Considering User Specific Design Criteria Gathered From a Participatory Design Study: A Case Study on Designing Icons for an Info-Assistant System Interface

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Abstract

This article shares our experiences on how a participatory design study can be effective in building up design criteria for a specific design problem. Our research is based on concepts gathered through surveys applied to user groups, which are turned into specific design criteria and then into icon sets with a participatory evaluation study, and finally presented to the user groups again via control tests. In the end, all the data collected from three studies are turned into design criteria for future studies. In the study carried out, design criteria have been established by a certain group of designers at the end of the first stage in which 180 users participated. The study resulted with % 9 increase in user success. But the main outcome is the case specific design criteria gathered through an iterative-participatory design study.

keywords: *info-assistant systems, icon design, participatory design, special design criteria*

Résumé

Analyse des critères de conception spécifiques de l'utilisateur tirées d'une étude de conception participative: une étude de cas sur la conception d'icônes pour une interface système informative

Cet article se concentre sur la façon dont une étude de conception participative peut être efficace dans la construction de critères de conception pour un problème spécifique. Notre recherche porte sur des concepts au moyen d'enquêtes appliquées à des groupes d'utilisateurs, qui sont transformés en modèles avec une étude d'évaluation participative, et enfin présenté à nouveau par le biais des groupes d'utilisateurs des tests de contrôle. En fin de compte, toutes les données recueillies à partir de trois études sont transformés en critères de conception pour des études futures. Dans l'étude pilote menée, les critères de conception ont été établies par un certain groupe de designers à la fin de la première étape à laquelle 180 utilisateurs ont participé à partir dequels jeux d'icônes ont été conçus en fonction de ces critères. L'étude a permis d'augmenter de 9 % dans le succès de l'utilisateur. Mais le principal résultat est le cas des critères de conception spécifiques recueillies dans le cadre d'une étude de conception itérative participative.

mots-clés: *systèmes d'info-assistant, design d'icon, conception participative, critères de conception*

Özet

Katılımcı Tasarım Çalışmasında Ortaya Çıkan Kullanıcıya Özel Tasarım Kriterlerinin Değerlendirilmesi: Bilgi-Destek Sistemi Arayüzünde Yer Alan İkonlar İçin Bir Vaka Çalışması

Bu makale, katılımcı tasarım çalışmasının vakaya özel tasarım kriterlerinin belirlenmesinde ne kadar etkili olduğu ile ilgili deneyimlerimizi paylaşmaktadır. Yaptığımız araştırma, kullanıcı gruplarına uygulanan anketlerin sonucunda elde edilen kavramları, anket sonuçlarının özel tasarım kriterlerine ve bağlantılı olarak ikon setlerine çevrildiği katılımcı tasarım çalışmasını, son olarak da bir önceki aşamada tasarlanmış ikon setlerine uygulanan kontrol grubu testlerine dayanmaktadır. Tüm sürecin sonunda bu üç aşamanın sonuçları ileriye dönük kullanıma açılmak üzere bir tasarım kılavuzunun özel tasarım kriterlerine dönüştürülmüştür. 180 katılımcı ile gerçekleştirilen testlerin sonucunda elde edilen veriler, bir tasarımcı grubu tarafından değerlendirilmiş ve özel tasarım kriterleri belirlenmiştir. Çalışmanın sonuçları, ikonların algılanırlığında % 9 artış ile sonuçlanmıştır. Fakat esas kazanım, ortaya çıkan özel tasarım kriterleri olmuştur.

anahtar kelimeler: *bilgi-destek sistemleri, ikon tasarımı, katılımcı tasarım çalışması, özel tasarım kriterleri*

1. Introduction: The Design of Graphic-Based Info-Assistant Systems

Graphic-based info-assistant systems are mostly preferred by public administrations as decision making mechanisms. However, a vast mass of users also benefit from these systems to get information on issues that require immediate support. This very fact not only widens the size of the user group but also requires a wide user analysis of the issue, from different points of view, like culture, professional background and other demographic features.

