KASPERSKY lab

Research Report

Digital Companions

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Summary

Smartphones have long ceased to be mere technical equipment, becoming **closely related to the fulfilment of fundamental human needs**. They have taken on the role of **digital companion** and, in many cases, have become **the replacement for a range of psychological processes typically confined to human-human relationships.**

Our international research delves into the changing relationships we have with our smartphones, offering a psychological perspective on their use, based on the concept of digital companionship.

By combining a **variety of research methods** including self-survey reports, online interactive tasks, behavioral observation and laboratory-based experiments, our project provides extensive **empirical support to conclude that smartphones have by far transcended their objective as solely a technology aid for their users**.

The findings are based on research conducted across different countries by teams of researchers and on data obtained from a diverse range of study participants.

Key findings

When it comes to emotions, the research found that the extent of **smartphone use is associated with variables that are normally akin to social relationships,** such as personal involvement with the phone and the importance of the phone for a user's sense of identity.

The extent of smartphone use is also associated with variables that affect our daily lives, such as experiencing and coping with stress, as well as the fear of missing out on rewarding experiences when disconnected from the device. In terms of their psychological distance to the user, smartphones easily outperform all other forms of technology. In addition, they are located closer to the user than many human contacts.

At the cognitive level, the research demonstrates that **smartphones are a distraction when concentration and attention are required**. In our experiment, an increased distance between a smartphone and the user, increased test performance substantially and significantly – even when there were no actual alerts or disturbances involved.

When exploring behavioral observation, the **majority of participants in our tests quickly turned to their phone whilst waiting, but underestimated the speed at which this happens**. The findings also uncovered that **people apply social rules, such as gender-specific scripts and stereotypes to their interaction with smartphones**, which is reflected in their use and evaluation of these devices.

In contrast to these findings, other user decisions are inconsistent with the emotional, cognitive and behavioral relevance of a smartphone. The **vast majority of people readily part with the PIN code to their**

phone when prompted and most do so without hesitation. In addition, smartphone protection in the form of anti-virus software and PIN codes is very variable and not common. These inconsistencies may be due to their **lack of irrelevance to human-human relationships,** which in turn is not reflected when it comes to protecting our digital companions.

Introduction

How long had you been awake this morning before you touched your smartphone for the first time? And when did you last touch it today? If we consider all of the things we do with our phones – texting, emailing, listening to music, browsing, and more – one could ask, how could we possibly get along without our phones? Furthermore, if we think about the time we spend with our phones, is there anything or anyone else as close to us and as demanding on our time?

From a rational point of view the situation is quite clear: smartphones are technological devices, something like a portable computer, offering a variety of functions and applications. However, taking into account our own smartphone usage, this rational perspective becomes doubtful. Think about how often you grab your phone to check for messages. Think about the shiver that ran through you when you last realized that you had left your phone at home. And did you contemplate going back to fetch it? Considering phones from this point of view gives us a different perspective.

We are, in fact, not dealing with a simple portable computer. Our smartphone is more like a digital companion. Our relationship with our phones is less rational than it might have been at first sight.

A psychological perspective will guide us through this research report, as we try to find answers to the question: How does our smartphone affect us, our cognitions, emotions and our behavior. What is the impact of this beyond simple technology use?

Theory

With our smartphone 24/7

Imagine an average day: Our phone wakes us in the morning and, before having our first coffee it provides us with messages or emails. While having breakfast it is our access to the world's news. Furthermore, our phone then helps us to get through boring classes or meetings, reminds us of appointments, helps us navigate our way through foreign places, and so forth. For all questions big and small, for example when the name of a certain actor in a movie needs to be retrieved… our phone will help us. Moreover, and perhaps most importantly, our phone is our connection to our loved ones. Although our partner, family or friends are often close by, our phone somehow brings them closer to us. Because of our phone we can talk to them, send them messages, texts, pictures and videos. As a result we know what they are doing throughout the day and it feels like we are part of each other's life.

In short

Our smartphone is useful. It serves us with information, valuable tools and entertainment. However, even more importantly: Our smartphone is psychologically and socially relevant to us. It makes us feel close to our loved ones.

The scientific perspective

From a more scientific point of view, smartphones confront us with a **(relatively) new technology**, which has been gaining worldwide popularity since the launch of Apple's first iPhone in 2007. In contrast to previous mobile phones, the iPhone and all subsequent smartphones launched by competitors (first of all Samsung) offered new features in terms of handling (touchscreen) and functions (of a variety distributed over several previous devices). Since 2007 smartphones have enjoyed a triumphant rise in popularity: about 122 million smartphones were sold to end users worldwide in 2007, and more than 1.4 billion units were sold in 2015. About 20% of the population in Western Europe had a smartphone in 2011, and more than 60% own one today. Taking age differences into account the simple picture is that up to the ages of 35 to 40 (depending on the specific statistics) **nearly everybody owns a smartphone**. And although the aged population (55 plus and especially 65 plus) is markedly behind in terms of smartphone ownership, this gap is also closing.[1]

From a psychological perspective we are not interested in market potential. However, we are interested in phenomena that permeate everyday life. We have therefore started by asking: What makes smartphones so popular with humans? Why do people want to own and to use them? **What psychological function do smartphones fulfill**?

