INTUI. Exploring the Facets of Intuitive Interaction.

Daniel Ullrich, Sarah Diefenbach

Technische Universität Darmstadt, Folkwang Universität Essen

Abstract

The growing interest in intuitive interaction in research and product design comes along with a demand for according measurement tools. The present research introduces a novel questionnaire which captures different components of intuitive interaction, in particular, *Effortlessness*, *Gut Feeling*, *Magical Experience* and *Verbalizability*. Components and the respective questionnaire items were developed based on literature review and an expert workshop, and then tested for reliability and validity in three empirical studies with a total of 334 participants. In all three studies a stable four factor structure representing the four components emerged. Analysis of correlations to further measures provided a deeper understanding of the concept. Finally, product category specific patterns of the relative specification of the components could be identified. Altogether, the presented questionnaire forms an easy applicable tool for practitioners and researchers.

1 Introducing the concept of Intuitive Interaction

Product designers are facing new challenges over and over again: after the claim for usability, which was even manifested in an ISO norm (DIN EN ISO 9241-11 1998), it was remarked that products should be even more than usable (e.g., Burmester et al. 2002), and the term usability was integrated in the more holistic term user experience (Hassenzahl & Tractinsky 2006). Finally, the latest buzzword among researchers and vendors is intuitive interaction[41]: Many companies promote their products as being more intuitive than ever, for example, Adobe announced to improve its products by "making the most powerful editing techniques more intuitive" (Adobe System 2010). And when presenting the new iPad at the Apple Keynote in San Francisco, Steve Jobs claimed that "this new category of devices will connect users with their apps and content in a much more intimate, intuitive and fun way than ever before." (Apple Inc 2010). Accordingly, there is also a growing interest in the role

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[41] We use the terms *intuitive interaction* and *intuitive use* interchangeably, both stand for interaction styles which are perceived as highly intuitive. Accordingly, *intuitiveness* is not regarded as an existing product feature but as the subjectively perceived degree to which a product is being usable in an intuitive manner.

of intuition in usability testing and evaluation (e.g., Meyer & Kindsmüller 2009). However, it is still unclear how a product's intuitiveness can or should be assessed. In this paper, we present a novel questionnaire which is based on a multidimensional concept of intuition, and thus captures different facets of intuitive interaction.

When starting our research it quickly became clear that rating a product's degree of intuitiveness would be a challenging undertaking, at least in the sense of objective assessment: What is intuitive for one person might appear absurd for the other. The question whether something appears intuitive depends on the congruence to one's personal prior experience, so that a new "objectively" intuitive concept might not be perceived as such when it deviates too much from the familiar concept. For example, this was revealed when Microsoft introduced the new ribbon interface in the Office 2007 Suite. Though it was supposed to be the "intuitive counterpoint to the typical standard Windows menu system" (Microsoft 2010) some users were sceptical about its advantages and hesitated to switch from the familiar menu-structure to the foreign ribbon structure, and declared the latter as "a disaster", "shockingly painful to use" and "definitely not intuitive" (Kyd 2007). The grouping of similar commands and the expanded overview of available functions certainly allows an easy entry for novice users, but at least for some of the expert users, the convincing simplicity of the new concept could not outweigh the loss of their familiar menu structure.

However, this dependence of perceived intuitiveness on prior experience is not only an obstacle but also a chance to design for intuitive interaction. Luckily there are also shared cultural experiences which thus can be used as a basis for the design of operating concepts (e.g., Hurtienne & Israel 2007). Accordingly, the reference to prior experience is central to most suggested definitions which describe intuitive use as the unconscious utilization of knowledge acquired through past experiences (e.g., Blackler 2008; Naumann et al. 2009). However, speaking of intuitive use and not simply of the application of knowledge, there remains the question how much these past experiences must differ from the actual use case. Moreover, Naumann and colleagues (2009) point out that intuitive use results in *efficient* interaction, and accordingly focus in their questionnaire on intuitive use on performance related issues such as "perceived goal achievement", "error rate", and "learning". In our view, intuitive interaction is not a solely pragmatic issue. Other than classical usability criteria, which may be surveyed in form of "checklists" such as the ISO norm questionnaire (Prümper 1997), it requires a holistic approach which respects its complexity. Instead of limiting our scope, we were rather interested in indentifying the different facets that constitute the overall experience of intuitive interaction. Thus, our research goal was to first identify the central components of intuitiveness by literature research and interviews, and then map these onto questionnaire scales.