The research carried out so far shows that while presenting a complex piece of information to the user, the use of graphic expression as a supportive element facilitates the learning and decision making processes (Leitner 1997). Thanks to this advantage provided by visual media, the number of info-assistant systems has risen dramatically through the last decades. In order to provide more effective public management and bring about an awareness to the public, these systems have also been used in fields such as transportation (Weber and Kwan 2002:226-240), disasters (Dimopoulou and Giannikos 2000:523-534), crime rate (Curry 1999:681-699), and infrastructure which can be researched under the heading of participatory info-assistant systems (Obermeyer 1998:65-66). Therefore, info-assistant systems can be considered as critique interactive systems which have become an inevitable part of our lives in terms of public communication.

Today, it is clearly seen that the effective use of info-assistant systems differs according to different cultures as well as other factors like user experience on the subject or user profession. With this point of view some researchers prefer to analyze the components that make up the interface individually rather than taking the system as a whole. If we refer to the components of interface as appearance (visuals, color, and icons), interaction, navigation, metaphors and mental models (Marcus 2005), we assume that icons will be considerably affected by user experience and cultural factors. The reason for this is that the use of metaphors is a significant factor in icon design and metaphors are culture–dependent sources of information.

Assuming that there are some user specific design criteria in icon design, in this case of Turkish Users, which haven't been studied enough yet, turning these design criteria into usable data for design is a research question that still requires a significant study. Consequently, this research study aims at contributing to the answers of the aforementioned questions by focusing on several user groups build up of Turkish, German and Austrian designers and non-designers and find out specific design criteria to be turned into valuable data for design.

2. Cultural Studies on Interface and Icon Design and Their Shortcomings

In the research, we first searched for the studies questioning whether the effectiveness of icons as informative interface design elements depends on culture or not. With the research in mind, we assumed that culture is also effective like other demographic factors. So the main idea was to find out a way to evaluate this for the design process with not just statistical results but also some valuable output.

Each research in question followed a different, specific method. Most of the studies carried out aim at comparing a certain culture with American Culture. Moreover, the studies were conducted with students. Even though the tests are not directly taking on info-assistant systems, they are informative web sites, therefore they constitute significant examples.

Hofstede's study on cultural characteristics is one of the basic references used for cross-cultural usability researches (Hofstede 1980). Hofstede determined data on Turkish user type through the tests he applied on IBM employees in 1978–1983. These data allow us to make a basic evaluation. According to these tests, the Turkish user portrayed a collectivist, polychromic image avoiding uncertainty and devoted to patriarchal authority. However, the results of the study in question are too general to make an evaluation concerning icon design.

In his study published in 2005, Aaron Marcus made a proposal on how the criteria Hofstede determined could be used in interface design (Marcus 2005). Marcus constituted a matrix table by using the five basic criteria he determined to analyze interface which are appearance, interaction, metaphors, navigation and mental models (Marcus 2005). This proposal aims at establishing matrix tables and design guidelines for different cultures but as Marcus puts forward it could only serve as the introduction of a very detailed study.

Another significant study in the field belongs to Evers, who analyzed the behaviors of Dutch, American and British users by, first, performance tests and then thinking aloud tests through a distant learning website (Evers 1999:261-262). The basic aim of the tests is to observe how the comprehensibility of the icons would change according to culture. It is seen that, in general the final analysis has been made separately for each icon instead of a general evaluation in this study.

One other valuable recent study belongs to Ahmad Syarief (2003) who prepared a survey based on ISO standards (ISO 9186) on the icon designs used in most popular six travel agencies and presented to Indonesian and North American user groups. The study took on the icons as realistic, symbolic and abstracted evaluating them in terms of message speed, content, and use of

location and time factors presented by Hall (Hall 1969). It was determined that American users preferred icons which convey explicit messages and they would like to receive them partially and fast when compared to Indonesian users.

