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Ulm University | 89069 Ulm | Germany

**Faculty of Engineering,
Computer Science and Psychology**
Institute of Media Informatics
Human-Computer-Interaction Group

Proposal

Bachelor Thesis in Media Informatics at Ulm University

Presented by:

Ronja Lehle
ronja.lehle@uni-ulm.de

Examiner:

Prof. Dr. Enrico Rukzio

Advisor:

Luca-Maxim Meinhardt

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1 Introduction

Research Questions

Smartphones have changed our daily lives dramatically over the last decade. They offer numerous advantages - such as global networking or simply entertainment - and have become essential as modern, digital Swiss Army knives. However, they also bring with them certain challenges. This paper will deal with a topic that describes the inappropriate use of smartphones during social interactions. This widespread behavior is called phubbing and is a combination of the words "phone" and "snubbing" (ignoring). Studies have shown that phubbing during a face-to-face conversation - especially in a social context - can have a negative impact on its evaluation and, in the long term, even on the social relationship between people.[3]

As there are already numerous studies on the causes and effects of the phenomenon, I would like to look at a reaction to it: How can phubbing be avoided? At the end of the day, the impact of smartphones on social interactions depends on **how** they are used. However, many users are often unaware that they are phubbing. Therefore, I think that a preventive, supportive behavior of the system makes sense, which helps users to use their smartphones more consciously and possibly prevents phubbing moments from occurring in the first place.

The research question of this thesis will essentially be:

- Do users accept a supportive behavior of the system in case of phubbing, which can lead to a more conscious use of smartphones?

2 Background & Related Work

2.1 paper about phubbing

Phubbing is made up of "phone" and "snubbing". Roughly translated, it means ignoring a person by using a smartphone in their presence. The word was originally invented in 2012 by the Australian agency McCann on mission of Macquarie Dictionary as part of a linguistic experiment. The fictitious campaign launched under the title "Stop Phubbing"^[9] described a phenomenon that was already known in many places but had no name. This was followed by numerous publications and media reports that used the term to address the issue of phubbing.

2.1.1 Can you connect with me now? How the presence of mobile communication technology influences face-to-face conversation quality[10]

The paper, published by the *University of Essex*, appeared in 2012 under the title "*Can you connect with me now? How the presence of mobile communication technology influences face-to-face conversation quality*". *Andrew K. Przybylski* and *Netta Weinstein* were involved in its publication. The paper focuses on the extent to which the presence of mobile phones can influence face-to-face conversations and the resulting interpersonal relationship. To investigate this influence, groups of two were asked to have (a) casual and (b) more meaningful conversations. They were randomly assigned to a setting in which either a mobile phone or a notebook was casually placed on the table. After the conversation, the participants were asked to rate the perceived relationship quality, partner closeness, interpersonal trust and the perceived empathy of the conversation partner. The results of the study, or rather the relationship ratings of the test subjects, showed that the bare presence of a cell phone inhibits the development of interpersonal closeness and trust, with less closeness, trust and empathy being perceived, particularly in the case of personally meaningful topics. Possible reasons for this result are not investigated further, but it is suggested that the subconscious perception of the phone represents large social networks and that's why too personal conversations are avoided. In addition, the test subjects' cell phones could be permanently associated with other individual factors (e.g. business, etc.), which could influence the presence.

In my thesis, I will mainly reference the paper in order to use the results of the study to describe an example that shows the influence of cell phones (through their presence alone) on interpersonal relationships and can therefore support the relevance of my thesis. However, it should be noted that the study is from 2012 and the overall social perception and behavior of mobile phones has changed because of their exponential development and use. It is therefore possible that the study results cannot be transferred to the present day. The study was also conducted with strangers. It remains to be seen what effect the study will have on the quality of an already existing relationship.

2.1.2 Collective solitude: Phenomenon phubbing. Analysis of the inappropriate use of smartphones in private and public communication[6]

The article "*Collective solitude: Phenomenon phubbing. Analysis of the inappropriate use of smartphones in private and public communication*", published by the journal "*Information-Wissenschaft & Praxis*" in 2014 and was written by *Vanessa Klein* from the *HAW Hamburg*. The article is a good introduction to the topic of phubbing. It also reports on possible causes and effects and the associated risks.

