INSPIRATION, GUIDANCE AND JUSTIFICATION: AN INTERACTIVE INFORMATION SYSTEM TO ASSIST DESIGN DECISIONS WITH USER RESEARCH DATA

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INTRODUCTION

User-research outcomes can help designers overcome communication barriers in design process. In some cases, designers are not able to participate in user research activity, especially when there is an outside firm or institute, which remotely or asynchronously conduct user research as in the case that is introduced in this paper. When designers are unable to get involved in the user-research process, data is communicated to them through research deliverables. In this regard, how this data is delivered is as critical as how it is collected, since the latter would be pointless if the former is not achieved. In this paper, the aim is to present a framework that involves requirements for effective delivery of user research findings to designers. To exemplify how the framework is operationalised in practice, we present an interactive information system for delivery of user research findings to assist in formulation of design decisions by providing inspiration and guidance for designers and maintaining data to justify design decisions in preliminary stages of the design process.

The information system is developed by METU/BILTIR UTEST Product Usability Unit (**1**) for communicating the results of a user research case, which is conducted for an automotive manufacturer firm. The case involves asynchronous collaboration between the two partners. During the collaboration process, designers were occasionally able to visit the unit to see the ongoing research process and provisional results.

In the following sections, we begin by introducing the communication barriers that designers experience during the design process, after which we discuss the expectations of designers from user research outcomes to overcome these barriers. The study continues with presentation of an information systems framework for sharing user research results. This is followed by introduction of the user research case, in which we used the framework in the form of an information system as a deliverable to communicate the results of the research case. Then, we discuss how the

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system is used in practice, and how it met expectations by highlighting the comments of a designer working in the project. The final section contains discussions and conclusions.

COMMUNICATIVE ISSUES IN DESIGN PROCESS: BARRIERS BETWEEN STAKEHOLDERS

During a design process, designers engage in communications with different stakeholders of the product development team from different backgrounds. Such communications among different disciplines in the design team can be often difficult (Maier et al., 2006), and having different mental models affects this situation (Badke-Schaub et al., 2007). In design process, designers face many obstacles in both receiving of information and in communicating their ideas to other stakeholders. In this study, we focus particularly on communication of user research findings and how these findings can be helpful for designers in collaborative communication with user researchers, marketing specialists and managers (**Figure 1**).

Barriers between Designers and User Researchers

During a user research activity, researchers are typically involved in the process of collecting data from users and communicating them to designers, commonly in the form of a deliverable. Although designer involvement in user research process is highly recommended (Stappers, 2006), and the fact that the boundaries between the roles of users, designers and researchers are becoming blurred in design research (Sanders and Stappers, 2008; Sleeswijk Visser et al., 2005), it can be usually hard for designers to accomplish such a multitasking procedure due to the division of labour under today's market conditions (van Veggel, 2005). In many cases, firms prefer to outsource user research, which requires asynchronous collaboration between designers and researchers. Accordingly, researchers act as a mediator in the process of user research activity, although there may be differences between researchers and designers that result in a communication barrier between the two. Such differences are related to their different problem-solving approaches (Hughes et al., 1997); their motivations in conducting research (Sanders, 2005); their foci in the design activity (St Pierre, 2002; Dorst, 2003); and their different terminology and
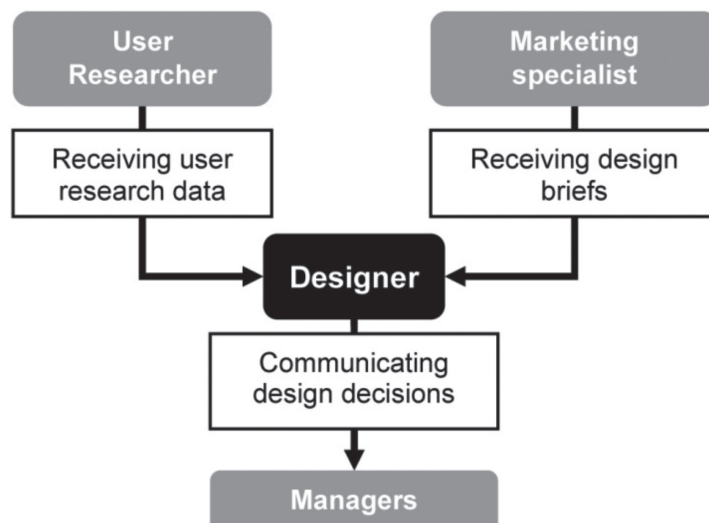

Figure 1. Flow chart depicting how designers receive information and communicate ideas.

languages (Stanton, 1998; Griffin and Hauser, 1996; van Veggel, 2005; Hughes et al., 1997). Such differences can diminish the benefits of user research by limiting the extent of empathy that designers can establish with the user. To maintain empathy and ensure a shared understanding of the findings of user research, the researcher should get to know the designer and their work context, and then plan the means of communication of the findings (Roschuni et al., 2013). In this way, the barrier between user researchers and designers can be breached.

Barriers between Designers and Marketing Specialists

As an input into the process, it is generally accepted that effective briefing is of critical importance (Petersen and Phillips, 2011; Phillips, 2004; Topalian, 2010). That said, briefs generated by marketing specialists, generally lack clarity and do not include all the information that designers need to initiate the process, or may sometimes be too fixed in the sense that they limit the creative idea generation phase. Designers start the process with incomplete data and develop certain constraints that are not covered in the brief, and generate new meanings in the form of design (Kolko, 2011). In this earlier stage, if it is effectively communicated to designers, user research can aid the process by providing constraints and inspiration.

Barriers between Designers and Managers

Design decisions should be persuasive enough to convince the management to invest in production. Martin (2007, 7) argues that disagreements between managers and designers result from their types of orientation in the product development process. According to him, executives focus more on reliability in terms of producing "a dependable, consistent, replicable outcome" (Martin, 2007, 7) and look for verifiable solutions that can be proven with reliable data. In contrast, designers are more validity oriented, being in search of "desired outcome" even if the process for producing that outcome is not replicable (Martin, 2007, 7). For the designer, desired outcomes enable deep understanding and multidimensionality of design problems. If they are to be persuasive, designers need to be able to support their decisions with reliable data while communicating them to managers.

EXPECTATIONS OF DESIGNERS FROM USER RESEARCH

In order to overcome the communication barriers in design process, designers have certain expectations from user research findings. According to Töre Yargın (2013), designers expect three key outcomes from the user research process:

Inspiration: Encouraging inspiration is considered as an important impact of user research (Blomberg and Burrell, 2008; Sleeswijk Visser, 2009; Ramey et al., 1992). Designers seek to utilise user research information as a source of inspiration and to lead the creative idea generation phase. That said, while doing this, they do not want to be restricted by rigid suggestions made by researchers.

Guidance: Another important expectation from user research is that it should provide guidance to designers. Useful guidance should take into account user requirements and suggestions made by the researcher on possible directions to be considered in the design. Such guidance can enable designers to elaborate on the design brief, which usually fall short of providing a full understanding of the requirements.