When the studies carried out on Turkish users are considered, on important one is a study conducted in Netherlands took on Dutch and foreign PhD students who had just moved to Netherlands. The two culturally different groups were compared by using Hofstede's individualist and collectivist criteria. This study was conducted in two stages by applying the 'Retrospective Thinking Aloud' and 'Plus-Minus' methods (Hall et al. 2004:489-503). There is one Turkish user among the foreign subjects; however, this number is not sufficient to make a general evaluation on Turkish users.

All the studies in question are not only significant in establishing the methods for icon design according to a certain culture, but they also reveal hints on the perception of visual images by users and the relations between visual images. While the aforementioned studies generally focus on interface design, the number of studies concerning icon design is significantly low. Moreover, these studies do not respond to how design should be shaped according to test results. The method proposed in this study is distinct from other examples at this very point.

3. Case Study: Perception Test for User Specific Design Criteria

The main aim of this study is to examine the effects of user research as usable data for design by the help of a participatory evaluation study.

For this purpose, we first, asked what was perceived about some concepts used in info-assistant systems to users from different demography, then icons sets were designed with these criteria in mind and finally these designs are examined (Figure 1).

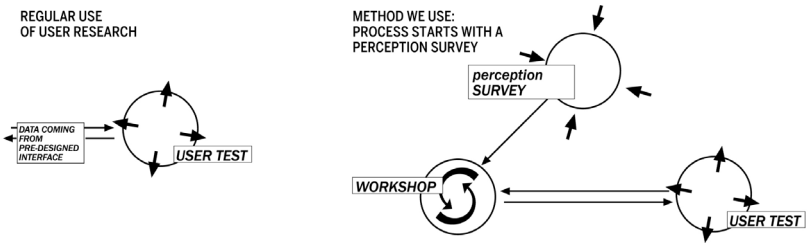

Figure 1. The regular use of user research and our use that starts with a survey

The method proposed in this research is three-staged. These three stages involve the analysis of user perception on the subject, the evaluation study of

the results with the participation of designers which ends with a design study and the testing of these designs through user tests. For the conducting of the research, the perceptions of concepts by users are analyzed through tests applied to different user groups (Figure 2, Stage 3). Later on, participatory design studies are conducted with designers according to the previous test results (Figure 2, Stage 4) and finally the icons prepared by designers are tested again by the user group (Figure 2, Stage 5) and the results are turned into case specific design criteria.

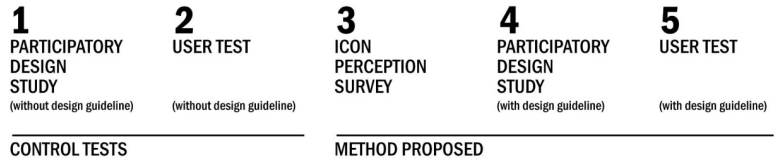

Figure 2. Process

However, at this point, in order to ascertain the efficiency of the method for observing the design criteria, icon sets designed with design criteria should be compared with those that are made without the design criteria as a control group. For this purpose, a different icon set are designed with the participation of the same designer group before the case specific design criteria are studied out (Figure 2, Stage1) and this set of icons are also tested with the user group as the second stage (Figure 2, Stage 2).