2.1.3 Put down your smartphone – unless you integrate it into the conversation! An experimental investigation of using smartphones during face to face communication[7]

The paper, published by *Sarah Lutz* from the *University of Mannheim* and *Karin Knop* from the *Koblenz-Landau*, appeared in 2020 under the title "*Put down your smartphone – unless you integrate it into the conversation! An experimental investigation of using smartphones during face to face communication*". The study - reported in the paper - examines the effect of smartphone use during a face-to-face conversation between friends on its progress and quality evaluation. For this purpose, it differentiates between **proactive, reactive, integrative** and **no** use. The study results show that proactive and reactive use of the smartphone - which includes interrupting the conversation - has a negative impact on the evaluation of the quality of the conversation, attention and the perceived politeness of the other person. However, reactive use is generally perceived more positively than proactive use. This is explained by the fact that conversation partners may understand the obligation of "constant availability" and therefore rate this behavior as less impolite. According to the study results, integrative use during a conversation (e.g. watching a video together) has no influence on its evaluation (neither damage nor improvement). It is interesting to note that one's own phubbing behavior

(whether one uses the cell phone often or less during a social interaction) was also not related to how the phubbing behavior of the other person was rated.

The study was only done with students who were already friends. Therefore, the results may only reflect one target group (age, social status, etc.). Another point to highlight, regarding the study results, is that no difference was made between social (e.g. chatting with friends, Instagram, etc.) and non-social (e.g. looking for information about train connections, reading restaurant menus, etc.) smartphone use. I think it is possible that proactive use could be evaluated differently if these two cases were separated.

Because I will recruit a similar target group for the testing and evaluation of my application (friends who meet regularly, possibly within the university), I can build on the results of this paper and use them as a further example of how proactive smartphone use (even between friends) during a conversation is experienced as negative by the other person. I also find it interesting that one's own phubbing behavior has no influence on the evaluation of the other person's phubbing behavior. I think that this comment in particular shows how important general phubbing prevention is, because one's own behavior in this regard is probably not in relation to one's own desired social etiquette.

2.1.4 The ubiquity of social reinforcement: A nudging exploratory study to reduce the overuse of smartphones in social contexts[4]

The paper, financed by the *IULM University (Italy)*, *Istituto Europeo per lo Studio del Comportamento Umano (Italy)* and *Oslo Metropolitan University*, appeared in 2021 under the title "*The ubiquity of social reinforcement: A nudging exploratory study to reduce the overuse of smartphones in social contexts*". *Massimo Cesareo, Marco Tagliabue, Annalisa Oppo and Paolo Moderato* were involved in its publication.

The paper deals with the implementation of a preventive method to avoid abusive smartphone use in a social context. The developed tool is a "nudge"¹ in the form of a box, which prompts users with a textual social hint to put their smartphone in the box for the duration of the social interaction. The experiment was done in a pub. Several groups of guests with a nudge on the table and groups without the nudge (control group) were observed. The number of smartphone uses per person/table and the duration of these uses were evaluated. The field study showed that guests' smartphone use was reduced by this small "push" in form of the nudge (compared to the control group

¹A "nudge" is a method of influencing people's behavior without using prohibitions and commandments.[14]

without a nudge). Although the study was conducted in a real-life scenario, the group of study participants was limited to pub-goers. It should also be noted that there are no observations if the behavior could be maintained in a long-term study. In other words, if guests act differently when they have gotten used to the nudge by repeating the setting.

I would like to use this paper primarily as a background for the successful use of preventive methods regarding smartphone use in a social context. I can draw two important findings from the experiment: 1. The guests voluntarily put their smartphones in the box, which means that they have an interest in a setting that is as smartphone-free as possible during social interaction (pub visit); 2. Even the small hint on the nudge reduced smartphone use. This shows that there is no need for bans or restrictions to counteract phubbing behavior.