Justification: Designers need to justify their decisions while communicating them to other stakeholders and managers if they are to convince them of the merits of the design. For designers, justification is necessary in their personal decision-making process. By supporting their ideas with reliable data from user research, they proceed in the design process by making effective decisions (Friess, 2010; Lai et al., 2010; Ramey et al., 1992).

These expectations require effective communication of user research findings, ensuring the ability to overcome communication barriers between designers and other stakeholders in the product development team. If findings are effectively communicated, they can be utilised for (1) bridging the gap between researchers and designers in the user research process by maintaining empathy with the user, (2) dealing with insufficiencies in the design briefs by guiding and inspiring designers with user data, and (3) providing data to support the decisions of designers, while justifying the decisions and convincing other stakeholders in the product development team. In the following section, we introduce an information system framework for effective delivery of user research findings, leading to empowerment of designers with sufficient data to overcome communication barriers.

AN INFORMATION SYSTEMS FRAMEWORK FOR COMMUNICATING USER RESEARCH FINDINGS

Figure 2 illustrates the basic structure of the framework for delivery of user research findings as an interactive information system. To overcome the communication barriers and maintain the impacts that designers expect from user research, delivery of findings should satisfy certain information and system qualities. These qualities and impacts that help the designer manage the communication barriers constitute the core structure of the framework.

Figure 2. Framework of an interactive information system for delivery of user research knowledge for inspiration, guidance and justification.

How the dimensions in core structure are operationalised may change according to the stakeholder with whom the designer is communicating.
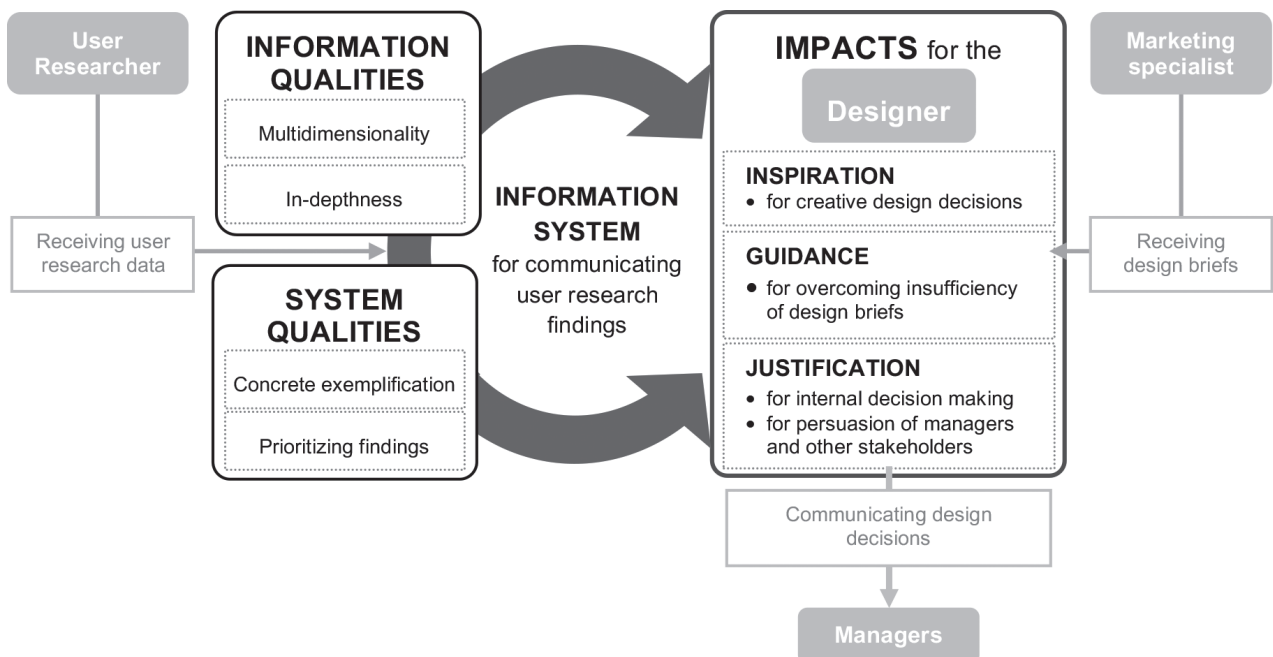
In the following subsections, we describe how the information system should be designed to overcome the barriers between designers and other stakeholders in the product development team.

To Overcome the Barrier between User Researchers and Designers

In this framework, user research data is communicated by user researchers in the form of an information system. In order to overcome the barrier between user researchers and designers, data should be provided as transparent as possible, while making it more usable and easily accessible is critical for maintenance of designers' empathy with the user. Providing an in-depth understanding of the context and maintaining multidimensionality by delivering information on all relevant parameters are important qualities of the system that can result in both empathy and inspiration, leading potentially to creative outputs as a direct impact of the user research.

To Overcome the Barrier between Marketing Specialists and Designers

To manage the communication discrepancy between designers and marketing specialists who provide design briefs, designers need guidance regarding design requirements. This guidance, which is crucial in initial stages of the design process, is usually lacking in the briefs provided by marketing departments. Prioritizing the problems that users experience or highlighting the important user values can guide the identification of design requirements, as well as supporting design decision-making process. Moreover, designers may have different questions in mind related to design briefs they receive from the marketing department, and may verbalise these questions in a variety of ways. Accordingly, to make the answers accessible, the system should facilitate different methods of accessing the multidimensional data.

To Overcome the Barrier between Managers and Designers

Justification of ideas from user research is important for designers for two critical reasons. First, justification is necessary in the internal design decision-making process of a designer. While designing, designers need confirmation that their decisions are valid for the target user group, and the ability to support their decisions with user data allows them to proceed in the design process. Second, they need to be able to justify their ideas when pitching their designs to managers and other stakeholders. In order to convince others, designers need concrete proof and reliable findings that they can communicate clearly, and so deliverables should be in the form of communicable and sharable outputs. As an advice to designers, Martin (2007) emphasizes the importance of providing analogies from existing ideas, since they enable designers to build up stories that can be used to convince the management of the viability of their original ideas. The outcomes of user research should be presented in such a way that designers can use them to make analogies related to their design decisions, and in this regard a concrete exemplification of the findings will benefit designers in making such analogies. Concrete exemplification refers to deliverable materials that can illustrate clearly the abstract evaluations of users, such as visuals of a specific product component that a participant refers to while mentioning his/her preferences. Furthermore, prioritizing the findings by listing them according to importance is crucial, as designers will be able to refer easily to the hierarchy while justifying their design decisions, thus empowering their arguments when convincing other stakeholders.

INTERACTIVE INFORMATION SYSTEM FOR PERCEIVED QUALITY VARIABLES IN AUTOMOTIVE DESIGN (2)

We employed the framework described in previous section while delivering the results of a user research case on perceived quality variables in the field of automotive design, in which results were delivered in the form of an interactive information system. In this section, we provide a brief overview of the content of the information system and present the interaction flow by illustrating it with example information search scenarios.

