



Symbols and Functions in Human Machine Interface: Are Google Icons a Possible Solution for Intercultural Usability?

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Abstract. We explored the possibility of taking icons from Android Smartphones, for the use in graphical user interfaces (GUI) in bakery sheeter. This idea was generated from the fact that Android Smartphones are sold worldwide and that the icons used in the menu should have a degree of popularity that most people could deal with. With this research question in mind we created a mixed method design for the study (qualitative and quantitative data). Results show that some icons were able to represent basic navigation function in industrial machines.

Keywords: Graphical user interface · Usability · Icons · Intercultural

1 Introduction

User Interfaces in general have to be self-explained and easy to use. Norms help to reach this goal. The ISO 9241 is a multi-part standard from the International Organization for Standardization [1] covering ergonomics of human-computer interaction. In some areas, those norms lack intercultural perspective, which is a challenge in general [2]. Many industries, like for example the bakery industry, machines are sold in many different countries. These machines are used by people of different cultures and technical- and educational-background. These circumstances lead to the following study: We explored the possibility of using icons from Android Smartphones in a graphical user interfaces (GUI) of a dough sheeter. This idea came as a conclusion from the fact that Android Smartphones are sold worldwide. With a market share of over 86% the Android operating system is dominating the smartphone market in 2018 [3]. Simultaneously over 383 million smartphones were sold in Q1 of 2018 [4]. This means that nearly 330 million Android phones in Q1 of 2018 were purchased in areas all over the world. With this fact, a lot of “the same” icon/function process knowledge is distributed to different kinds of cultures of the world. Those icons used in the Android smartphone would have a degree of recognisability that deserves attention. Because of this and the fact that differences in GUI Design alters learning of new GUI functions [5] we assume that Google icons could be used in the navigation of an interface in an industrial context, because of possible implicit knowledge of the participants.

2 Methods

17 subjects (10 female; mean age, 24.35; range 20–28) were recruited from the student body of the School of Applied Psychology at the University of Applied Sciences Northwestern Switzerland and participated in a mixed method study (integration of qualitative and quantitative data). The Participants were assigned to one of four groups. Those groups would start with either the original dough sheeter or Google Icons; and assign either icons for navigation or icons for dough processing.

All Participants filled in an online questionnaire measuring technology acceptance and technical expertise, two subscales of the questionnaire for Technology Affinity (TA-EG), as well as gathering demographics.

To assess, whether Google icons represent a valid alternative when designing an industrial user interface, participants were instructed to assign cutouts of either the original dough sheeter icons or Google icons to laid out cards with descriptions of existing functions of the sheeter. Since there were a total of 53 function-icon pairings in the user interface of the dough sheeter, it was not feasible to have all participants assign all of them. They were instead split into two groups that consisted of “dough processing” or “navigational” pairs. The functions-icon pairings and descriptions were provided by the manufacturer of the dough sheeter. 33 Google icons were selected by experts from the catalogue for material design with the criterion to find all potentially suitable items (out of 955) while not cluttering the list with possibly hundreds of unrelated icons. After these steps, participants would assign icons to either 27 dough processing or 28 navigational function descriptions. Participants who assigned to dough processing functions first saw a video introduction into how dough sheeters work and were taught some of the most important bakery jargon (as per a pre-test) to understand what the functions described. While assigning, participants were thinking-out-loud which in turn was summarized and noted on a per-function and per-icon level by a researcher in the room. The assignment was completely free. Participants could take their time, make (and comment) changes and decide whether one, multiple or none of the icons fit any given function. They were also expressively told that they did not have to assign all icons or cover all functions.

3 Results

Statistical Analysis showed both navigational and functional assignment groups were comparable in terms of technology acceptance and technological expertise. The results of the technology acceptance scale were not normally distributed (Kolmogorov-Smirnov: .011). Though the results of the technological expertise scale were (Kolmogorov-Smirnov: .200). Thus a Mann-Whitney U-Test was performed of the former ($U = 42.5$, $p = .475$) and a t-test for the latter ($t(15) = -.997$, $p = .136$).

As assumed the icon-to-function assignment was higher in the industrial icons since they may have been more suited to dough processing. Surprisingly over 20% of the Google icons also showed a high degree of icon-to-function assignment. In Fig. 1 all assignments for every Google icon and every function are presented.