Of course, we do know what these phones are capable of. Functions and usability are obvious and can capture the overall incentive for approaching smartphones in the first instance. However, they do not sufficiently explain the ubiquitous and persistent behaviours that we are all so used to by now: people reaching reflexively for their phone as soon as they need to wait for a second, friends sitting in a café in front of each other, both heads down typing on their phone, people bumping into street lamps while walking with their head down across the street. Let's be open about it. Of course there are rational reasons for frequently using your phone - but always and at all costs?

We therefore propose a perspective which is less logical but rather (psycho)logical and ask for the deeper-running reasons for the omnipresence of smartphones. Taking into account what psychology knows about human beings, we might assume that smartphones address certain basic human needs, such as the need for achievement, affiliation, and power. Put differently and more precisely, smartphones help us to

[1] Statista, 2016a; 2016b

understand and participate in the (social) world, to make better use of our leisure time, to create content and pursue projects, and also to develop our identity. They are reliable companions and this why we have entered into a relationship with them.

The characteristics of human-human relationships in terms of cognition, emotions and behavior are well known from the psychological literature. We know how such relationships are established, how people interact, and what they typically feel for each other. If our smartphone is indeed a companion, we will have to consider that these characteristics can be applied to a phone as well, strange as it may seem. **Do we have feelings for our phone, feelings of being connected or close, feelings of trust and care?**

In summary, based on usage statistics as well as psychological theory, smartphones are likely to be more than ordinary portable computers. We have introduced the term "digital companion" to stress the guiding idea of our research: smartphones are our connection to the world, providing us with a variety of objective and useful features. In addition, however, they serve us in terms of our social and emotional needs. These needs are linked to our fundamental psychological functioning and affect the way we think of and feel about our phones.

In short

This research is a first step towards an understanding of the role and the meaning of our phones exceeding their technical and rather trivial surface functions. Our aim is to gain a deeper insight into what is going on between us and our digital companions.

Research Questions

To start finding answers to our questions, we have pursued a two-level project. Firstly, we will present the findings from an **online survey,** which asked people to report on their smartphone, their use and their thoughts and emotions. Secondly, to get a more detailed and a more unobstructed in-depth-look we invited people to our **laboratory,** where they were observed while interacting with their own, and also with other, unknown phones. Thus, two sets of research questions were derived:

Part 1: Online Survey

Do smartphones affect us emotionally?

How can the relationship with our smartphones be described in terms of psychologically relevant factors?

e.g.: how close or connected do we feel to our phones? Are our phones perhaps even a part of ourselves? Do we trust our phone?

Does the way people use their smartphone tell us anything about other psychologically relevant factors?

e.g.: their happiness, stress and coping behaviors?

Part 2: Laboratory Study

Do we even wait anymore?

How long do we wait until we touch our smartphone?

And are we aware of it?

Do we care about sensitive (phone) data?

Are we aware of sensitive data?

Do we give away our PIN?

Do we give away our phone?

Do we adopt social rules when interacting with smartphones?

Are we polite to phones?

Does the perceived gender of the device matter?

Being without our smartphone: Are we affected emotionally or cognitively?

Does the mere absence of our smartphone affect our cognitive performance?

How do we respond emotionally to smartphone separation?

Part 1: Online Survey

Research Methodology

Our online study focused on the meaning/importance the smartphone carries as well as the relationship and the emotional connection users feel they have with their smartphones.

Sample

We recruited participants over a period of three months (February to April 2016) via online advertisements (e.g. Ebay classifieds), social media platforms (e.g. Facebook) and mailing lists. The resulting overall sample consisted of **1215 participants** ranging in age from **15 to 83 years** (*mean age* = 28.6, *standard deviation* = 9.09)[2], from a variety of countries with a distinct focus on Germany and the United Kingdom. **Female respondents were in a two-thirds majority** and **the overall level of education amongst participants was high.** The majority were students and employees with a university degree.

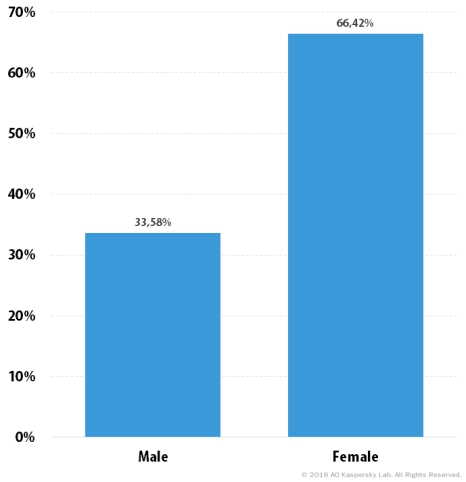


Figure 1: Participants by gender

[2]In the following, mean values will be denoted by *M*, standard deviations by *SD.*