Content of the Information System

For the user research case, structured in-depth interviews were carried out with potential user groups in a laboratory environment through open ended evaluations of the competing products. The study focused on dimensions of perceived quality in midibus design and the relationship between perceived qualities and product components, as well as their impacts on user evaluation criteria.

To design the interview, we retrieved perceived quality variables for automotive design from several sources in literature (such as Hossoy et al., 2004; Karlsson et al., 2003; Yun et al., 2004). Based on these qualities and the research brief given by the collaborating firm, we compiled a variable pool for formulating the questions in the interview. Participants evaluated three midibus designs by considering each perceived quality in the variable pool. Evaluations were done both quantitatively and qualitatively and the interviewer asked for the underlying reasons for evaluations. Moreover, cameras were mounted inside and outside of the midibuses to observe and record the activities and statements of the participants.

Figure 3 represents how the interviews were carried out conceptually. Participants were asked to evaluate a part of the midibus (interior, exterior or driver cabin) based on a specific perceived quality variable. While explaining the reasons of their evaluations, they referred to a certain product component and sometimes compared it to other midibuses in the sample. Also, they often related the evaluated perceived quality to other qualities. For example, when they were evaluating craftsmanship quality of the midibus interior, they might say that inferior craftsmanship quality of handles of the seating unit made them feel less secure inside the midibus. In this case, the two perceived qualities, namely craftsmanship quality and
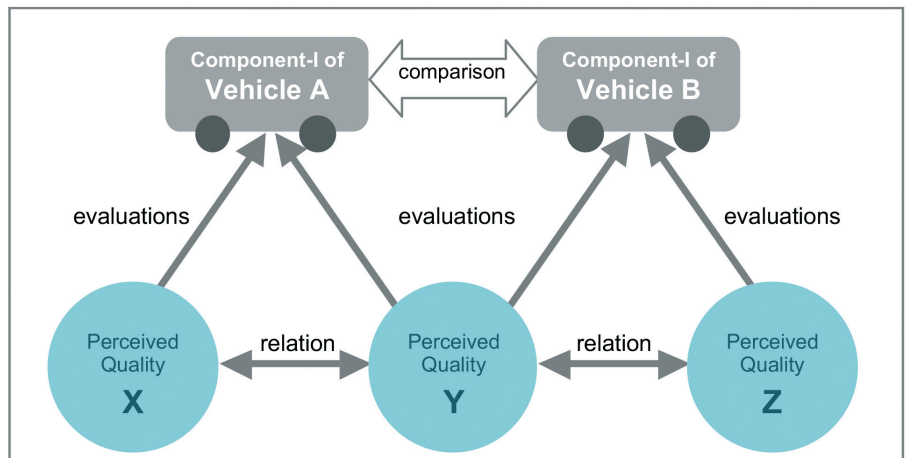

Figure 3. Conceptual illustration of the structured in-depth interviews, which forms the content of the information system

security were related and both of them were affected by a specific design of a product component handles of the seating unit. Considering this conceptual structure, we conducted content analysis with all data gathered through interviews. Through content analysis, relations among perceived qualities and between perceived qualities and product components were identified. These analyses allowed us to define the current structure of the information system.

Studies of perceived qualities and perceived values have a considerable history and their importance for marketing and design research is well received in literature (Gallarza et al., 2011; Zeithaml, 1988). The exploration of user values and perceived qualities is suggested especially if new directions and products are planned, since it allows an understanding of product-related meanings for the target user group (Russell et al., 2004; Zeithaml, 1988). In this way, designers can create new solutions for the meanings that are more critical or personal for the user, although there is a common belief among scholars that studies of such personal constructs has some limitations (Gallarza et al., 2011). It has been suggested that one of the major difficulties related to research of user values is that values and qualities are subjective and vague concepts, the definitions, which can differ between users, practitioners and researchers. To overcome this difficulty, it is important to provide concrete examples to clarify these vague definitions in the form of visual representations of tangible product attributes. That said, such an exemplification should not restrict the designers' imagination, but should rather recommend different directions and present all related parameters that are affected by the example.

In order not to lose the richness of the qualitative data and to be able to present findings with different perspectives, repetitions in narration are unavoidable, and this makes the delivery bulky and hard to explore. We observed that communicating this kind data through conventional deliverables, such as project reports, can be impractical, and so we decided to design an interactive information system that adopted several data visualization techniques.

Interaction Flow of the System

Figure 4 summarizes the interaction flow, in which the findings are presented by layering the content into levels to provide for a more engaging interaction.

The flow begins with a basic decision made by the designer regarding the aim of his/her information search in the system. The designer can browse the same content either with the focus of perceived qualities or product components. These two subjects constitute the dual structure of the system, which has a cyclic character. That is to say, perceived qualities are explained with reference to related product components, and vice versa.

The dual structure allows two different means of accessing the content, which can assist designers in overcoming insufficiencies in design briefs. As discussed previously, briefs can lack in clarity and may include only vague descriptions, which may hinder the designer in the identification of requirements. Providing such different methods of access can help designers explore the content considering their primary information needs, and this enables them to define requirements based on the user-centred data listed in the content of the information system.
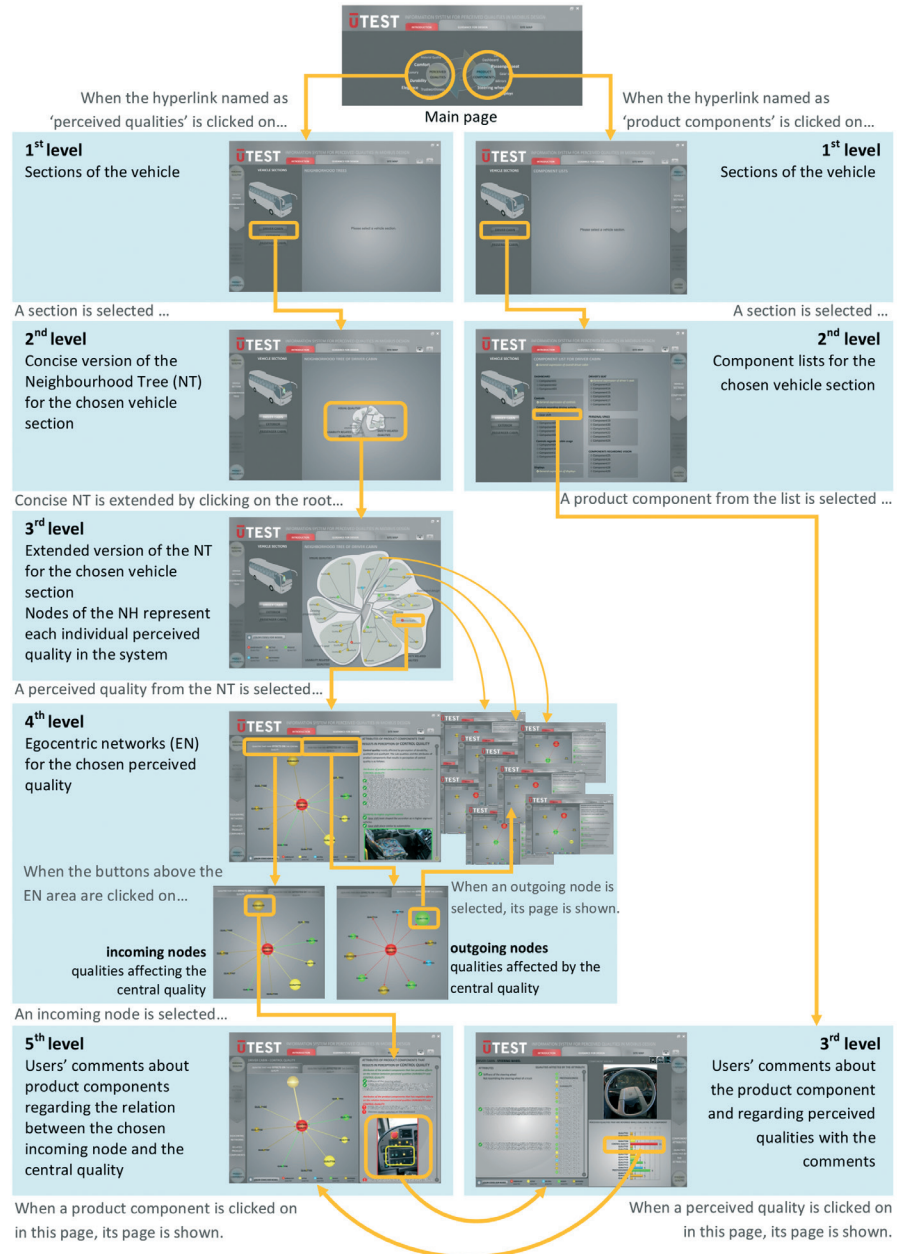
Figure 4. Interaction flow.