To broaden our scope, we did not only include HCI literature on intuitive interaction but also psychological literature on intuitive decision making. Here, the following central aspects of intuitive decision making were identified:

- Intuition is a process that is usually fast and without the need of effort (e.g., Agor 1986, Bastick 2003, Hammond 1996, Hogarth 2001).

- Intuition is usually an unconscious process (e.g., Agor 1986; Bastick 2003; Fischbein 1987; Hammond 1996).

- Intuitive decisions are based on gut feelings rather than reason (Gigerenzer 2007; Hammond 1996; Hogarth 2001).

- Intuition leads us to decisions which cannot necessarily been explained (e.g., Agor 1986; Bastick 2003; Fischbein 1987; Hogarth 2001).

Based on these finding we formulated labels to capture each of these prominent characteristics of intuitive decision making. In particular, these were *Effortlessness*, *Attention*, *Gut Feeling*, and *Verbalizability*. Concerning the last one, *Verbalizability*, we are not certain whether something that applies to decision making – intuitive decisions are characterized by a low degree of verbalizability – can be applied to intuitive interaction as well. However, we still wanted to include this component in our questionnaire to find out whether any correlations to the other components or overall ratings could be revealed. In addition to these four components derived from the literature on intuitive decision making, we believed that there should be an additional component, capturing the experiential characteristics of intuitive interaction compared to "normal" interaction. Here, our idea was that the event of using technology in a particularly affect-based, effortless manner, exceeding the user's expectations, might also be experienced as something special or even magical. Thus, we added *Magical Experience* as fifth component. We therefore began our research with a model of five components.

2   Questionnaire Construction

Based on the components of intuition which we identified in our literature review, an initial set of items was constructed in a workshop with fifteen participants. At first, they were asked to name characteristics of intuitive interaction based on their daily experience. In order to make sure that participants reported their spontaneous ideas and did not narrow down their thoughts, this brainstorming was conducted before the concepts from intuitive decision making were introduced. However no entirely new component could be identified. After this, statements capturing the experience of (non-)intuitive product interaction were gathered for each of the five components among five usability experts of the authors' working group. They were encouraged to think of as many statements as possible, these were noted without any discussion or critique. In this manner, altogether about fifty statements were gathered. For example, the statement "While using the product I was guided by feelings." related to *Gut Feeling*, "Using this product was easy" related to *Effortlessness*. In the following phase, the statements gathered so far were critically discussed and some of them reformulated. Also, some statements were reassigned to another component than they were initially formulated for. During this discussion it turned out that some statements could be better understood by making use of contradictory terms such as "... guided by feelings" versus "... guided by reason". Hence, we decided that the questionnaire should consist of a list of paired, contradictory statements, which then could be used to describe one's personal experience of product use by indicating which of the two statements was more suitable. Accordingly, we gathered

contradictory terms for all the statements, while those statements for which no opposite could be found were excluded. Finally, we selected a set of items for a first version of the questionnaire on intuitive interaction.

In order to create a measurement tool which can be easily applied with manageable expenditure we did not want more than twenty items for the final version of the questionnaire. We therefore aimed at selecting about thirty items for the first version, with the idea to keep about half of them for the final version. So again, the collection of statements was critically observed and items which were quite long, complicated, or almost similar to another one were excluded. In the end, a set of thirty-two items remained which was used in the pilot application of the questionnaire. Table 1 shows exemplified items for the five components (for the final questionnaire visit http://www.intuitiveinteraction.net/).

Effortlessness: Using the product… …was difficult. / …was easy.

Attention: Using the product… …required my close attention. / …ran smoothly.

Gut Feeling: When using the product… …I was guided by reason. / …I was guided by feelings.

Verbalizability: In retrospect… …it is hard for me to describe the individual operating steps / …I have no problem describing the individual operating steps

Magical Experience: Using the product… …was nothing special. / …was a magical experience.

Table 1: Sample Items of the initial questionnaire

3   Application of the INTUI Questionnaire

In the first version of the questionnaire we presented the mentioned set of items as a seven-point-scale with the respective opposite statements as poles. The items were poled in changing directions, so that for some items the statement indicating higher intuitiveness was on the left (1), for some it was on the right (7).

