# Classification of the Context of Use for Smart Phones

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**Abstract.** Mobile devices like smart phones are used in various contexts of use. Hence we conducted an explorative field study to determine factors influencing smart phone interaction. The results of the study suggest that a smart phone is often used in a relaxed situation and a familiar environment. In contrast to this, few interactions take place in a stressful situation. In addition to that, the location and the activity of the test participant seem to have an impact on the smart phone interaction.

**Keywords:** classification of the context of use, mobile context of use, influence factors, mobile app.

## 1 Introduction

Smart phone applications are used in various contexts of use. With the intention to reduce the complexity of these applications for the user, the relevance of context-sensitive behavior increases. That is why it is essential to get a detailed description and classification of the context of use. Therefore we developed a native iPhone questionnaire app for a field study. Within this study we tracked the test participants' context of use while they were using their personal smart phones.

## 2 Method

We invited 16 test participants to the university to be briefed about the field study and to deploy the questionnaire app on their personal iPhone. For a period of two days test participants were asked to document the contexts of any use on their smart phones, where a *use* was determined by unlocking the display. To ensure a balance between work related and private usage, the test participants had to select one weekday (between Monday and Friday) and one day at the weekend (between Saturday and Sunday) for the record. Test participants should characterize their context of use with the help of the app each time before they normally interacted with their smart phones. They were also informed that sensor and user data would be recorded repeatedly in the background.

The handling of the questionnaire app was designed so that the participants could quickly and flexibly state their context and thus the regular interaction with the smart phone was influenced as little as possible. Furthermore, the opportunity was given to

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describe an interaction later in case they were under time pressure. For each use, answers to 15 questions (14 mandatory and 1 optional) had to be given. One question each was presented on one screen of the app. Care was taken that the questions cover each of the influence factors of Schmidt's [3] working model for context. This model refers to mobile computers and contains 6 influence factors which can be associated with 2 dimensions, namely *human factors* (information on the user, the user's tasks and social environment) and the *physical environment* (infrastructure, physical conditions and location). First, test participants were given the opportunity to skip the questionnaire in case they were unable to answer it in their current situation. Then, they had to provide the following information via the questionnaire: the perceived relevance of the interaction, their emotion, if and which other main tasks they had, their smart phone task, activity, social environment, location, environmental influences, other devices in the environment and whether or not they were influenced by something else. Finally, they had to state which of these potentially influencing factors was the most significant. To assess their emotion (pleasure, arousal and dominance) the 5-step Self-Assessment Manikin (SAM) [2] was used.

In addition to the manual entry of the context of use, the app ran in the background and recorded data about the participant's behavior. The selected answer options and the stored data were then sent to a server at TU Berlin for later analysis. After all test participants finished the study, the data were screened and usage instances outside the considered 2-day period were deleted. Two evaluators then sorted the free text responses into categories. For instance, the activity was classified into the categories *lying*, *sitting*, *standing*, *walking* and *other* and the location was classified into *home*, *mobile or outdoors*, *stationary and not a private apartment*, *work* and *other private apartment or garden*. The interval variables of the three dimensions of SAM and the perceived 5-step relevance of the interaction were normalized to the value 3 for each test participant.

## 3 Results

The study was conducted from August 12, to September 1, 2013. Sixteen test participants (7 male and 9 female, aged from 21 to 29 years) completed the questionnaire 736 times in total, with an average of 46 (min = 20, max = 86, sd = 21.4) interactions within the two days.

From the wealth of data collected in the study, in this paper we only present the findings which we can interpret by now. In 92.4% of the situations test participants were not affected by influences outside the model of context of use which was presented in Chapter 2. This indicates that the model covers most relevant factors of the context of use. The main influences which were added were tiredness and stress. The smart phone was mostly used in a stationary context, and especially a lot at home (62.9%). Furthermore, smart phones were used mainly for communication purposes (53.9%). The smart phone was no longer used primarily for making phone calls (9.4%), but a lot for written communication, especially for short messages (33% for chat and SMS).

We now present the influence factors *location* and *activity* in two contingency tables (Table 1 and 2) and their influence on the smart phone task. The percent values describe the distribution of all interactions in a row. The color is normalized in each column, which means the color white indicates the lowest value and the color green indicates the highest value in each column.

In a private apartment the smart phone was rarely used for phone calls (Table 1). Furthermore, test participants used the smart phone for short messages in the same distribution at all location except for *another private apartment or garden* (e.g. a friend's apartment). Games are used mainly at home and in a mobile or outdoor context. Not surprisingly, the smart phone was mostly used for navigation in a mobile context. In a stationary location, which was not a private apartment (e.g. cafe, concert) the smart phone was primarily used for communication (70.7%). Unfortunately, during the study only a few of the 16 test participants interacted with their smart phone in *other private apartment and garden* or at *work*.