The participants' age groups

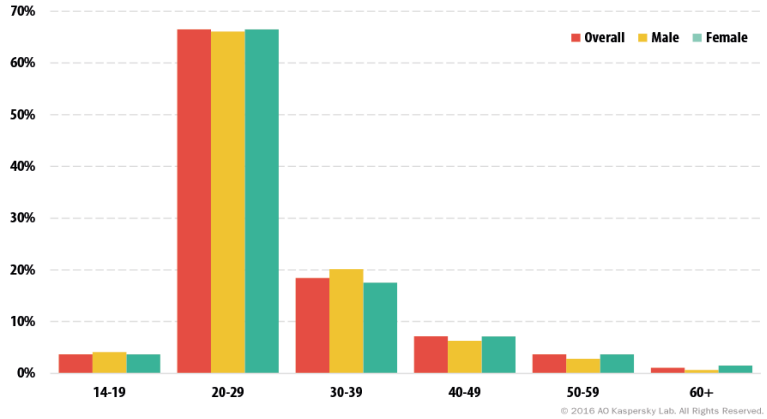


Figure 2: Frequency of participants by age group, asking "How old are you?

Figure 3: Number of participants by origin; most participants from Germany (808), UK (148) and USA (33)

According to age groups most participants were students, more than 400 were employees

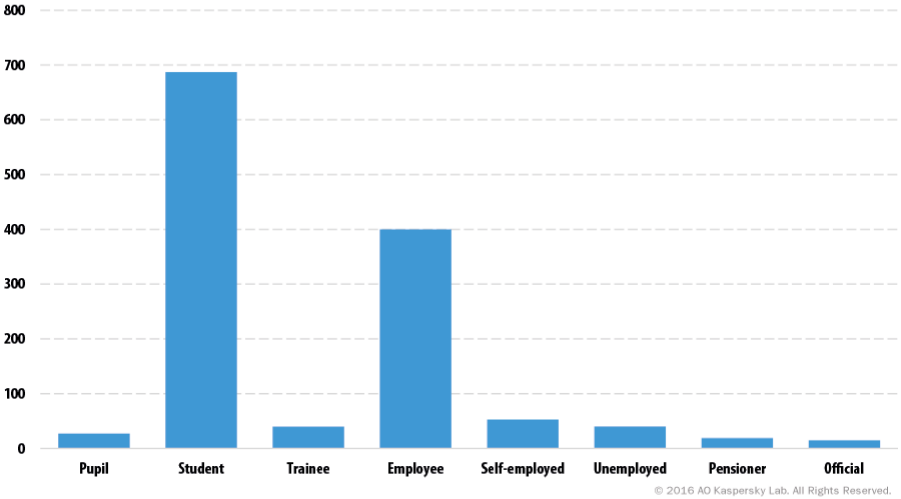
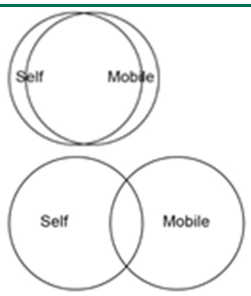


Figure 4: Number of participants by occupation, asking "What is your occupation?"

Procedure and instruments

Participation in the survey was entirely voluntary. The survey study followed core ethical principles based on the Declaration of Helsinki. Participants were asked to engage in self-reports and responses to set tasks. The central variables are as follows:

Instrument: title and authors	Example Item
Oxford Happiness (Hills & Argyle, 2002) Overall happiness in terms of subjective well-being.	I am well satisfied with everything in my life.
Fear of missing out (Przybylsky, Murayama, DeHaan & Gladwell, 2013) The fear of missing out on positive experiences others presumably have (online) while being offline. As a consequence, the instrument captures the desire to stay continually connected with peers - easily possible via one's smartphone.	I get worried when I find out my friends are having fun without me.
Involvement with your mobile phone (Walsh, White, Cox & Young, 2011) An index of the strength of connection with one's mobile phone in cognitive terms (e.g. thinking about the phone when not using it) and behavioral terms (e.g. constantly checking the phone for messages).	I interrupt whatever else I am doing when I am contacted on my mobile (conflict with other activities).
Trust in your mobile phone (based on: Rempel, Holmes & Zanna, 1985) An adapted version of the "Trust in Close Relationship Scale" originally designed to gauge levels of trust in one's relationship partner (e.g. the willingness to rely on the partner being confident that they will satisfy the expectations). We focused on one's mobile phone instead of the partner and accordingly transferred the items asking for participants' trust in their phone.	I trust my mobile. I feel attached to my mobile.
Stress caused by your mobile phone (Carolus & Strobl, in prep.) Index of the level of stress caused by your mobile phone, e.g. by lots of unread messages or by read messages when the sender can see that the message is still not answered although read.	My mobile stresses me out.
Coping - Handling stress with your mobile phone (based on: Satow, 2012) Index of dealing and managing stressful situations (= coping) with your mobile phone. The items ask for using the phone as a tool for coping by either actively managing stress, giving social support or creating a distraction from stressful situations.	My mobile helps me to cope with stress.
Inclusion of mobile in the self (based on: Aron, Aron & Smollan, 1996) Adaptation of the "Inclusion of Other in Self (IOS) Scale" originally assessing closeness in relationships. Typical for close relationship: the self and other begin to overlap by including aspects of the other in the self. We transferred this idea to the relationship with smartphones and replaced human beings we might feel close to with mobile phones. As a result, participants were asked to select the picture that best describes their relationship with their mobile phone.	
Smartphone/ Media Usage Duration and experience of participants' smartphone usage.	