2.1.5 Your phone ruins our lunch: Attitudes, norms, and valuing the interaction predict phone use and phubbing in dyadic social interactions[2]

The paper, published by the *University of Basel*, appeared in 2022 under the title "*Your phone ruins our lunch: Attitudes, norms, and valuing the interaction predict phone use and phubbing in dyadic social interactions*". *Christiane M. Büttner, Andrew T. Gloster and Rainer Greifender* were involved in its publication. The paper examines the extent to how certain factors influence the frequency of phubbing during a group lunch (study setting). The predictors that were tested in this study are: the **attitude toward phubbing**, **subjective norms of phubbing** (individual expectations of people how to behave in a situation, e.g. if it is okay to use the smartphone during a conversation), **interaction value** (how good the interaction is perceived to be), **perceived interaction value of the partner**. It was observed that the higher the perceived value of an interaction, the less the smartphone was used during the conversation. However, a lower rated interaction did not predict phubbing behavior. Personal attitudes towards phubbing, but not subjective norms, were also validated as predictors. It was observed that phubbing is contagious. A phubbed person becomes a phubber themselves and a devils circle develops.

From this paper, I would particularly like to use the insight that phubbing can be contagious. This is a good example to show that phubbing often happens subconsciously (you get phubbed, so you simply phub even though you wouldn't actually have done it) and therefore an intervention or raising awareness of the system can be useful. I also find it interesting that a greater appreciation of the interaction can act as a kind of "protective factor" against abusive smartphone use. This observation can be taken up

in the design of the interventions. For example, you could ask a question like: "Do you like the conversation?" and in this way make people aware of the appreciation of it.

2.2 paper for technical implementation

2.2.1 Analysis of Social Interactions Through Mobile Phones[8]

The paper, published by the *Center for Research and Telecommunication Experimentation for Networked Communities (Italy)*, appeared in 2012 under the title "*Analysis of Social Interactions Through Mobile Phones*". Aleksandar Matic, Venet Osmani and Oscar Mayora-Ibarra were involved in its publication.

This paper was a milestone in the field of "analyzing social interactions" and has been recited many times. The study explores how cell phones can be used to predict social interactions. For this purpose, the parameters "interpersonal distance" and "relative body orientation" were analyzed. The distance between two smartphones (interpersonal distance, assuming that people carry their cell phones with them) was calculated and recorded using their RSSI values (via the Wi-Fi signal). These calculations were then used to classify four types of distance: **intimate distance** (hugs, whispers, etc.), **personal distance** (interactions between good friends), **social distance** (interactions between acquaintances) and **public distance** (e.g. speaking in front of an audience). By analyzing and evaluating the relative body orientation - which could be recorded using sensors built into the smartphone - it was possible to differentiate between formal (e.g. workplace; body posture remains stable over a longer period of time) and informal (e.g. conversation; greater variance in body posture) situations.

Since the paper is from 2012, it can be assumed that technically more is already possible. However, I would like to include it in my work, because it provides a solid basis for the idea of being able to recognize social interactions based on the evaluation of cell phone data in real time. In my work, I will also use the RSSI values in the distance calculation (via BLE). I would also like to adopt the categorization of the four distances.

2.2.2 Corona-Warn-App[12]

Read more about this documentation in chapter "Implementation".

2.3 paper for the implementation of the study

2.3.1 MindPhone: Mindful Reflection at Unlock Can Reduce Absentminded Smartphone Use[13]

The paper, published by the *LMU Munich* and *University of Waterloo (Canada)*, appeared in 2022 under the title "*MindPhone: Mindful Reflection at Unlock Can Reduce Absentminded Smartphone Use*". *Nada Terzimehić*, *Luke Haliburton*, *Philipp Greiner*, *Albrecht Schmidt*, *Heinrich Hussmann* and *Ville Mäkelä* were involved in its publication.

The paper is about the MindPhone app, which was developed to counteract abusive, absent-minded smartphone use. The function of MindPhone is relatively simple: when the smartphone is unlocked, a notification pops up asking the user a question. The study was structured as a 2x2 mixed design. This means that there are 2 question and 2 answer modes. The questions were either **what the user intends to do with the smartphone (intention)** or **what the user intends to do in real life after using the smartphone (activity)**. The answer could either be entered in a text field (active, mode 1) or be thought (passive, mode 2). The total duration of the study was 2 weeks. One week for each response mode. The test was run with 2 groups. Which question was asked depended on the group selection. This was randomized. There were 28 test subjects who had the app installed on their smartphone for the entire duration of the study. The study was guided by the questions if a more mindful smartphone use can be achieved when thinking about its intention and the following activity, and what difference it makes if the answer in this regard is only thought (passive) or concretely formulated in text form (active). To this, the screen time and the number of unlocks were recorded. Additionally, the study was qualitatively evaluated using three questionnaires. After each week, a questionnaire on the answer mode, and a final feedback at the end of the study. The data collection was anonymous, but each participant had a unique ID. After successful participation in the study, the test subjects received a payment of 30,00€. The results of the MindPhone study showed that the test subjects developed a better awareness of their smartphone use by answering (actively or passively) the question. This resulted in a significant reduction in screen time and the number of times they unlocked their phones.