**Table 1.** Contingency table of location and smart phone task

| | | Smart phone task | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Phone call | Short messages | E-mail | Social networks | Other mobile web | Games | Media consumption | Navigation | Basic smart phone functions | Other | **Total** |
| **Location** | Home | 7.6% | 34.1% | 10.4% | 5.8% | 18.6% | 4.1% | 4.1% | 0.9% | 13.4% | 1.1% | 463 |
| | Mobile or outdoors | 13.3% | 37.2% | 10.6% | 0.9% | 13.3% | 1.8% | 7.1% | 8.8% | 6.2% | 0.9% | 113 |
| | Stationary, not a private apartment | 15.5% | 36.2% | 19.0% | 6.9% | 5.2% | 0.0% | 5.2% | 0.0% | 12.1% | 0.0% | 58 |
| | Work | 11.3% | 34.0% | 11.3% | 1.9% | 18.9% | 0.0% | 3.8% | 0.0% | 18.9% | 0.0% | 53 |
| | Other private apartment or garden | 8.2% | 8.2% | 16.3% | 16.3% | 28.6% | 0.0% | 4.1% | 0.0% | 6.1% | 12.2% | 49 |
| **Total** | | 69 | 243 | 85 | 41 | 128 | 21 | 34 | 14 | 89 | 12 | |

**Table 2.** Contingency table of activity and smart phone task

| | | Smart phone task | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Phone call | Short messages | E-mail | Social networks | Other mobile web | Games | Media consumption | Navigation | Basic smart phone functions | Other | **Total** |
| **Activity** | Sitting | 10.2% | 32.4% | 11.1% | 6.9% | 18.2% | 2.4% | 3.8% | 1.9% | 11.1% | 2.1% | 423 |
| | Lying | 2.3% | 33.3% | 11.7% | 5.3% | 18.7% | 6.4% | 6.4% | 0.6% | 14.0% | 1.2% | 171 |
| | Standing | 11.4% | 39.8% | 12.5% | 3.4% | 14.8% | 0.0% | 1.1% | 3.4% | 13.6% | 0.0% | 88 |
| | Walking | 24.4% | 24.4% | 13.3% | 0.0% | 13.3% | 0.0% | 8.9% | 4.4% | 11.1% | 0.0% | 45 |
| | Other | 11.1% | 33.3% | 11.1% | 0.0% | 0.0% | 0.0% | 22.2% | 0.0% | 11.1% | 11.1% | 9 |
| **Total** | | 69 | 243 | 85 | 41 | 128 | 21 | 34 | 14 | 89 | 12 | |

While walking, the smart phone was used in 24.4% of all interactions for phone calls and less than usual for short messages (table 2). When the participants had a more relaxed body posture (lying or sitting), they used social networks and games more often compared to situations when they stood or walked.

In 80.7% of all cases test participants interacted with their smart phone while sitting or lying, 84.6% of the interactions took place in a stationary context and 64.8% with a low arousal level. The interactions which took place in a relaxed and stress-free situation (i.e. with low arousal, stationary and while sitting or lying all together) account for 48.8% of all interactions in this study. The data indicate that the participants often used their smart phones when they were in a relaxed body position, not on the move and in a relaxed situation. Furthermore, interactions which happened in a relaxed situation were perceived not to be very relevant for the test participant.

Looking at the most important 10% of all smart phone interactions compared to the least important 10% something stands out: communication is changing. With an above-average frequency the smart phone was used for phone calls (24.3%) and less often for e-mails (6.8%), if the interaction was perceived to be important. In contrast to that, the smart phone was never used for phone calls (0.0%) and more frequently for e-mailing (17.6%), if the interaction was perceived to be unimportant.

## 4 Discussion

In this study we detected some results which are consistent with other studies, for instance that the smart phone was mostly used at home [4] and primarily for communication [1]. In addition, the communication changed at different locations and when different activities were performed. Very often the smart phone was used for communication in a public location (e.g. cafe, concert). Possibly the smart phone was used to find each other in these cases. Furthermore, it could have been difficult to enter text for short messages while walking, so test participants took a break and stood or sat down. Unfortunately, because the study took place in the semester break and test participants were mostly students, the context *work* in the influence factor *location* may be underrepresented in this study.

## 5 Conclusion and Future Work

There is a large cluster that accounts for interactions which take place in a stress-free environment, and a small cluster that accounts for interactions, where the interaction is perceived to be important. The smart phone interaction and especially communication was changing in different locations and when the test participants performed different activities. So the smart phone was very often used for communication in a public location. Unfortunately, the sample is too small to make statements about more specific contexts. These initial findings can give a hint to describe the context of use better in further studies. We plan to distribute a questionnaire app to a higher number of test participants offering only multiple choice questions and no free text question and also to collect more dependent variables.

We hope these results will help us in further studies to classify the clusters for smart phones into more precise contexts. When available, sensors in the smart phone can automatically classify these meaningful contexts in the future, non-relevant information can be hidden, and relevant information can be shown to the end user, depending on the classified context of use.

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