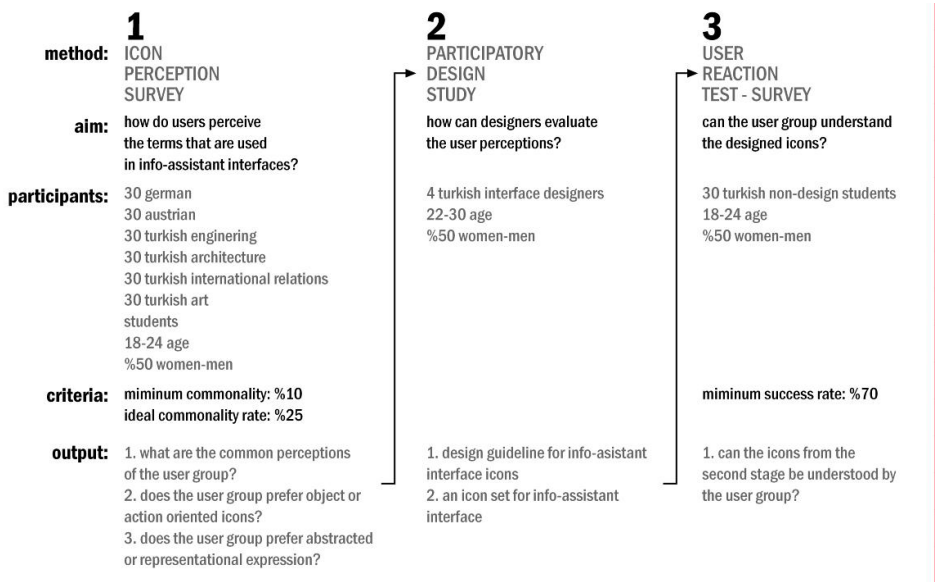

Figure 3. Conducting of the method

3.1. Participants: The Sampling of the User Groups

In accordance with the aforementioned conclusions, for the concept test in the first stage of the research, six different user groups were targeted:

1. Non-designer German students,
2. Non-designer Austrian students,
3. Turkish students who study international relations,
4. Turkish students who study architecture,
5. Turkish students who study engineering,
6. Turkish students who study art.

The sampling has been done in order to examine different aspects of user types.

First two groups are students from two relatively close western countries, Germany and Austria. There is no particular reason for why specifically these two user groups were chosen. What is to be considered is the possibility of difference coming from living in different grounds. As a secondary user criterion, we classified Turkish students according to their fields of study as another consideration focusing on how much these fields and the experience they gained were effective on students' perception. For this purpose, four more groups were analyzed.

The group analyzed in perception tests, involved university students aged between 18 and 24. When the world wide researches are considered, it is seen that university students constitute the highest percentage of computer users (Kehoe and Pitkov 1994). As a rule, the subjects who took this perception survey were to be non-designers since; otherwise, it was likely that they could be conditioned because of their previous experience. There were an equal number of male and female subjects.

Participatory workshop, which is the second stage of the study, was conducted with a group of interface designers. The designers in question were required to have received either graphics design or communication design education and be involved in the target culture. This group aged between 22 and 30 consisted of two male and two female designers (Figure 3).

As for the user reaction tests which make up the final stage, the user group involved 30 people, who are aged between 18 and 24 (Figure 3) as the target group.

3.2. Materials: Criteria for Analysis

We aimed at finding out the common perceptions of a certain user group by presenting them ten keywords (icon concepts) related with info-assistant interface design and analyzing the concepts that the users first associate with these concepts. With this purpose, the following three main criteria are analyzed in this study to be turned into a design guideline during the second stage which is a participatory design study:

1. Are there any common perceptions of the user groups?
2. Do the user groups perceive the concepts in question in an abstract or representational way?
3. While visualizing the concepts, do the user groups think in an action or object-oriented way?

The criterion of icons to have an abstracted, representational or artificial expression is the most preferred method among the researches carried out on icon perception. This study as well analyzes this criterion. Concrete icons visualize the facts that they are to express, without using an indirect expression and in a way that we encounter them in real life. As for abstracted expression, instead of the object or case itself, another concept is selected to express the condition in an indirect way. Artificial expression is based on the use of pre-designed visual signs for certain facts (Figure 4).