In the following subsections, two different information search cases are illustrated, introducing the stages of interaction with the system. The cases are drawn from our observations regarding insufficiency of design briefs.

Exploration through Perceived Qualities

For the first example scenario, we consider the case in which designer receives a brief that requests a specific perceived quality in the design. These qualities can be identified based on such activities as customer preference surveys conducted by the marketing department, which often fail to provide underlying reasons, making it hard for the designer to integrate them into the design (Bruseberg and McDonagh-Philp, 2002). Accordingly, to identify the requirements for the design, the designer
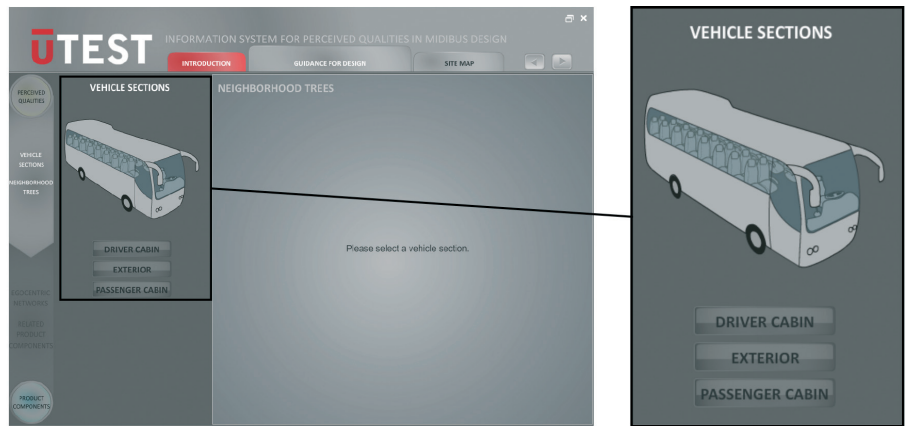
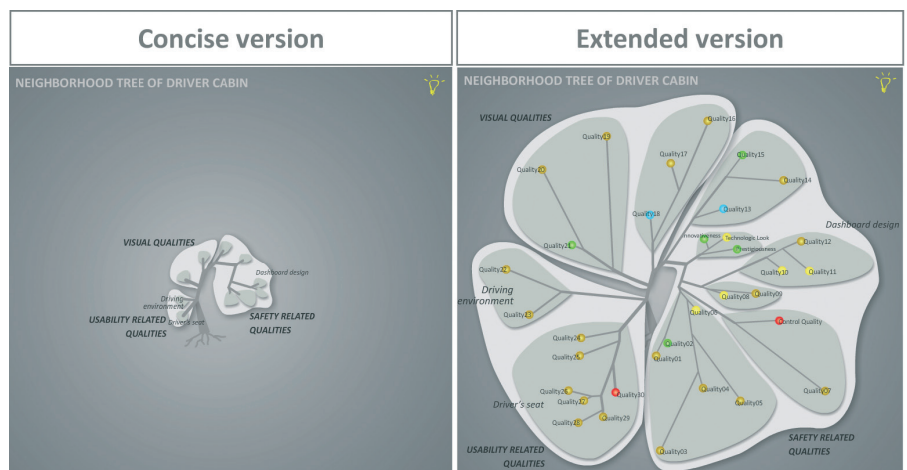**Figure 5**. Vehicle sections for perceived qualities.

Figure 6. Concise and extended versions of NHs.

has to understand the meaning of the perceived quality from the user's perspective.

In our example scenario, the brief asks for a driver cabin that looks prestigious. The designer starts to browse the content from the perceived qualities, after which following steps are taken while exploring the system.

1st level: The system shows the vehicle sections (**Figure 5**), which shows the relevant perceived qualities. The designer looks for the relevant section according to the brief, and for the current case, s/he chooses driver cabin.

2nd level: The system presents the perceived qualities related to the chosen section in the form of a graph, known as a Neighbourhood Tree (NT). The system begins by displaying the NTs in concise form, showing only the major groups of qualities. By clicking on each group, it is possible to view their qualities they include (**Figure 6**).

3rd level: The designer can explore the extended version of the NT at this level. To generate NTs, we specified each statement in which a participant related a specific quality to another, and then calculated the frequency of pairwise relations between the qualities. The resulted data was used in software known as PHYLIP to generate interactive NTs (Felsenstein, 2005) (**3**). They illustrate the relationships between the perceived qualities, and represent the dominant relations by using tree branches as a metaphor (**Figure 6**). The distance from the root indicates the hierarchy of the quality