As my work overlaps (interventions, question if the system is accepted) with the MindPhone study (and the study is simply very well structured), I would like to be inspired by this paper for the evaluation of my app and design the study structure similarly. Read more about this in chapter "Method".

3 Implementation

To be able to investigate the research question, I would like to write an app that:

- recognizes if a smartphone user is in a social context,
- initiates interventions should the user use their smartphone while the app has detected a social interaction,
- should run in the background of the devices during the entire study,
- initiates questionnaires to test persons and sends them to a server.

3.1 real-time contact detection

For this first part of the implementation, I would like to define - from a technical point of view - what a "social interaction" is in this work:

- Two, or more subjects - who have the app installed on their smartphone - are in a social interaction when their smartphones are at a distance from each other which is smaller than the fixed defined benchmark.

To determine such a distance between two devices, I use the "Corona-Warn-App" as a guide. The "Corona-Warn-App" was published by the Robert Koch Institute (RKI) in the course of the Covid-19 pandemic. It was developed by SAP and Deutsche Telekom AG. It is open-source and therefore freely accessible. Due to the easing of the pandemic, it has been in sleep mode since June 1, 2023 and is no longer being developed further.[11] It is a contact tracing app that informs users if they have had contact with infected people (close contact) in order to avoid infecting third people (during the incubation period) and break the chain of infection. „*The Corona-Warn-App uses a new framework provided by Apple and Google called Exposure Notification Framework. The framework employs Bluetooth Low Energy (BLE) mechanics. BLE lets the individual mobile phones act as beacons meaning that they constantly broadcast a temporary identifier called Rolling Proximity Identifier (RPI) that is remembered and, at the same time, lets the mobile phone scan for identifiers of other mobile phones.*“[12]

For a better understanding, I would like to explain the technologies - which I will use based on the Corona-Warn-App - in more detail:

Bluetooth Low Energy (BLE)

BLE is a variation of Bluetooth technology that was specially developed for use in devices with low power usage. While classic Bluetooth is designed to transmit large amounts of data over long distances, BLE has been optimized to transmit small amounts of data over short distances while using as little energy as possible. Additionally BLE devices can be connected more quickly and easily than classic Bluetooth devices (without pairing).[1] Since only a short distance is required for social contact detection, and low power usage of the device is also an advantage, the properties of BLE are ideal for applications of this type.

iBeacon

iBeacon is a technology developed by Apple that uses advertisements via BLE to define a radius around a beacon device so that an iOS or Android device can detect when it has entered or left this radius. They are mainly used in public spaces (museums, shops, etc.) to send users offers or information that they can receive on their smartphone (e.g. in an app).[5]

Both smartphones - between which a possible social interaction is to be detected - have the app installed and can scan for BLE devices and also simulate a beacon to send advertisements. If a device scans an advertisement that has the ID that is defined for the application, then it is in the radius of the second smartphone that is acting as a beacon (this means it is in the close proximity). The recognition of the second device is registered as a social interaction.

3.2 interventions

The program will show users interventions in the form of a pop-up/overlay with corresponding text, if they unlock their smartphone during a period registered as a social interaction.

(TODO: Research Notifications)

There will be two possible types of intervention, which are different in the time of their display after unlocking the smartphone:

- directly
- after a certain time interval

The intervention type is changed by the app after one week.

There will also be two different modes for closing the interventions:

- directly
- after entering "reasons" in a text field
- (*alternatively: after a certain time interval*)

3.3 background running

(TODO: Research Background Running of software)

3.4 questionnaires

The app will initiate the display of a questionnaire at predefined times. If test persons have filled it out, it is sent to a server as soon as the device is in the WLAN.