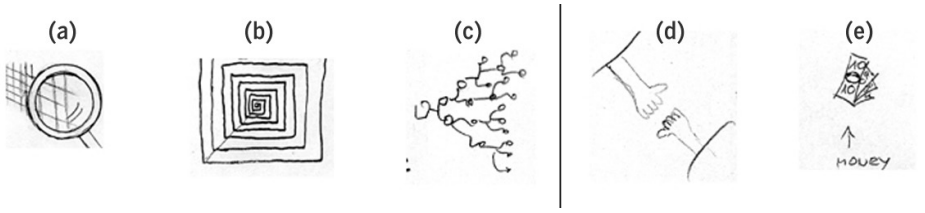

Figure 4. Examples of icons with abstracted (a), concrete (b) and artificial expressions (c) / action (d) and object-oriented expressions (e)

However, in addition to this, whether the icons are object or action-oriented is also considered as a second criterion (Nisbett et al. 2001:291-310) since the info-assistant system interface icons we used in this case study are generally presented to express actions. At this point out, we are aiming to find out whether the users have an object or action-oriented perception. While action-oriented icons emphasize a fact through movements, "object" oriented icons visualize that fact with an object that would express that fact (Figure 4).

In order to find answers to these questions, the results of the surveys were evaluated in two different ways:

1. The symbols that subjects drew in tests were compared and common drawings were determined. The minimum commonality criterion was accepted to be 10 % in order to be able generalize a commonality while viewing the common icons the user groups drew. The fact that users made quite different preferences for some icons had been influential in determining this rate. It was observed that the commonalities did not go above 60 % even concerning the most distinct examples. For this reason, the ideal commonality criterion was accepted to be 25 % concerning the examples which encountered the most commonality.

2. In the second research method, concrete-abstract, action-object relations of concepts the subjects determine for each icon are analyzed. In this way, it was observed whether the user group had a certain preference for each icon as a group or individually. While the analysis in question was carried out, no outstanding differences among the aforementioned relations were observed. Therefore, a difference between 10 % and 20 % was accepted within the analysis criterion.

3.3. Procedure

Our research was based on a three staged study.

1. After examining the interactive info-assistant systems, we determined the key actions of informative interactive systems as "SUCCESFUL / ASK / SEARCH / ANSWER / HELP / WRONG / COMPARE / LIST / SORT / DETAIL". As a starting point we gave the users a visual survey to reveal the concepts related with these actions. The users are asked to draw down whatever comes to their mind at first sight, about the concept. Thanks to these icon perception surveys, the common concepts that the user group refers to when perceiving the concepts in question are analyzed. Moreover, we examined whether the concepts which the user group refers to are object or action-oriented and has abstract or concrete expressions.

2. Later on, participatory design study is conducted relying on the survey results. Accompanied by a supervisor, the designers work on the metaphors suggested by the user group. They discuss the criteria to be included in a design guideline and design an icon set in the light of these criteria. When the new icon sets are compared with control tests, it was obvious that the participatory environment has increased the efficiency of the designers in both design criteria developing and icon designing.

3. In the final stage, the subjects are given a ten-question survey in which they match the keywords with the icons prepared by designers in the second stage, one keyword for each icon. The test takes place in internet environment (Figure 5). And at the end, without using a complex analyzing method, results

are evaluated using a basic rating of success percentage to compare with control group tests.