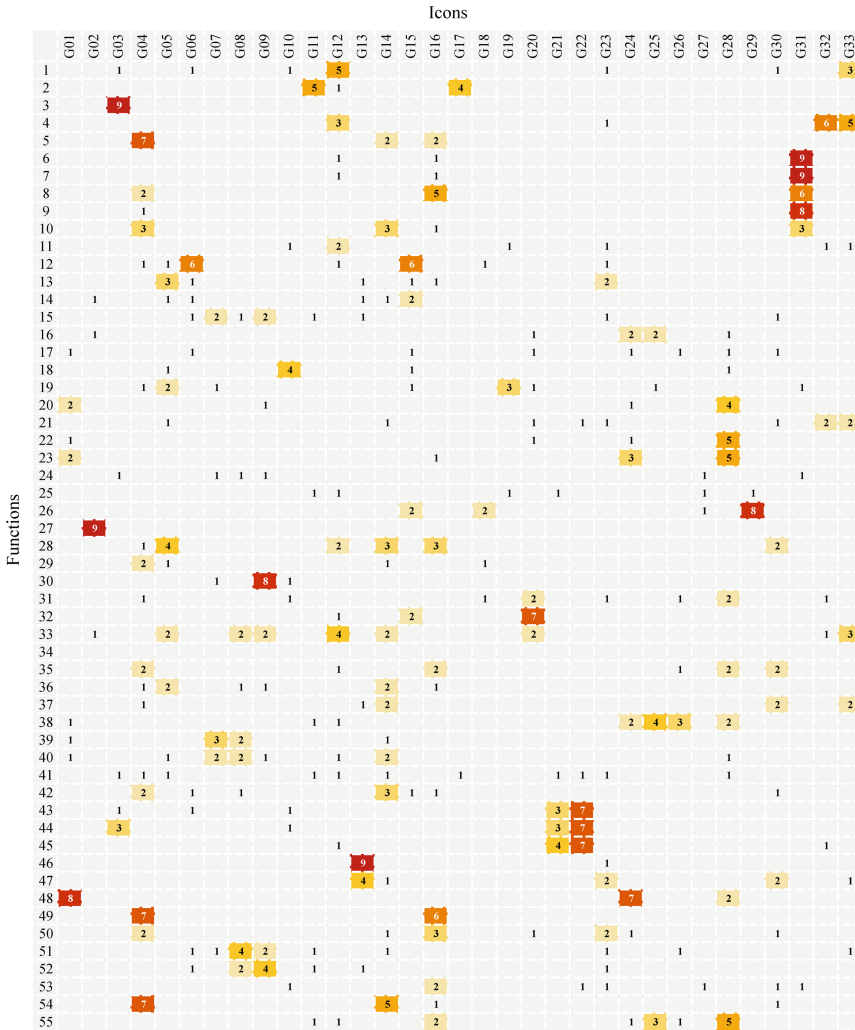


Fig. 1. This shows a figure consisting of how often (numbers in black or white) a Google icon (upper axis) fitted into a navigation function (left side) of an industrial dough-sheeter. The darkness indicates the number of assignments of an icon to a given function.

The information in Fig. 1 is only able to show how icons are being interpreted and how the icons were interpreted as best fitting to a certain function. Without verbal information from the participant, at this stage, no conclusion about the quality can be presented. This means that e.g. the allocations of the icons G14, G28, G16, G31 and G04 could be due to their generic appearance or due to their multi-faceted effect on the viewer’s opinion. To find a stable ground for further interpretations, qualitative analyses of the thinking-out-loud summaries was performed to shed light on what the strengths and weaknesses of the presented icons are. For the first twelve icons this is shown in Fig. 2.













Nº	Symbol	Assignments	Assignments / functions	Strengths	Weaknesses
G01		17	2.13	Known as refresh from internet browsers	
G02		12	3.00	Is recognized as trashcan / recycle bin	
G03		16	2.67	Is recognized as a Home button to return to the starting page	
G04		42	2.47	Is recognized as a symbol for settings	Assigned a lot since it is unspecific / generic
G05		20	1.67	Is recognized as a pen to edit something.	
G06		15	1.50	Is recognized as a plus to add, increase or speed up	
G07		12	1.71	Left pointing arrow is assigned to reduce or go back	Interpretation is dependent of rotation / pointing direction
G08		16	1.78	Is used for slowing down and interpreted as less-than	Interpretation is dependent of rotation / pointing direction
G09		23	2.56	Is used for next and end functions	Interpretation is dependent of rotation / pointing direction
G10		11	1.38	Tic-mark to choose option or mark as accepted	
G11		12	1.63	Is used to close or shut-down	
G12		29	1.61	Is recognized as a menu or a list (of settings) and was also interpreted as thickness of dough	

Fig. 2. The figure shows the first twelve assigned icons. It is sorted by the internal number of the study, and presents the used Google-icon, absolute assignments to all functions, ratio between allocations and numbers of all functions it was assigned to as well as verbally generated strengths and weaknesses by participants

With the additional qualitative data, the reflection and the decision of which icon to use in industrial setting is much better grounded. 1. If GUI designers are not quite certain about whether to take e.g. G05 or G04 for possible settings and changing process G05 seems to have an advantage over G04, because too many allocations for different functions could be a sign for many interpretations of what this icon stands for, which was also mentioned in qualitative data. 2. If there are icons that are similarly

looking (e.g. G07 and G08), qualitative data shows that it is to prefer only one of those and in this specific case take that one that is associated intended function by the GUI designer. In case of G07 and G08 it could be “go back” or “less than” because “slow down” or “reduce” points on the same dimension.

4 Discussion

In this study we assumed, that Google icons could be used in the navigation of an interface in an industrial context, because of possible implicit knowledge of the participants due to the massive distribution of the android OS in smartphones [3, 4]. We found evidence that strengthened our assumption. We also found that without qualitative data, this kind of research could lead in the wrong direction. When it comes to the interpretation of the intention of the user. In addition, replications of this study with a sample of subjects with different cultural background will show if we can get closer to a solution that the cultural difference can create when it comes to human machine interaction [2]. In summary the analysis of Google icons was valuable especially regarding the thoughts of the user when it comes to functional assignment. With this knowledge, a more targeted use of icons could be realized during the design of new GUIs in industrial context.

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