3.1   Pilot Application

For a first test, our questionnaire was applied to a very basic use case, i.e., operating an MP3 player. We chose this ordinary task because first and foremost, we wanted to find out, whether the item inter-correlations would reveal the underlying five components. While following studies certainly should deal with potential differences between the components' respective specifications, at this point of time, we wanted to study a standard operational concept without a special relation to one of the components.

The study was conducted with 64 participants (53 female, mean age=24 years) who had to perform a number of defined tasks (e.g., selecting specific songs, changing the volume etc.). To capture the participants' experience in a natural usage situation, at first, participants did not know about the significance of using the player. In fact, they used the player as a natural part of our "study on the influence of music on cognitive performance", in which participants

had to solve anagrams while listening to different styles of music. Afterwards, participants were handed out the questionnaire and were asked to describe their experience of using the player. Besides the questionnaire on intuitive interaction, we surveyed two global evaluation ratings (seven-point scales; not at all intuitive – very intuitive and bad - good) and a number of variables concerning general expertise and frequency of use of MP3 players. Furthermore, participants also expressed their impression of the player itself, using the AttrakDiff 2 questionnaire (Hassenzahl et al. 2003).

The main aims of this study were to examine whether the components of interaction, which built the basis for the item construction, would also show up as separate scales in a factor analysis and to identify the respective items, which represented the scales best. Besides this, we used this study to test whether a small difference between two operational concepts will already lead to differences in usage experience. Therefore, we used two different players, which were quite similar with regards to height and design but which slightly differed in the function of the operational controls (see Figure 1 for the two players). With player 1, the upper side of a button (marked with a "+") had to be pressed to raise the volume, and the lower side (marked with a "-") to reduce it. With player 2, the function of the upper and the lower part of the button was reversed. This is rather unusual and deviates from learned image schemas (Hurtienne & Israel 2007). Thus, using player 1 might be rated as more intuitive than using player 2.
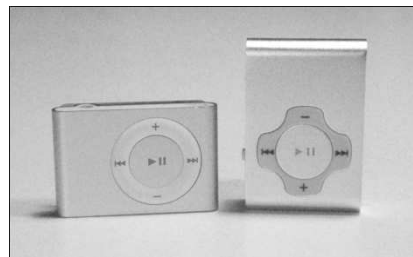

Figure 1: Player 1 and Player 2

For analyzing the structure underlying the ratings on our questionnaire, at first, all items were analyzed by main components analysis, using varimax rotation. To check whether the number of factors accorded to the number of components, the number of factors was not prefixed but defined by the Kaiser criterion (Eigenvalue > 1). Instead of the expected five factors, at first, six factors emerged. However, on two of them there were items with similar loadings on other factors as well. Thus, items which could not be definitely assigned to one factor were excluded. More precisely, we kept only items which showed high loadings (min .65) on only one of the factors and only low loadings (max .30) on all other factors at the same time. In another main components analysis with the remaining twenty items only four factors emerged. While *Gut Feeling*, *Verbalizability* and *Magical Experience* each built a separate factor the items representing the components *Effortlessness* and *Attention* all loaded on the same factor. Obviously, these two concepts are too similar to be distinguished in one's impression of interaction. And indeed, there is a high conceptual proximity: If using a prod-

uct requires little attention, usage also appears effortless. Hence, we combined the two components into one scale (which we named *Effortlessness*). As we still wanted to reduce the number of items for the next version of the questionnaire, we only kept the items with the highest loadings. In the end, the four components were represented by a set of sixteen items. A final main components analysis with the remaining items showed a clear four-factor structure with 79% explained variance and also the internal scale consistency was satisfying (Cronbachs Alpha: *Effortlessness*: .96; *Gut Feeling*: 85; *Verbalizability*: .84; *Magical Experience*: .81). Thus, further analyses were based on these remaining sixteen items.