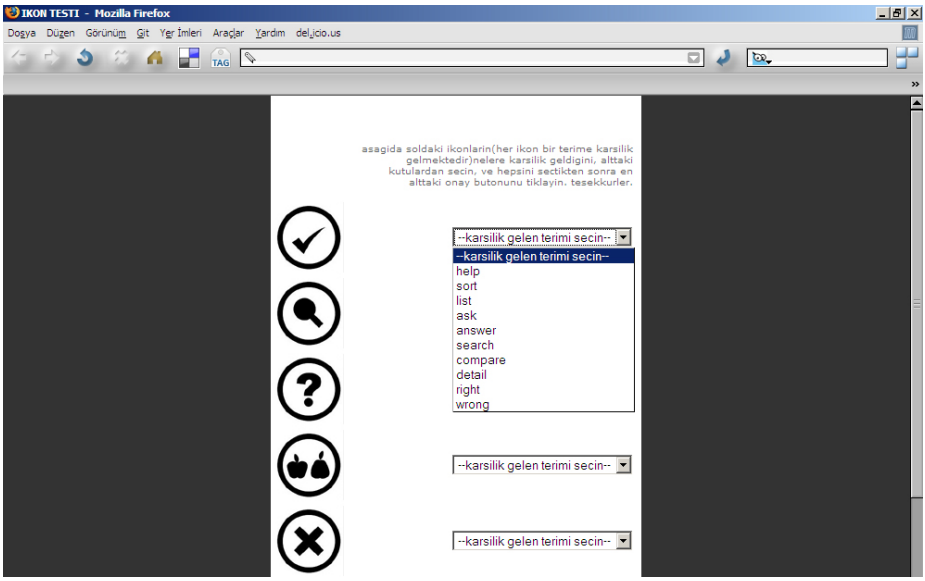

Figure 5. Survey study for the 3rd stage

4. Results: Perception Tests for User Specific Design Criteria and Evaluation

4.1 First Stage: The Common Perceptions of User Groups

As a result of the 180 surveys we carried out by asking the users to draw whatever they first think of when encountering the keyword, it was seen that common concepts can be determined for certain keywords, but it was not possible to make the same judgment for each. Moreover, if we consider it in terms of cultural factors, common concepts based on culture can be determined only for some icons. For example, the concept "help" (Figure 6) can be expressed by a cross in one culture and in another it is visualized with a hand, however, the concept "list" is presented with a common visual among the cultures analyzed within the test.

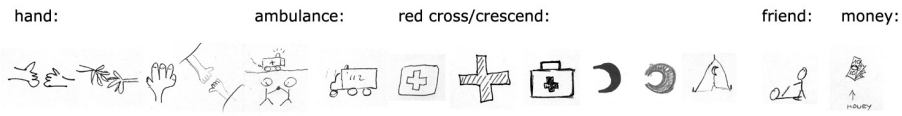

Figure 6. Conceptual drawings for "Help" icon

For the "Search" keyword (Figure 7), "magnifier", "key" and "eye" concepts appear to be common solutions. On the other hand, unlike Turkish users, German and Austrian users suggested "treasure" which is a object-oriented concept.

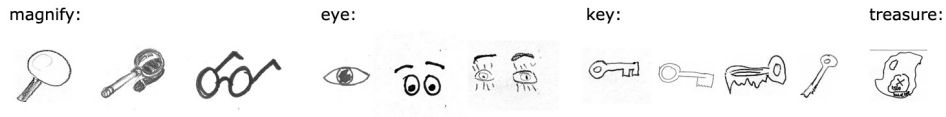

Figure 7. Conceptual drawings for "Search" icon

Another keyword that received such great similarities is "compare", for which users generally preferred to draw different objects and human figures in an object oriented and representational manner. A secondary significant output concerning this concept is "balance" (Figure 8).

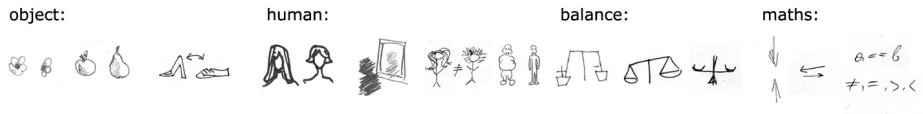

Figure 8. Conceptual drawings for "Compare" icon

For the concepts "Correct" (Figure 9) and "Wrong" (Figure 10), unlike the German and Austrian group, Turkish user group preferred symbols like "tick" and "cross" which are evidently assigned symbols. This fact shows that Turkish users prefer assigned symbols more than European users do. Another fact portraying this difference is that German and Austrian users depict the concepts "correct" and "wrong" with a smiley or a sad face whereas Turkish users do not use such expressions.

