2**	7	**1**	14	11	16	12	15	6	10	13	9	
Booking System	**German**	6	**4**	**2**	7	9	11	**5**	14	10	16	13	15	8	12	**1**	**3**	**0,89**
	Indonesian	**4**	**2**	8	6	7	14	**5**	12	10	15	13	16	9	11	**3**	**1**	
Online Banking	**German**	8	6	**2**	7	9	12	**5**	14	11	16	13	15	**4**	10	**1**	**3**	**0,76**
	Indonesian	**4**	**2**	9	7	**2**	15	8	12	11	14	13	16	6	10	**1**	**5**	
Webshop	**German**	6	9	**3**	7	10	15	**4**	12	8	16	11	14	**5**	13	**1**	**2**	**0,86**
	Indonesian	**5**	**4**	10	8	9	16	**2**	11	7	15	13	14	6	12	**1**	**3**	
Messenger	**German**	**5**	**4**	**3**	**2**	10	14	7	15	13	6	12	16	9	11	**1**	8	**0,71**
	Indonesian	**4**	**3**	6	**5**	7	16	**2**	9	8	14	13	15	12	11	**1**	10	
Social Network	**German**	7	11	**3**	**5**	16	14	9	13	8	**2**	6	15	12	10	**1**	**4**	**0,59**
	Indonesian	**3**	9	7	**5**	15	16	**2**	6	**4**	10	11	13	12	14	**1**	8	
Video Conferencing	**German**	6	**3**	**2**	**4**	**5**	11	7	16	12	9	14	15	10	13	**1**	8	**0,81**
	Indonesian	**5**	**2**	7	6	**4**	16	**3**	13	12	14	10	15	8	11	**1**	9	
Learning Platform	**German**	**4**	**5**	8	7	**2**	11	**3**	14	12	15	9	13	10	16	6	**1**	**0,93**
	Indonesian	**3**	**5**	7	9	**2**	13	**4**	12	11	14	10	16	6	15	7	**1**	
Video Portal	**German**	7	10	9	**1**	16	14	**3**	11	8	15	**4**	**2**	12	13	6	5	**0,83**
	Indonesian	6	11	7	10	14	16	**1**	9	7	15	**2**	**4**	12	13	5	3	
News Portal	**German**	**5**	6	8	**3**	11	15	**2**	13	6	16	9	12	**4**	14	10	**1**	**0,85**
	Indonesian	9	8	11	**4**	10	16	**2**	7	**5**	15	12	14	**3**	13	6	**1**	
Info Web Page	**German**	**3**	**5**	9	**4**	8	15	**2**	12	6	16	11	13	7	14	10	**1**	**0,84**
	Indonesian	**5**	9	11	7	6	16	**2**	10	8	14	12	15	**3**	13	**4**	**1**	
Game	**German**	6	9	**5**	7	16	14	10	**4**	**3**	13	**1**	**1**	11	8	12	15	**0,82**
	Indonesian	8	13	**4**	7	16	10	**5**	**2**	**1**	15	**3**	6	12	9	14	11	

TABLE C. Average Importance Ratings of UX Aspects for Products and Categories. Scale Ranges From -3 to +3.

Product Category	Quality of Content	Adaptability	Perspicuity	Efficiency	Intuitive use	Usefulness	Novelty	Aesthetics	Dependability	Stimulation	Clarity	Trust	Value
Video Conf. Tool	1.07	-0.06	1.39	1.89	1.58	1.61	-0.78	-0.06	2.05	-0.05	1.32	2.17	0.68
Discord	0.36	1.09	1.57	2.04	1.43	1.57	0.26	0.78	1.91	0.57	1.48	2.17	1.09
Microsoft Teams	1.08	1.03	1.83	2.07	1.43	2.10	-0.77	0.50	1.87	-0.14	1.53	2.20	1.20
Messenger	1.16	-0.16	1.87	2.05	2.22	0.90	-0.10	0.55	2.08	0.44	1.67	2.61	0.59
WhatsApp	0.40	-0.36	1.78	1.80	2.05	0.92	-0.41	0.61	2.03	0.58	1.78	2.53	0.60
Video Portal	1.10	-0.04	1.07	0.64	1.51	-0.60	0.52	1.09	1.01	1.48	1.27	1.00	0.58
Netflix	1.75	1.15	1.58	1.07	1.82	-1.47	0.95	1.38	1.22	2.07	1.27	0.69	0.82
YouTube	0.93	0.70	1.39	1.07	1.87	-0.21	0.32	0.79	1.26	2.10	1.31	1.07	0.46
Social Network	1.69	0.56	1.46	0.98	1.73	-0.25	0.63	1.11	1.80	1.46	1.40	2.51	0.94
Instagram	0.62	0.34	1.02	0.86	1.45	-1.12	1.23	2.23	1.20	2.25	1.23	1.68	1.14
Text Processing	-0.01	1.05	1.97	2.37	1.60	2.48	-1.61	-0.53	2.55	-0.63	2.09	1.37	1.09
Microsoft Word	-0.23	1.33	2.02	2.03	1.44	2.53	-1.45	-0.40	2.33	-0.61	1.83	1.33	1.35
News Portal	2.87	-0.58	0.86	0.64	1.16	0.37	-0.18	0.56	0.62	0.37	1.50	0.31	1.21
Tagesschau.de	2.84	-1.00	1.00	0.82	1.19	0.43	-0.54	0.35	0.41	0.38	1.39	0.04	2.11
Web Shop	2.42	-0.76	1.92	1.60	2.07	1.05	0.27	1.33	2.26	0.81	2.12	2.70	1.96
Zalando.de	1.54	0.09	1.43	1.35	2.00	-0.42	0.71	1.74	0.94	1.60	1.86	2.03	1.91

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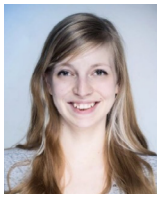

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