3. PHYLIP is a software program for visualizing the resemblance of biological species based on their genetic codes. It uses a clustering algorithm that provides a graphical visualization based on a tree metaphor. In this study, we use this software visualize the closeness between the perceived qualities in the system. The implication matrix generated from the content analysis is the input data for the software.
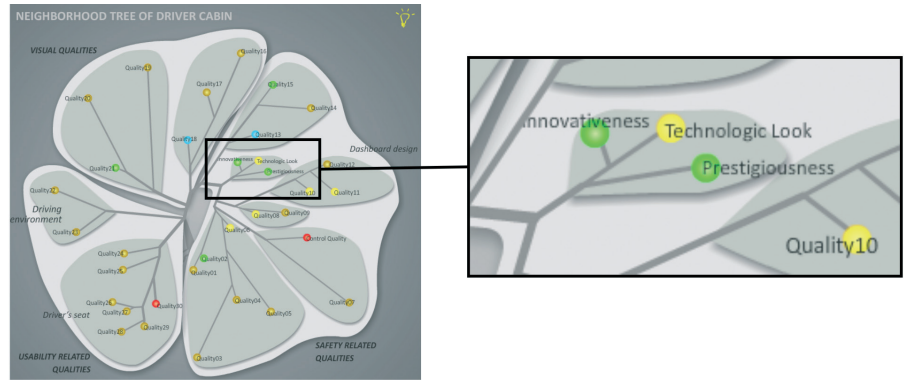
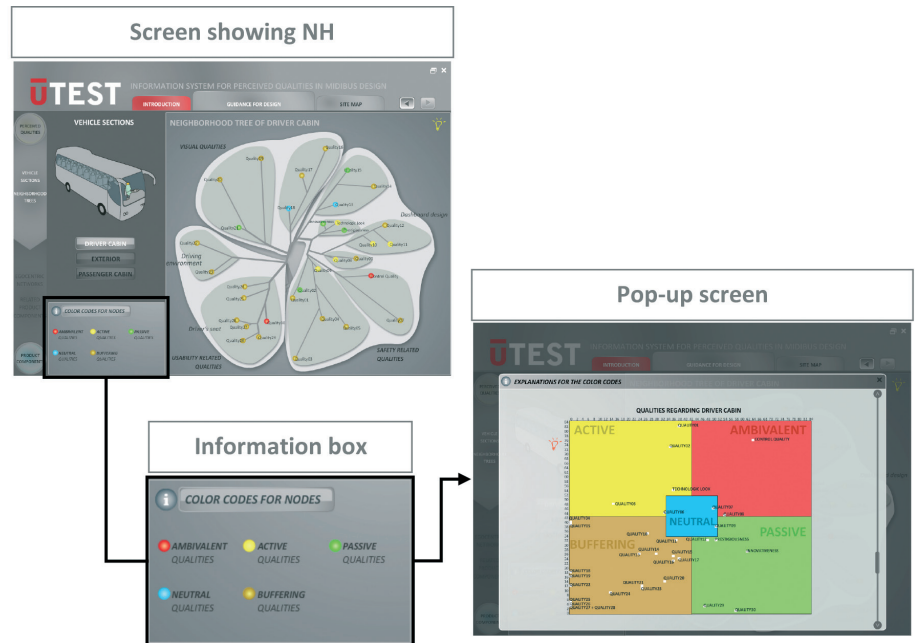**Figure 7**. Close-up view of groups in NHs.

Figure 8. Information box for the colour codes and the pop-up screen representing the SG from the CIA.

–the greater the distance, the less it is referred to by the users as a critical quality. Qualities with the same roots are perceived as similar.

The designer can locate the quality prestigiousness among the dashboard design-related qualities (**Figure 7**). In this example, it is close to the root as one of the most important qualities, and shares the same branch as technologic look and innovativeness, which are perceived as similar qualities by the users.

Each quality in the system is colour-coded, based on the findings of a procedure called a Cross Impact Analysis (CIA) (Scholz and Tietje, 2002). The designer can look for the meanings of the colour codes in information boxes on every page, where qualities are represented with different colours. Clicking on the information box opens a pop-up screen displaying the results of the CIA in the form of a System Grid (SG) and text explaining the meanings of the coloured areas (**Figure 8**).

The SG illustrates the characteristics of each quality in the system (Scholz and Tietje 2002). The qualities in the yellow area are those that are more active; that is, they have major influence on other qualities, but are less affected by them; while the green area lists the passive qualities that are
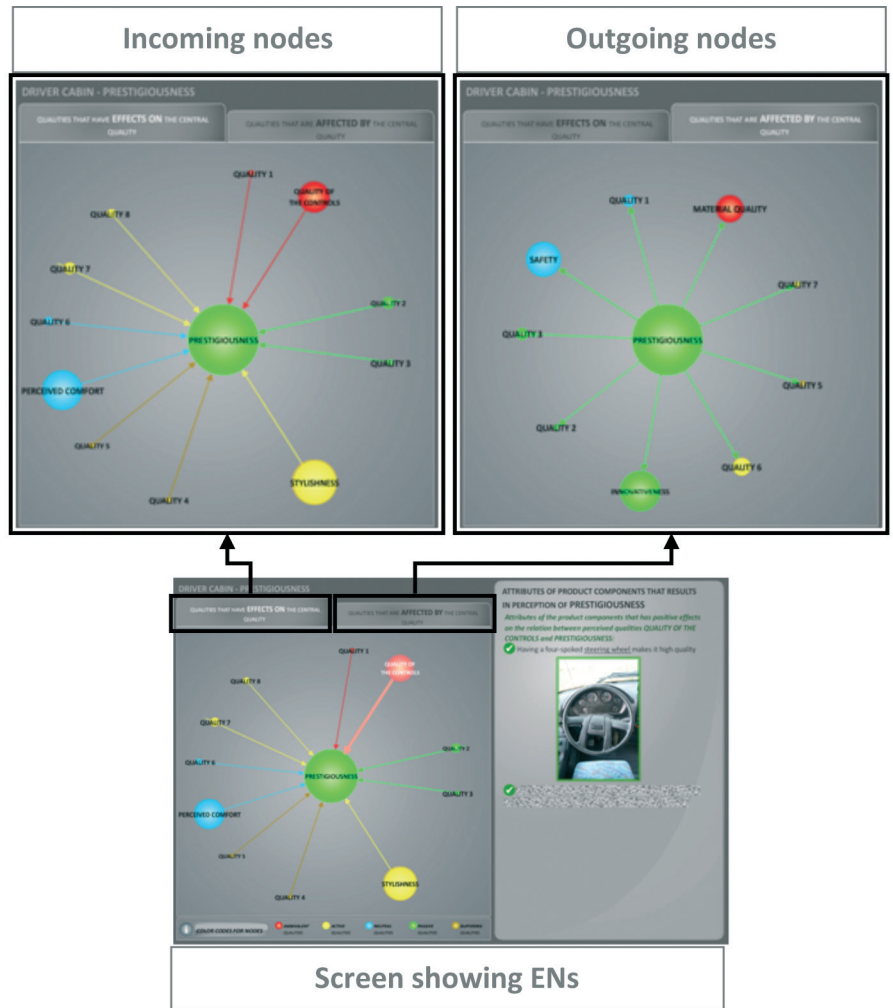
Figure 9. ENs showing incoming and
outgoing nodes.

4. The term Egocentric Network (EN) is used
for the network diagrams which only show
the relations of a specific quality. The quality
placed at the centre of the network and other
qualities are placed at the periphery (**Figure
9**).

affected by the other qualities, but have little influence over them. The
most critical area is the red one, listing the ambivalent qualities that are
both affected by the other variables and they have an impact on them. The
remaining qualities are buffering ones, which have a minor effect on other
qualities and are less affected by them. Prestigiousness is in the passive
area, meaning that it is important for the user, but has little influence on
the other qualities. It is one of the end goals rather than being a means to
an end, and as such, designing for this quality requires the consideration
of qualities that affect prestigiousness. To do that, the designer needs to
explore its Egocentric Network (EN)(**4**).