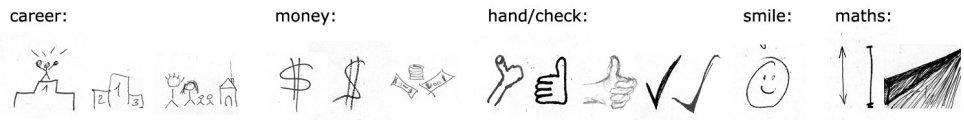

Figure 9. Conceptual drawings for "successful" icon

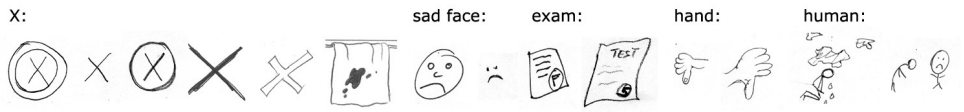

Figure 10. Conceptual drawings for "wrong" icon

4.2 Second Stage

4.2.1 Participatory Design Studies and Determining the Criteria

When the survey results of the first stage were compiled, together with the group of designers, we made comparative analyses of ten selected concepts according to different cultures within the chosen criteria. As a result of the analyses, it was observed that some concepts received commonalities while others portrayed cultural differences. Drawing on this conclusion, we grouped the concepts according to the meaning they revealed in order to find out which icons revealed cultural differences:

1. Icons informing a state: correct, wrong, detail.
2. Icons that encompass a comparison: compare, sort, list.
3. Icons informing an action: search, ask, help, answer.

If we consider our study in terms of these groups it is impossible to mention any cultural difference concerning icons that inform a state such as "correct", "wrong" and "detail". All three user groups preferred to draw on concrete expression by placing various objects or numbers side by side which depicts a commonality at this point (Figure 9-10). As for the concepts encompassing comparison such as "compare", "sort", "list" various cultural differences were observed, however, generally widespread icons had been similar among cultures (Figure 8). For instance, 30 % of the Turkish user group drew objects for "compare" icon while this rate was 25 % for the German-Austrian group. However, the secondary basic concept for German-Austrian group was "balance". Consequently, it cannot be stated that there are evident cultural differences for icons encompassing comparison. On the other hand, the third group which consisted of "search", "ask", "help" and "answer" were among the concepts that led to apparent cultural differences. While Turkish user group preferred concepts like "hand" or ""thrusting out a hand" which is an indirect expression for "help" icon, the German-Austrian group preferred concepts such as "Red Crescent" and "Ambulance" which have a direct expression. Similarly, when visualizing the concept "Answer", German-Austrian group preferred concepts with direct expression such as "speech bubble" or "!" whereas the Turkish user group selected abstracted expressions like "teacher", "exam" or "bulb".

Considering abstract/representational expressions, designers generally preferred abstract images after the survey whereas they designed both abstract and representational icons before the participatory design study. They also decided that concepts should be considered separately when action-object oriented expressions are in consideration.

Figure 11. The icon set prepared by designers without using the criteria.

Drawing on these conclusions, it can be stated that different cultures similarly have a tendency to express icon concepts using assigned symbols with concrete expression. In addition, considering action based icons, there are certain culture-dependent commonalities concerning icons which are likely to be compared.

4.2.2 Icon Set Design

As a result of all these discussions, design criteria were determined for icons both in general and individually composed of design proposals. Then, the designers created an icon set with the design criteria in mind. At this point, we reached a crucial interpretation of the study. In the first stage of surveys, the user groups responded to every concept individually without taking them as a whole. However, the designer prefers to design the icons to appear in an interface within a certain identity. This fact shows that designers are to accept the proposals in the criteria as references for their own narrative instead of merely evaluating the facts without commenting on them. At this point, it is clearly seen that during the process of design it is impossible to rely on the criteria to the full but studying the test results together help their design process.