In order to analyze the components' correlations to other measures, scale values were computed for each component by averaging the respective items. Regarding the AttrakDiff scales, pragmatic quality was related to *Effortlessness* (r=.70**) and hedonic quality to *Gut Feeling* (r=.26*). Regarding the overall intuitiveness rating, a linear regression with the four scales as predictors revealed *Gut Feeling* to be the most relevant predictor (Beta=.45; p=.001), followed by *Effortlessness* (Beta=.25; p=.027). This order supports our initial notion that intuitiveness should be regarded as more than another usability component. Even though the pragmatic-related component *Effortlessness* is definitely important, the most relevant intuitiveness predictor is rather related to hedonic quality. The other two components, *Verbalizability* and *Magical Experience*, could not significantly improve the amount of variance explained by the first two components (R Square=.25). Anyway, it was not our stated aim to find items with the highest possible correlation to an overall intuitiveness rating. Such "overall items" are good to reveal which product is perceived as "better", but they do not give information about room for improvement. However, we believe the differentiation of components of intuition to be a chance to reveal which critical issues are relevant for differences in overall evaluation. For example, regarding the two players it could be revealed that the significant difference between the two in the bad–good rating (M=5.52 vs. 4.43; t=3.12; p=.003) might be traced back to the fact that using player 1 was more effortless than using player 2 (M=4.98 vs. 4.06; t=2.42; p=.018), the correlation between *Effortlessness* and the bad-good rating is r=.46**.

Finally, we studied the inter-correlations between the four components. As the four components represent four factors, it was not surprising that most correlations were quite low and not significant. The only component that was correlated to the others was *Verbalizability*. Interestingly, there was a positive correlation to *Effortlessness* (r=.29*) and a negative correlation to *Magical Experience* (r=-.39**). This is consistent with our notion in the introductory section: In contrast to intuitive decisions in general, which appear effortless without being explainable, effortless "usage decisions" are not necessarily impossible to verbalize. However, the negative correlation to *Magical Experience* reveals, that a high degree of verbalizability may also reduce the "magic of intuitive interaction". Probably, this ambivalence points out one of the main challenges of designing for intuitive interaction: One the one hand, operational elements have to be unambiguous, on the other hand, explicit hints on how to perform a certain function contradict the magic feeling of knowing what to do without being told.

3.2 Further Applications

In order to test the stability of our scales we conducted further studies with a wide variety of products. Our second study dealt with two kinds of typical interactive products, software and websites. More specifically, these were two types of photo editing software (Photoshop Elements, Paint.NET) and three hotel booking websites (hotel.de, hrs.de, trivago.de). Again, participants had to perform specific tasks (editing a photo in a certain way, finding a hotel for a specific date) and describe their experience of using the product afterwards. Each of the 37 participants (31 female, mean age=24 years) worked with all three websites and one photo editing software. So altogether, there were 148 (4*37) cases aggregated over products. A principal components analysis with varimax rotation revealed again four factors with 78% explained variance. Hereof, a relatively large part (30%) was explained by the *Effortlessness* component, the other components each explained about 16%. All in all, the factorial structure remained stable, only one *Gut Feeling* item also showed negative loadings on the *Effortlessness*- and *Verbalizability* factor. Table 2 shows the factor loadings >.30 based on the aggregated data set (principal components analyses for the single products showed the same relations).

Item	Component				
	Effortlessness	Gut Feeling	Verbalizability	Magical ence	Experi-
Effortlessness 1	.908				
Effortlessness 2	.859				
Effortlessness 3	.902				
Effortlessness 4	.928				
Effortlessness 5	.918				
Gut Feeling 1		.900			
Gut Feeling 2		.837			
Gut Feeling 3		.866			
Gut Feeling 4	-.536	.500	-.417		
Verbalizability 1			.860		
Verbalizability 2			.789		
Verbalizability 3			.810		
Magical Experience 1				.783	
Magical Experience 2				.798	
Magical Experience 3				.841	
Magical Experience 4				.759	

Table 2: Factor loadings of the 16 final Items

Having assured the stability and reliability of scales in a controlled setting, we decided to broaden our scope on all kinds of interactive products. Our third study was performed as online-study with 233 participants (178 female, mean age=38 years). These were asked to describe a current situation where they had used a technical product for the first time without the help of a manual. The description of events reached from using a public ticket machine to using a vacuum cleaner. All in all, four categories of frequently named products could be

identified: computer software and computer accessories, mobile phones, fun products (video games consoles etc.) and home appliances (coffee machines, washing machines etc.). After the description of the event, participants were asked to rate their usage experience with the INTUI questionnaire and a global intuitiveness rating.