The pop-up screen can be closed to return to the neighbourhood tree screen
shown in **Figure 6**. Each node on the tree is a hyperlink to the EN diagram
of the related quality. The designer clicks on prestigiousness in the current
scenario.

4th level: The system displays the ENs of the selected perceived quality
(**Figure 9**). First, the system shows the EN for qualities affecting the central
quality (incoming nodes). The outgoing nodes, involving the qualities
affected by the central quality, can be viewed by clicking on the second
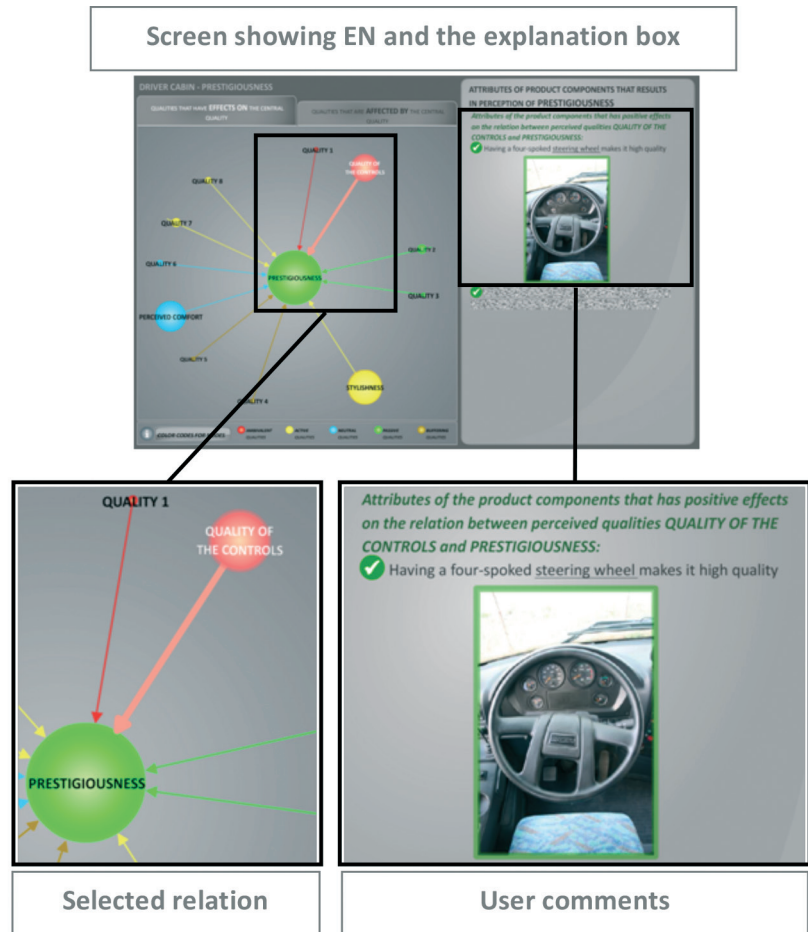button above the EN area.

Figure 10. Close-up views showing the selected relationship between the incoming node and the central quality, and related user comments.

The diameter of each node indicates the frequency of which the users referred to the relationship between the node and the central quality, and so in this sense, it presents a hierarchy of relations. For this example, prestigiousness is mostly affected by the qualities stylishness, perceived comfort and quality of the controls, indicating that if these qualities are achieved, prestigiousness can be maintained. If the outgoing nodes are considered, prestigiousness affects mostly the perceptions of innovativeness, safety and material quality, meaning that if the mentioned qualities are targeted, prestigiousness should be maintained. In the outgoing nodes view, the nodes are hyperlinks to pages showing their egocentric network and relevant product attributes.

In order to understand which attributes of which product components should be considered for maintenance of prestigiousness, the affecting qualities in the incoming nodes view should be clicked on. In this example scenario, the attribute quality of the controls is clicked on.

5th level: When one of the incoming nodes is selected, the user comments related to the product components, including the perceptions of both the chosen incoming quality and the central quality, can be viewed in the

explanation box (**Figure 10**). These comments explain how the incoming quality affects the central one.

In the example, the relationship between control quality and prestigiousness is explained by indicating the user comments related to the attributes of the component steering wheel. In this example, a four-spoked steering wheel can enhance the perception of control quality, and this has a positive effect on perceptions of prestigiousness. As such, if designer is aiming to create a driver cabin that looks prestigious, s/he should consider this attribute carefully, in that it results in a perception of this quality based on the findings of the user research.

This attribute of the steering wheel may not only affect these two qualities, or designer may want to understand what other qualities can be affected by this design decision. In this case, s/he can click on the product component in the explanation box to explore which qualities are sensitive to changes in the component design. In this example case, when the steering wheel image is selected, all relevant information regarding the steering wheel is shown as illustrated at the last level in **Figure 4**.

Exploration through Product Components

It is common for designers to start a design process without a formal design brief. In such cases, a product component may need to be designed when there is a lack of criteria providing constraints for the design process, and so the designer needs to identify the constraints to specify the requirements. Understanding which qualities are important for the user of the component can help designers specify the design criteria.

In this example case, the designer is asked to design a steering wheel, for which the exploration process begins with product components.

1st level: Similar to previous case, the system displays vehicle sections listing the relevant product components. In this case, designer selects driver cabin.
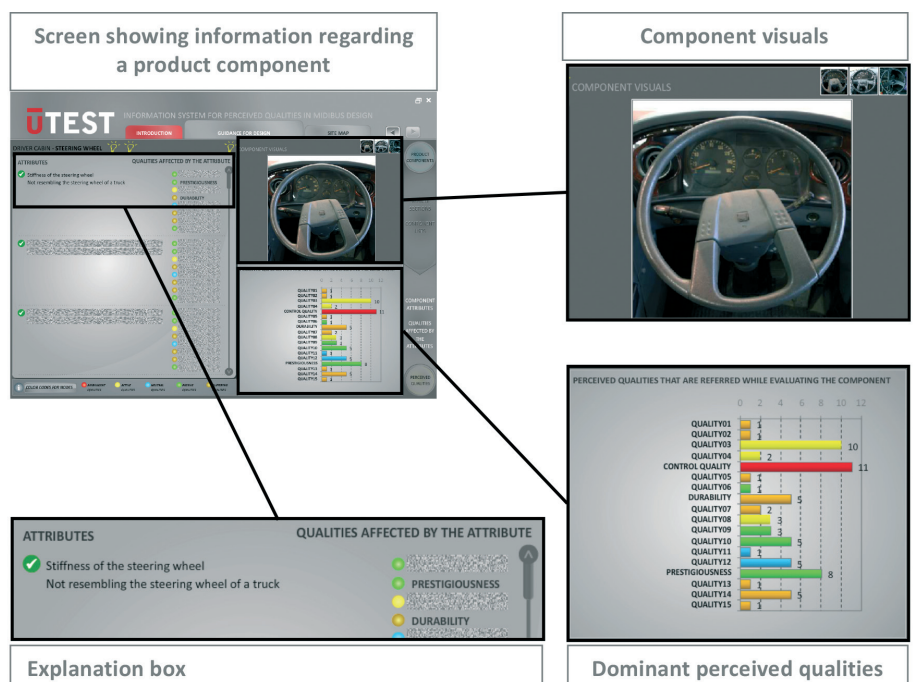

Figure 11. Content of the product component page.