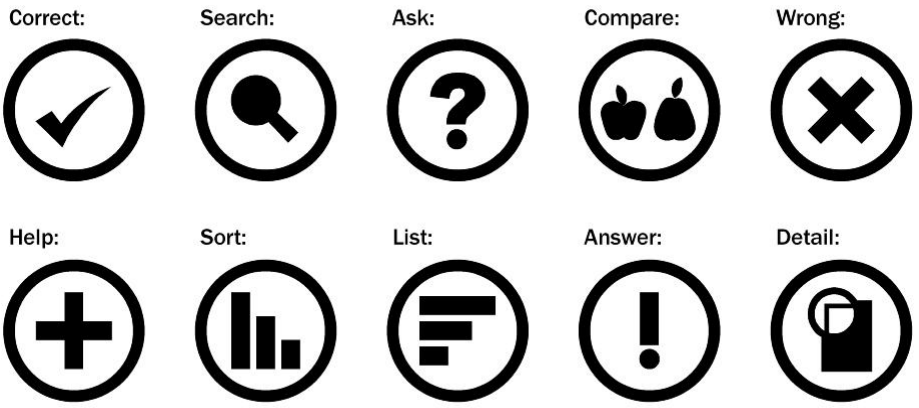

Figure 12. The icon set prepared by designers using the criteria

4.3 Third Stage: User Reaction Tests and Measuring the Efficiency of the Method

At this point, it will be essential to mention the control group work. Before the stage in which we worked with the user group of 180 people, we gathered with the group of four designers without and criteria in hand and made a preliminary work for the design problem in question which resulted in the design of an icon set (Figure 11). Later on, as the last stage of user perception tests surveys are given and the reaction of user groups to these icons are measured. In the tests, the icon set has provided a 62 per cent success rate.

Throughout the second participatory design study conducted with the four designers following icon perception survey, designs were prepared according to the profile the user groups determined and the new icon set was tested at the final and third stage of the study (Figure 11). The result of the tests points to 71% success rate for the comprehension of icons. Drawing on this fact, we can conclude that the user group is successful at perceiving the designs of concepts they visualized themselves. When the third stage of perception tests is compared with the work carried out with the control group, the success rate increases from 62 % to 71.

5. Discussion

This article takes on a research question to find out how can the user specific design criteria for different user groups, can be turned into usable data by the help of a participatory design study. As a case study we examined "interactive info-assistant systems icon design".

As a result of literature review, we can admit that the methods used for this field, are always applied in terms of the present interfaces. This fact makes us think that it is not possible for the user group to imagine independently of the designs that are in use on the internet. Moreover, we also observed that the results of tests have not been established into design criteria after evaluation. In response to this, we analyzed user groups' perception of certain concepts thanks to surveys, the usage of collected data in design and the realization of control tests for the efficiency of these designs. If we evaluate this research in terms of methodology; the results of the three-stage research is compared to the designs prepared without the bundle of criterion as a control group in order to measure the efficiency of the method. A 9 percent difference of efficiency was recorded between icons designed with criteria in mind and those designed without. To summarize, the icons designed with at least having the criteria that are found out through the process, are in mind were perceived more efficiently. Even if this method requires longer time for application, the process can be considered as a reasonable way since there is also the outcome of establishing design guidelines using the criteria.

The study in question should not only be taken as a user research study for preparing guidelines but also as a design research study using the participatory design method. When the conclusions are evaluated in terms of icon design, the second stage of the study and the participatory workshop conducted with designers should be considered.

Recently, an increasing emphasis has been given to participatory study groups in the field of usability which aims at benefiting from the professional experience of the designer groups. Thus, in this study, the results of perception tests in the first stage was evaluated with designers and transformed into criteria for a design guideline. The designer group stated that this study provided the necessary information they needed before creating designs and that evaluating the results of the group work had been beneficial for them. This makes the study valuable for the design process while it also helps to leave some valuable information for future studies when turned into guidelines. However, it appears that since the icon set has to have a certain consistency, the results of perception tests need to be interpreted by the designer group.

In the present study carried out, only icons among interface elements were analyzed. In the sequel of this study potential behavior-oriented elements "Layout" and "Navigation" will be analyzed in order to measure the efficiency of the method in terms of establishing design guidelines. Moreover, the evaluations on cultural and professional differences among user groups should be taken on again in the following stage by using the same groups and the new results should be compared with the former ones. In this case study of "icons for info-assistant interface", the context-dependency of the icons has been kept out of focus. The case can also be examined within context-dependency as a future study.

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