PORD Positioning Relations and Devices (working title)

Following our view on smartphones as digital companions, we suppose users have established some kind of emotional relationship, resulting in a feeling of closeness to their phone. As a consequence, we compare the "emotional relevance" participants attribute to their phones with that attributed to close human beings.

The instrument developed here is based on a technique from psychological therapy to visualize relational structures and cohesion within a family by positioning pieces (each representing family members) on a chessboard.

This basic idea of visualizing relationships on a chessboard was used to outline how close we feel (1) to a range of relevant others and (2) to media devices. Our online tool was called PORD (Positioning Relations and Devices). Users were instructed to:

1. Name people relevant to them (out of a list of suggested groups such as close friends)
2. Name media devices they use (out of a list of suggested media devices)
3. Place an icon representing themselves on the board
4. Place icons representing people and devices on the board with closeness to the self-icon indicating a higher importance

In short: If the icon of a person or a media device is positioned closer to the piece representing me, this person/device is more important to me.

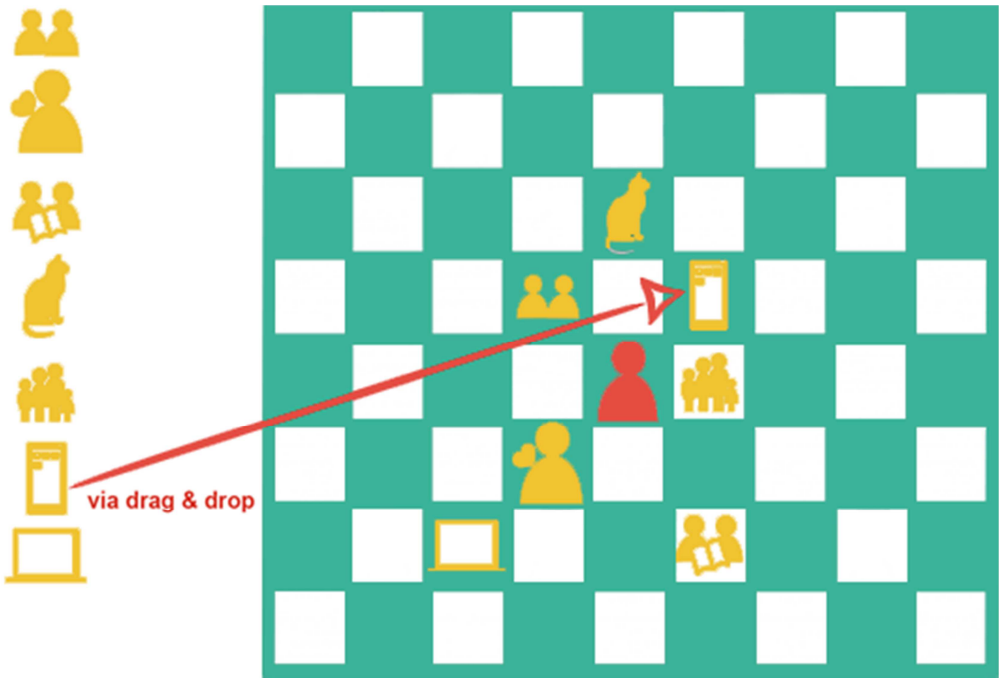


Figure 5: Positioning of the selected persons and media devices

Results

The following part presents the main results of our survey. We start with reported smartphone usage and go on to cover the variables outlined before, under procedure and instruments.

Smartphone usage

Given that a day is limited to 24 hours and that we all need to sleep, our smartphone occupies a substantial amount of the time at our disposal. Regarding the variance in duration of usage we have distinguished three groups of users: low, medium and high users[3].

In terms of work-related use (including using the phone for purposes of education and training) vs. spare-time phone usage we find an age effect: the younger the user the more intense their smartphone usage during spare-time. In contrast, work-related usage is quite consistent across age groups.

Regarding their duration of smartphone usage three groups can be distinguished: light users (up to 1:45 h/day), medium users (1:45 - 3:00 h/day) and 24% heavy users (more than 3:30 h/day)