(Keeping alternatives open, e.g. via email)

(TODO: Research)

4 Method

In order to evaluate the application of this work on the basis of the research question, I will perform a study. For this, I would like to use the study in the paper "*MindPhone: Mindful Reflection at Unlock Can Reduce Absentminded Smartphone Use*"[13] as a guide.

4.1 study design

The study design will be a **2x2 mixed field study**. There are 2 intervention designs - which differ in the timing of their insertion - and 2 answer modes with which the intervention can be closed.

- **Intervention design 1:** appears immediately after unlocking,
- **Intervention design 2:** appears after a certain time interval,
- **Answer mode 1:** direct closing possible,
- **Answer mode 2:** closing possible after textual input of "reasons".

4.1.1 test subjects

The number of participants in the study should be between 20 and 30. The test subjects are randomly assigned to a test group.

Group 1

Intervention 1, Answer mode 1/ Answer mode 2

Group 2

Intervention 2, Answer mode 1/ Answer mode 2

4.1.2 duration of study

Test subjects install the app and delete it after the study period has ended. The study runs for 2 weeks. After each week, the participants switch from answer mode 1 to answer mode 2.

4.1.3 evaluation

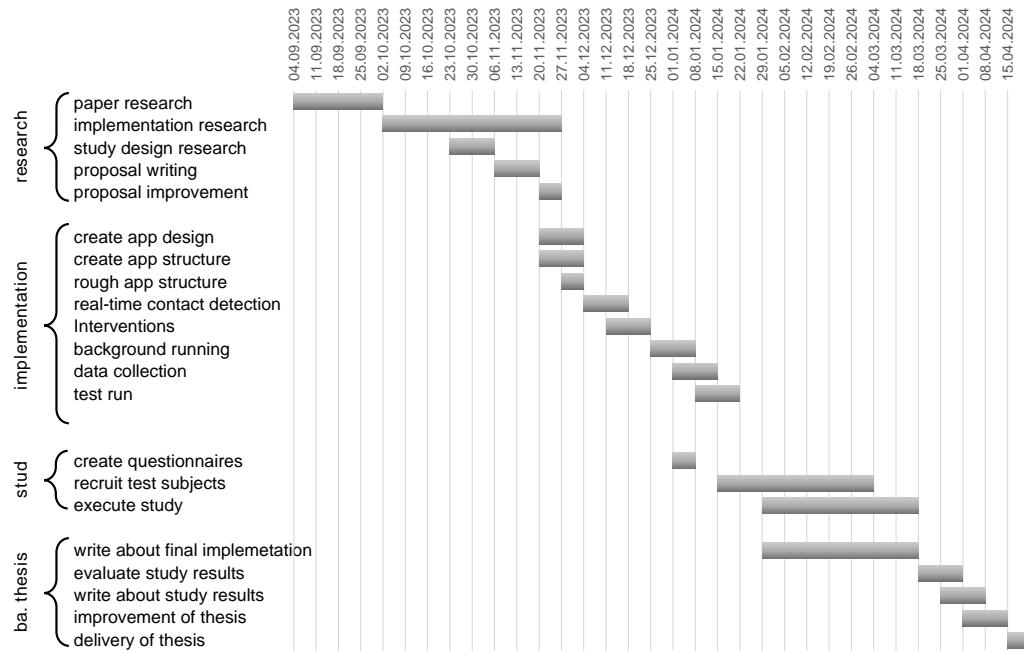
The evaluation of the study is based on the collection of the following data:

- Number of unlocks during social interaction, or number of interventions during social interaction,
- Screen time during social interaction (if possible),
- 2 questionnaires (each after one week),
- Qualitative overall feedback at the end of the study with the opportunity for comments, wishes and impressions.