2nd level: The system lists the related components, as shown in **Figure 4**, from which the designer selects steering wheel.

3rd level: At this level, the system displays (1) an explanation box showing all comments related to the component and the perceived qualities related to each comment, (2) the component visuals, as evaluated by the users, and (3) a chart summarizing the dominant perceived qualities related to the component (**Figure 11**).

The designer can look for both positive and negative comments made by the users, and can see which qualities were mentioned most frequently when evaluating this component. For steering wheel, the most dominant attributes are control quality, visibility and prestigiousness, which can be considered critical for the component design. The perceived qualities listed on the page are also hyperlinks that open the relevant pages, allowing the designer to explore what needs to be done to achieve the dominant product qualities for the product component.

INFORMATION SYSTEM IN USE

The objective in designing such an interactive information system was to provide a knowledge source for designers that satisfies the expected impacts and employs the framework presented in **Figure 2**. In this section, we discuss how we planned to meet these impacts and how the system is perceived by designers.

Since we developed the system for a specific case that contains classified information and is protected by confidentiality agreements, it was not possible to conduct a rigorous evaluation of the system's effectiveness. For the purposes of receiving feedback and exploring the potentials of using such as system in practice, we interviewed a designer representative from the collaborating firm in order to discuss the effectiveness of the interactive information system (**5**). During the interview, we asked about their overall satisfaction with the features. The comments of the designer are presented to ascertain whether the proposed information and system qualities were helpful in achieving the desired impacts (**6**).

Providing Inspiration

Multidimensionality and in-depthness in the communication of the content are critical for maintaining inspiration. Multidimensionality is a typical quality for user research studies, given the involvement of different variables and a variety of users. In this system, we aimed to maintain accessibility to multidimensional content by providing hyperlinks to all related items, allowing the designer to explore all related parameters regarding the components, as well as their perceived qualities. Moreover, we aimed to reflect this multidimensionality by allowing the relationships between the perceived qualities to be understood through NTs and ENs related to each quality.

Presenting in a transparent way all data gathered during a user study ensures empathy with the user, especially if designers are unable to participate in the research phase. This requires in-depthness while presenting the findings, allowing designers to make their own interpretations. In this system, through the layering of information at certain levels, the content supports exploration in detail by providing access to all of the user comments. This transparency ensures the system is open to interpretation of designers, permitting effective synthesis activity

5. The evaluations done by the designer representative was not aim at verifying the effectiveness of the system, instead, it explored the potentials of using such a system in practice. In that sense, the evaluations presented in this section should be considered as discussions on how the system performed in practice based on the framework that was introduced in **Figure 2**.

6. Quotations translated from the original language.

that can result in creative outputs. The respondent designer considered
this to be a positive aspect of the system, even though such an interactive
structure has the risk of being perceived as a complex interaction:

> "Actually, it looks complicated, as it directs to so many pages through the
> links and branches into so many sections; but when you use this system
> during the design process you can access so much different [in terms of
> interestingness] information."

In this sense, the interactive structure enables the designer to gain access
to the required information as well as the relevant dimensions, which
may lead the designer to come across some unexpected findings that can
support creativity.

Maintaining Guidance

Designers value highly any guidance that is supported by researchers'
insights, as long as they do not involve strict directives and rigid guidelines
that restrict the designer's imagination (Töre Yargın 2013). Designers seek
guidance especially when briefs fail to deliver information that can help
them to identify the design requirements. Based on this consideration, we
proposed the dual structure for the exploration of the content presented
in the interaction flow. Providing multiple ways of exploring the content
and maintaining access to multidimensional data is crucial for designers
when seeking guidance in defining the requirements. The respondent
designer underlined this aspect as one of the most critical benefits of the
system, stating that the ability to access multidimensional data related to a
component was helpful when defining the design criteria:

> "Let's say that you are designing a multi-set [passenger's control unit in
> the bus] […] since the multi-set is an interior component, you should be
> able to receive information on the other components related to it so that
> you can specify the design criteria. While using the system, we can access
> information from the page not just about multi-sets, but also from other
> pages that are related to it. In this way, we can connect the dots and specify
> the criteria […] In vehicle design, the main aim is to identify the criteria
> and requirements for the design, after which you can propose solutions for
> them…"

Supporting Justification

While justifying decisions to others, making analogies using examples
from user data and supporting the ideas with reliable findings have
major importance when pitching a design. Since the decision to move
to production involves high investment risks, managers need to be
convinced with reliable data. Although qualitative and in-depth data
are highly favoured by designers, since they provide the insight and
empathy required for the design activity, managers are more interested in
quantitative and generalisable outputs, based on their reluctance to take
risks (Martin, 2007). Therefore, while communicating results, prioritizing
the problems and findings by putting them in a hierarchy is highly
important (Rubin, 1994; Barnum, 2002; Blomberg and Burrell, 2008). The
SG from the CAI that is presented in **Figure 8** defines the colour-coding
scheme that is used for emphasizing the critical qualities. As a further
indicator, the diameter differences between the nodes in the ENs, as seen
in **Figure 8**, illustrate the hierarchy that exists between qualities that affect
the central quality, which means that if central quality is to be achieved,
the major nodes should be given due consideration by designers. While
communicating their ideas, designers can utilise this data to justify their

decisions by indicating which perceived qualities are important for the user and which of them are considered in the design.

Although we received little feedback about how prioritization can be used to convince the other stakeholders of the validity of an idea, the respondent designer commented about its importance in supporting decisions, indicating where to focus in the design:

> "[In ENs], the circles had different diameters. At a glance, we could see which of the qualities were related, to what degree or where we should focus. We could say 'this circle is much bigger, so we should focus on it'. This was an obvious advantage. It emphasized important factors through colours and dimension differences. I think this was a good attribute [of a deliverable]."

Although the prioritization approach in the ENs was helpful in supporting the designer's decisions, the colour codes specified in the SGs seemed to fail in accomplishing this, as the terminology we used was found to be too confusing by the designer:

> [Names for the colour codes] In all honesty, I didn't understand these at first. I needed to look through them in more depth to understand them […] I needed to turn back and look for their meanings several times. It would have been much clearer if the words used to explain them had reflected their characters…"

The terms in the SGs were based on previous studies (Scholz and Tietje, 2002), but as we understood from designer's comments, different terms that are clearer to the designer should have been adopted. Although findings may have been useful in supporting decisions, the SGs were not used due to this failure in communication.