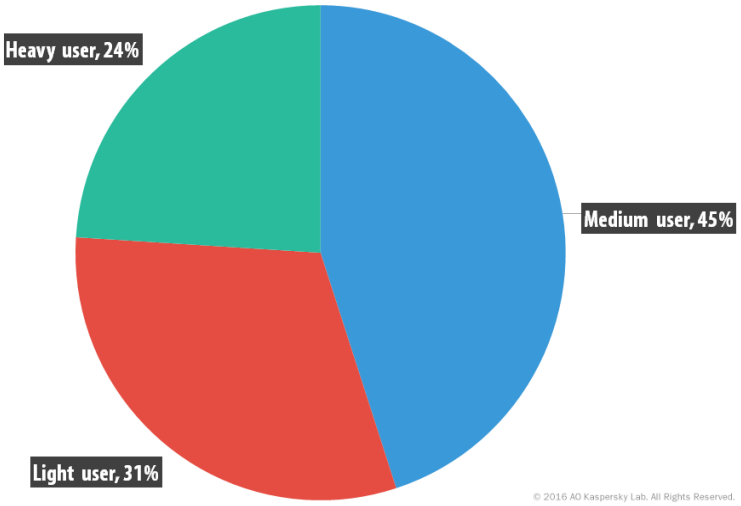


Figure 6: Categorization of participants by duration of usage (spare-time) in light (0 - 1:45 h), medium (1:45 - 3:30 h) and heavy users (3:30+ h)

[3] The medium usage class was defined by the mean usage of all participants (*M = 2.6 h per day*) plus or minus one standard deviation (*SD = 1.7*) around it. Light (usage < 1.75 h) and heavy (usage > 3.5 h) users are participants falling outside this interval.

Younger participants use their mobile the longest for spare-time activities (3.2 h/day), whereas participants aged 40-49 years use their mobile the longest for work-related activities (1.7 h/day):

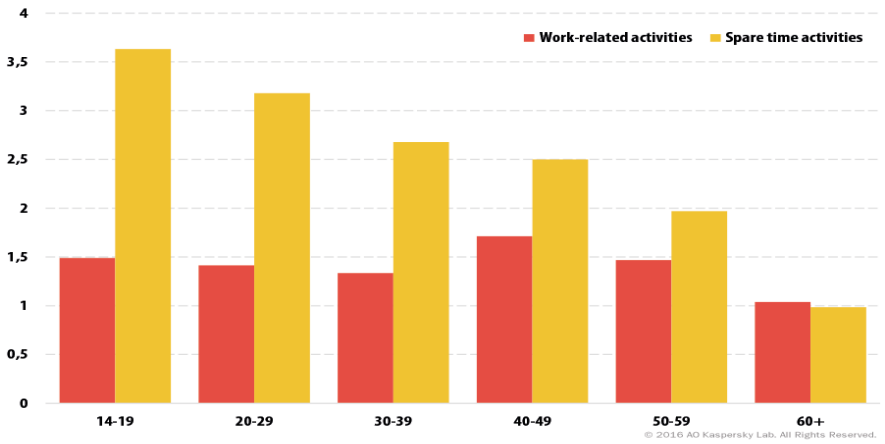


Figure 7: Frequency of participants who have anti-virus software on their smartphone by gender, asking "How many hours per day do you use your mobile?"

Almost 100% of all participants use their smartphone regularly

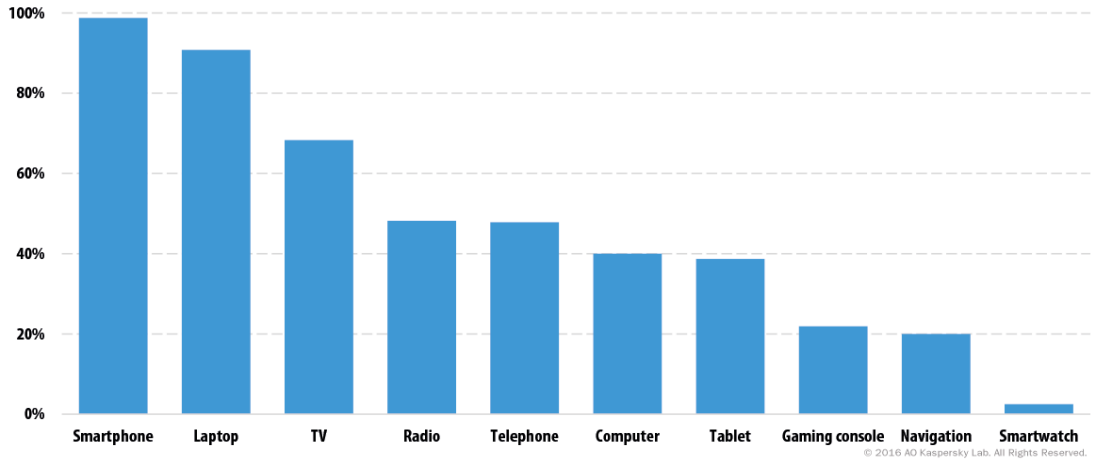


Figure 8: Diagram of all media devices which are listed according to the frequency of selection

63% do not have anti-virus software installed on their smartphone, and this holds equally for male and female users