5 Timeline

	task	start	end
research	paper research	04.09.2023	01.10.2023
	implementation research and prototyping	02.10.2023	26.11.2023
	study design research	23.10.2023	05.11.2023
	proposal writing	06.11.2023	19.11.2023
	proposal improvement	20.11.2023	26.11.2023
implementation	create app design	20.11.2023	03.12.2023
	create app structure	20.11.2023	03.12.2023
	Implementation of rough app structure	27.11.2023	03.12.2023
	Implementation of real-time contact detection	04.12.2023	17.12.2023
	Implementation of Interventions	11.12.2023	24.12.2023
	Implementation of background running	25.12.2023	07.01.2024
	Implementation of data collection	01.01.2024	14.01.2024
	internal test run and improvement	08.01.2024	21.01.2024
	Implementation of questionnaires (?)		
stud	create questionnaires	01.01.2024	07.01.2024
	recruit test subjects (advertisement, etc.)	15.01.2024	03.03.2024
	execute study (incl. meetings for final feedback)	29.01.2024	17.03.2024
ba. thesis	write about final implementation (incl. problems?)	29.01.2024	17.03.2024
	evaluate study results	18.03.2024	31.03.2024
	write about study results (correspond with rq)	25.03.2024	07.04.2024
	improvement of thesis	01.04.2024	14.04.2024
	delivery of thesis	15.04.2024	21.04.2024

5 TIMELINE



Bibliography

- [1] bluetooth.com. The bluetooth® low energy primer. [Online]. Available: <https://www.bluetooth.com/de/bluetooth-resources/the-bluetooth-low-energy-primer/>
- [2] C. M. Büttner, A. T. Gloster, and R. Greifeneder, "Your phone ruins our lunch: Attitudes, norms, and valuing the interaction predict phone use and phubbing in dyadic social interactions," *Mobile Media & Communication*, vol. 10, no. 3, pp. 387–405, 2022.
- [3] C. Büttner, A. Gloster, and R. Greifeneder, "Your phone ruins our lunch: Attitudes, norms, and valuing the interaction predict phone use and phubbing in dyadic social interactions," *Mobile Media Communication*, vol. 10, 10 2021.
- [4] M. Cesareo, M. Tagliabue, A. Oppo, and P. Moderato, "The ubiquity of social reinforcement: A nudging exploratory study to reduce the overuse of smartphones in social contexts," *Cogent Psychology*, vol. 8, no. 1, p. 1880304, 2021.
- [5] developer.apple.com. (2014) Getting started with ibeacon. [Online]. Available: <https://developer.apple.com/ibeacon/>
- [6] V. Klein, "Gemeinsam einsam: Phänomen phubbing. untersuchungen zur unangebrachten smartphone-nutzung im privaten und öffentlichen miteinander: Collective solitude: Phenomenon phubbing. analysis of the inappropriate use of smartphones in private and public communication," *Information-Wissenschaft & Praxis*, vol. 65, no. 6, pp. 335–340, 2014.
- [7] S. Lutz and K. Knop, "Put down your smartphone—unless you integrate it into the conversation! an experimental investigation of using smartphones during face to face communication," *SCM Studies in Communication and Media*, vol. 9, no. 4, pp. 516–539, 2020.
- [8] A. Matic, V. Osmani, and O. Mayora-Ibarra, "Analysis of social interactions through mobile phones," *Mobile Networks and Applications*, vol. 17, pp. 808–819, 2012.
- [9] McCann. (2013) Stop phubbing. [Online]. Available: <https://web.archive.org/web/20190107085241/http://stopphubbing.com/>

BIBLIOGRAPHY

- [10] A. K. Przybylski and N. Weinstein, “Can you connect with me now? how the presence of mobile communication technology influences face-to-face conversation quality,” *Journal of Social and Personal Relationships*, vol. 30, no. 3, pp. 237–246, 2013.
- [11] rki.de. Infektionsketten digital unterbrechen mit der corona-warn-app. [Online]. Available: https://www.rki.de/DE/Content/InfAZ/N/Neuartiges_Coronavirus/WarnApp/Warn_App.html
- [12] G. G. SAP, Deutsche Telekom. (2020-2023) Corona-warn-app: Documentation. [Online]. Available: https://github.com/corona-warn-app/cwa-documentation/blob/main/solution_architecture.md
- [13] N. Terzimehić, L. Haliburton, P. Greiner, A. Schmidt, H. Hussmann, and V. Mäkelä, “Mindphone: Mindful reflection at unlock can reduce absentminded smartphone use,” in *Designing Interactive Systems Conference*, 2022, pp. 1818–1830.
- [14] Wikipedia contributors, “Nudge theory — Wikipedia, the free encyclopedia,” 2023, [Online; accessed 15-November-2023]. [Online]. Available: https://en.wikipedia.org/w/index.php?title=Nudge_theory&oldid=1183834718