Another important concept aiding justification is concrete exemplification. Since perceived qualities are vague, it is important to explain them with examples of concrete products that arouse the perception of the quality for the user. This exemplification is important for both (1) the designer's comprehension of the abstract quality while engaged in internal justification in the design process, and (2) while communicating his decisions to the others using examples of successes and failures from actual products and making analogies and comparisons with his/her own design. Without referring to the system, the respondent designer pinpointed the importance of using concrete examples in design communication:

> "Terms like masculine and feminine can be used [in deliverables]. What is masculine and what is feminine? They [other departments] cannot understand these terms [as they are abstract concepts]. As a designer you can visualise the terms in your head; however it is meaningless if you cannot explain it to other departments. There should be more concrete explanations, but it is really a big deal to make them more concrete. After all, design is about doing this…"

In this system, perceived qualities are exemplified through product visuals and the comments of users, as can be seen in the boxes in **Figure 10** and **Figure 11**. Although there were few comments on how these examples may be helpful in the justification process, the designer commented that, overall, the information system was helpful in the justification process, since it enabled them to support their ideas by referring to particular content as a proof:

> "[We were able to say] 'I did this because the source says that'… The system enabled us to see different relationships, and we could refer to the source to

> support our decisions. I think the interactive system was really successful in that sense…"

Furthermore, to support justification, the system should facilitate multidimensional thinking, since seeing the different dimensions of a product feature or a perceived quality can help the designer by allowing him/her to ground his/her decisions on these dimensions. In this way the designer is facilitated in designing a coherent product:

> "Multidimensional thinking [supported by the system] enables coherency to be maintained in product design, allowing the 'whys?' to be answered. It prevents you from losing control of your design."

DISCUSSION

Our intention with the development of the interactive information system was to allow the delivery of user research findings in such a way that designers would be assisted in overcoming communication difficulties that exist within the design process, and to ensure they are able to garner useful outcomes from the user research findings.

Overall, the information system received positive reactions and was found to be useful. The system supported the expectations of designers to a great extent, providing them with sufficient relevant information to overcome communication barriers. First, the barrier that exists between designers and user researchers was addressed by providing relevant and in-depth information related to appropriate dimensions in an interactive and interconnected way. This served the designers in maintaining inspiration, thereby helping them understand user considerations more profoundly. Second, the barrier between designers and marketing specialists was addressed by overcoming the common lack of detail in design briefs coming out of marketing departments in terms of guidance they provide. If given access to multidimensional data, a designer is able to identify user requirements and constraints, permitting a framing of the design activity. Moreover, by providing the multidimensional data in a hierarchical way, identification of priorities and critical issues became an easier task for the designer. Third, the system was useful for justification of design decisions, thereby helping the designer to empower their arguments whilst communicating with managers.

Certainly, visualisation and design of the interactive system is open to criticism for further development. We consider that the major contribution of this study is the framework that is put forward outlining the qualities and impacts that researchers should keep in mind when planning the communication of user research findings. The requirements that are included in the current version of the framework are based on Töre Yargın's (2013) study and represent a macro-level model for effective communication of user research findings. At the micro level, further requirements should be specified that are specific to individual research cases. Since knowledge generated through user research is considered as an important asset of the firm and insights driven during a research case can be helpful in different design cases, it would be beneficial to pay effort for planning this kind of an information system. Such a system can extend the duration of using user research findings and maintain sustainable use of them.

The information system presented in this paper is specific to perceived quality variables in an automotive design case. In automotive design,

each product component passes through a separate product development process by considering overall requirements of the case. For other product categories, such as consumer electronics or home appliances, a more holistic approach would be required to be able to guide the designer. For such cases, we suggest that the structure of the system should be adapted by considering the dimensions presented in the framework for communicating user research findings.

Although the feedback received by the firm was limited to an interview with a designer representative, it enabled us to explore and discuss the potentials of the information system. For future studies, systematic evaluations of information systems that are developed based on requirements presented in the framework should be done, in order to assess their effectiveness. This kind of evaluative studies would provide more insight regarding how systems are utilized in practice, so that they can be further improved. Another issue that should be considered in future studies is that designer should be involved in the development phase of these information systems. Such a designer centric view is critical for developing useful systems for designers. Furthermore, although the current information system was proposed for designers' use, other stakeholders can benefit from the system. Therefore, in future studies, they can be considered as potential users and the information system can be improved and developed by considering their needs.

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**İLHAM VERME, YOL GÖSTERME VE GEREKÇELENDİRME:
TASARIM FİKİRLERİNİ KULLANICI VERİSİ İLE DESTEKLEYEN
ETKİLEŞİMLİ BİR BİLGİ SİSTEMİ**

Tasarımcı ve diğer çalışma paydaşları arasında bulunan çeşitli iletişim
engelleri tasarım aktivitesine ket vurabilmektedir. Tasarımcılar
iletişim engellerini aşabilmek için kullanıcı araştırması çıktılarından
faydalanabilmektedir. Bu anlamda, tasarımcılar kullanıcı araştırması
sonuçlarından, yorumlanabilir bilgiler sağlayarak tasarım kararlarına ilham
vermelerini, farklı yönlere dikkat çekerek kararlara rehberlik etmelerini ve
çalışma paydaşlarını ikna edebilmek için kararları gerekçelendirebilecek
bilgiler sağlamalarını beklemektedir. Kullanıcı araştırması bilgileri
tasarımcılara etkili bir şekilde iletildiği takdirde bahsedilen beklentiler
sağlanabilmektedir. Bu makalede, kullanıcı araştırması sonuçlarının
iletilmesi için geliştirilmiş etkileşimli bir bilgi sistemi tanıtılmaktadır.
Sistemin temel işlevi tasarımcıya ilham kaynağı sağlamak, yol
göstermek ve aynı zamanda tasarım kararlarını gerekçelendirmede
destek sağlamaktır. Sistemin sunulmasıyla hedeflenen, gelecekte bu tür
kullanıcı araştırması iletim araçlarının geliştirilmesinde göz ününde
bulundurulabilecek gereksinimleri tartışmaktır. Sistemi kullanmış olan
işbirlikçi firmadan, sistemin çok boyutlu bilgiyi başarılı bir şekilde ileterek
tasarım kararlarına rehberlik sağladığı yönünde olumlu geri bildirim
alınmıştır.

**INSPIRATION, GUIDANCE AND JUSTIFICATION: AN
INTERACTIVE INFORMATION SYSTEM TO ASSIST DESIGN
DECISIONS WITH USER RESEARCH DATA**

Design activity can be hindered by several communication barriers that
exist between the designer and other stakeholders. To overcome these
barriers, designers can utilise user-research outputs. In this regard,
designers look to user-research results to inspire decisions by providing
interpretable outputs, to guide decisions by pointing out possible
directions and supporting their arguments and providing justification for
their decisions for the persuasion of others. These impacts can be achieved
if user research findings are communicated effectively to designers. In
this paper, an interactive information system is introduced that has been
developed for delivery of the results of user research. The core function of
the system is to provide inspiration and guidance to designer, while also
assisting them in justifying their decisions. After presenting such a system,
the aim is to discuss the requirements for communication of user research
that can be considered while designing future communication media.
Positive feedback has been received from the collaborating firm, which
used the system, regarding how the system provides guidance through
successful conveyance of multi-dimensional data.

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