Again, the principal components analysis revealed four factors according to our four components. Also, the high cross-loadings of the critical *Gut Feeling* scale item vanished and the Cronbachs Alpha values were also satisfying (*Effortlessness*: .94; *Gut Feeling*: .68; *Verbalizability*: .72; *Magical Experience*: .79). Besides this further validation of the INTUI scales, we were interested in whether there would be differences in the relevance of the single components depending on the product category. To avoid that the product category is confounded with the number of intuitive and non-intuitive events, we simply excluded those events which were rated as rather not intuitive. Luckily, these were only 12%, so the large part of the cases remained for further analysis. Based on the categorization of products we calculated an analysis of variance with the product type as independent variable and the four INTUI scales as dependent variables. Here, significant differences between the product types were revealed for all the four scales, table 3 gives an overview over the mean values and the statistical data (Note: F-, df-, and p-values relate to between-subjects-effects. Means in the same row that do not share subscripts differ at p<.05 using Scheffe-Test.). Though all events were perceived as overall intuitive, the specification of the different components differed depending on product type. For example, *Gut Feeling* is more pronounced for fun products than for home appliances. On the contrary, using fun products is perceived as less effortless than using mobile phones or home appliances, which nevertheless does not seem to affect the overall impression of fun products as intuitive. For home appliances, the experience of (intuitive) interaction as magical is less pronounced than for the other products, however, using home appliances goes along with the highest values on the *Verbalizability* component.

	Computers	Mobile phones	Fun products	Home appliances	F	df	p
Effortlessness	5.6 (1.3)$_a$	5.3 (1,3)$_{ab}$	4.6 (1.5)$_b$	5.9 (1.3)$_a$	4,33	3	.001
Gut Feeling	3.0 (1.3)$_{ab}$	3.3 (1.1)$_{ab}$	3.4 (1.3)$_a$	2.6 (1.2)$_b$	2,95	3	.034
Verbalizability	5.4 (1.3)$_{ab}$	5.3 (1.2)$_a$	5.0 (1.3)$_a$	6.1 (1.3)$_b$	3,91	3	.010
Magical Experience	4.0 (1.4)$_a$	3.7 (1.5)$_a$	4.1 (1.2)$_a$	2.8 (1.4)$_b$	5,4	3	.001

Table 3: Mean values and standard deviations of components for the different product types and statistical data

4   Discussion

All in all, the application of the INTUI questionnaire showed promising results. The four components of intuitive interaction identified in the pilot application could be replicated in two further studies, and scale reliability values were satisfying as well. Moreover, it was also possible to reveal differences between products of the same category as well as between

product categories with regard to particular components. Regarding the differences between product categories we could identify specific patterns of the relative specification of the components for each category, which, however, resulted in intuitiveness ratings of the same level. While using fun products, *Gut Feeling* was more prominent than for the other categories, while using home appliances it was *Effortlessnes*s. These individual characteristics show how user expectations may vary depending on product type or usage situation. With its multi-dimensional approach the INTUI questionnaire allows for a differentiated interpretation of evaluation results. Besides finding out which of two products appears more intuitive to users, the scoring on the respective scales also reveals the crucial component. For researchers, this information is of theoretical interest, as it helps to clarify the concept of intuitive interaction. For product designers and vendors this information is of practical relevance, as it shows up the room for improvement.

In the next studies, amongst others, we want to find out whether the relevance of the different components does not only vary depending on product type, but also depending on the degree of proximity between the actual operational concept and prior experiences. Existing knowledge that is utilized in the present product interaction can be acquired in the same or in a different domain of interaction. We assume that the former case might provide the best ground for intuitive interaction in the sense of effortless interaction, as a known concept simply has to be applied in a slightly different use case. But the latter might lead to a stronger feeling of intuitiveness in the sense of being guided by one's gut feeling and a more intense experience. Following this line of thought, it also would be interesting to reveal whether there is an optimal level of proximity, a good balance between similarity and dissimilarity between the actual domain and the domain of knowledge acquisition. Studies with varying degrees of proximity may also help to clarify the ambivalence of *Verbalizability*, which we discussed in our first study. In the end, this will reveal whether perceived intuitiveness is simply the "conformity with user expectations", which should profit from high domain proximity, or if perceived intuitiveness depends on more than expectation conformity. This might even – up to a certain degree - rise with domain dissimilarity.

5   Literature

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Kontaktinformationen

Daniel Ullrich   Sarah Diefenbach
TU Darmstadt   Folkwang Universität
Alexanderstraße 10   Universitätsstraße 12
64283 Darmstadt   45141 Essen
ullrich@psychologie.tu-darmstadt.de   sarah.diefenbach@folkwang-uni.de