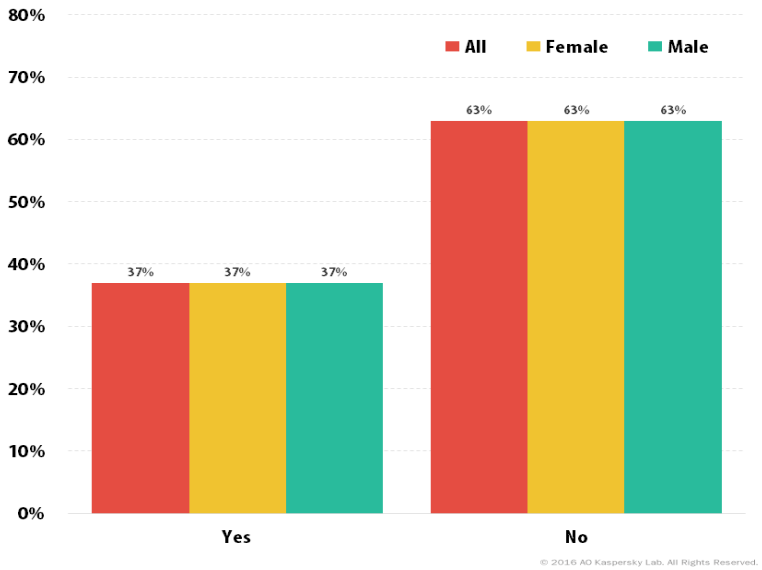


Figure 9: Percentage of participants who have anti-virus software on their smartphone by gender

Focus on Android vs. iOS: anti-virus software is used predominantly by Android owners

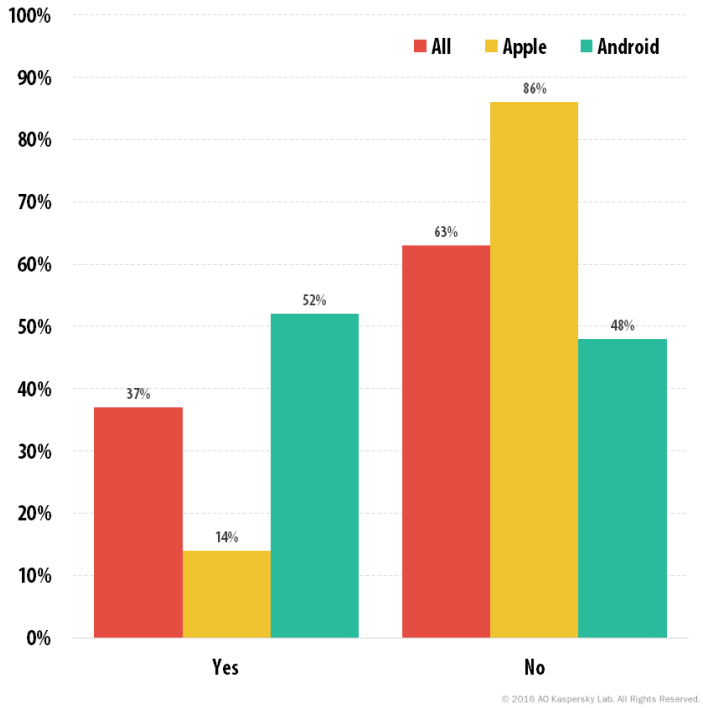


Figure 10: Frequency of participants who have an anti-virus software on their smartphone by operating system

Oxford Happiness: “if you’re happy and you know it…”

All participants were similarly happy (on average 5 on a 7-point scale): no significant differences were found

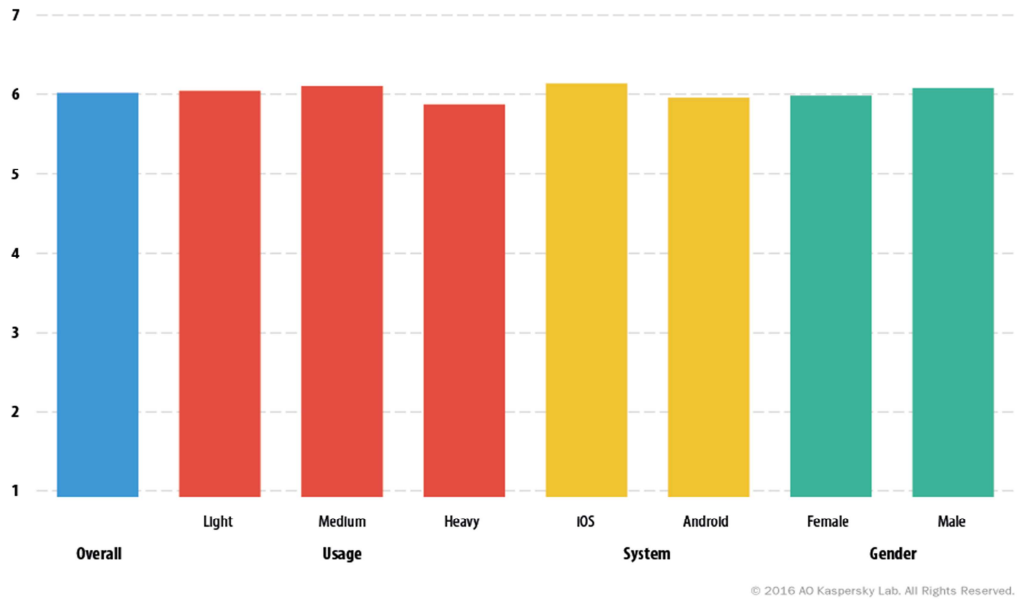


Figure 11: Mean values of the Oxford Happiness Scale by different groups

Considering the Oxford Happiness Scale groups (usage, operating system, and gender) do not differ significantly. This implies that neither the gender of participants, nor their amount of smartphone usage, nor the type of operating system on their smartphones, affects the general happiness participants experience.

Fear of Missing Out: “are they having fun without me?!”

Fear of missing out is positively linked to the amount of time spent with a smartphone: participants using their smartphone more intensely are more afraid of missing something while not using their phone.

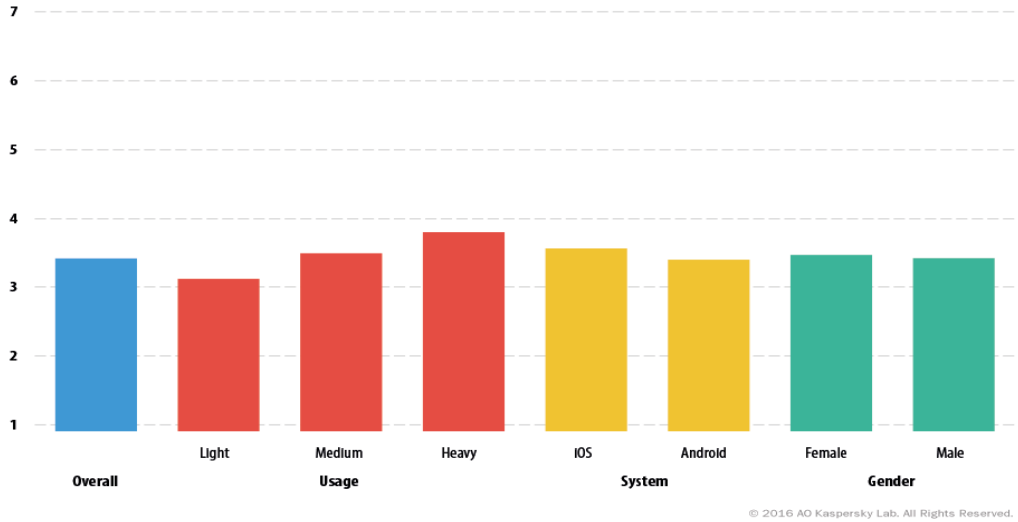


Figure 12: Mean values of Fear of Missing out (FOMO) by different groups

From a scientific point of view, on average participants score 3.43 (*SD* = 1.09) on a 7-point scale. Regarding their fear of missing something while not at the phone we only find mostly minimal and therefore negligible differences between groups, with one exception. The more participants use their phone, the more they are afraid of missing out on things ($p < .001$, $F(2) = 26.67$).

At least two conclusions seem plausible here: (1) people use their phone more intensively because they are afraid of missing something important or (2) people become afraid as a result of their intense phone usage.

Involvement with your mobile phone: "who needs a pet? I've got my smartphone!"

Heavy usage is associated with a higher smartphone involvement, and iOS users are slightly more involved than Android users

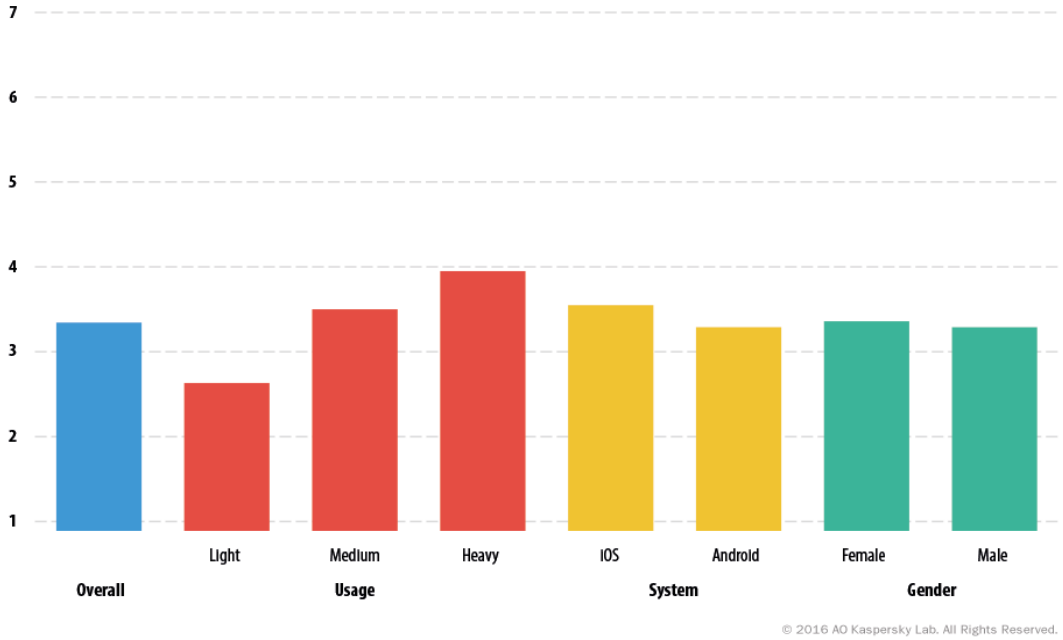


Figure 13: Mean values of Involvement in one's smartphone by different groups

Scientifically speaking, smartphone usage is positively correlated with a perceived involvement in our digital companion. Accordingly, heavy users report the highest involvement with their phone (M = 3.96, SD = 1.18), followed by medium users (M = 3.5, SD = 1.15) and finally light users (M = 2.63, SD = 1.08), resulting in a significant one-way ANOVA ($p < .001$, $F(2) = 101.72$). Furthermore, a significant mean comparison ($t(1093) = -3.27$, $p = .001$) shows that participants owning an Apple phone (iOS) are more involved with it (M = 3.55, SD = 1.15) than owners of an Android phone (M = 3.39, SD = 1.06).

Trust in your mobile phone: "you would never betray me, right?"

Men, iOS users, and heavy users trust their smartphone the most. However, we have to be careful: Although these effects are statistically relevant they are rather negligible as the differences are quite small

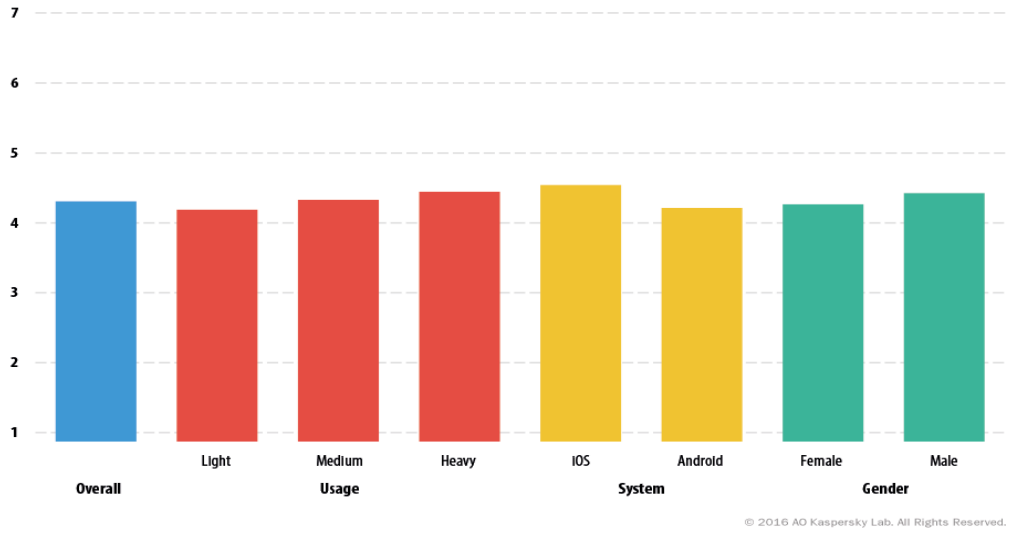


Figure 14: Mean values of Trust in one's smartphone by different groups

Considering that participants were asked about trust in their phone, thus applying feelings to an electronic device, it is remarkable that the average score is 4.31 (*SD* = .86) on the 7-point scale. Although very small, all group differences in figure 13 are significant: (1) men trust their smartphone slightly more than women, (2) Apple users more than android, (3) heavy users more than medium, and medium more than light users. Although these differences are statistically significant they are too small to be regarded as substantially relevant effects.

Stress caused by your mobile phone: “now I really need to focus - Oh look, a message!”

The level of stress caused by our smartphone depends on how much we actually use it. The more you use your phone the more stressed you are by it

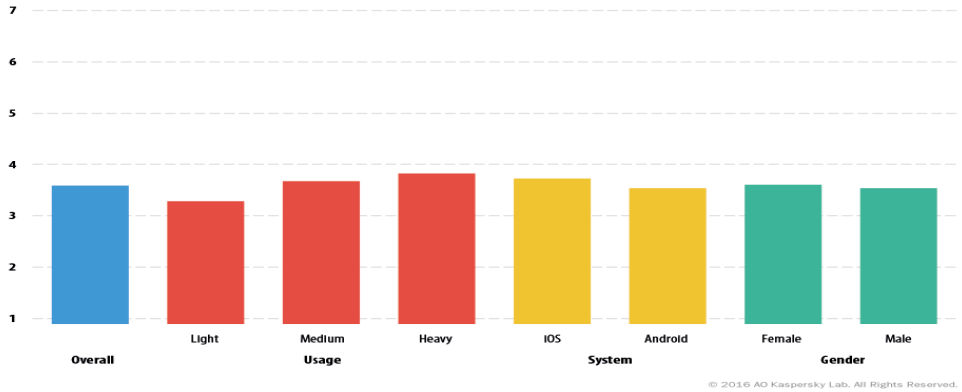


Figure 15: Mean values of perceived stress by different groups

From a scientific point of view: on average people experience a medium amount of stress because of their phone (3.60 on a 7-point scale). In terms of group differences only the amount of time spent with your phone is associated with stress, as indicated by a significant one-way anova ($F(2) = 19.08$, $p < .001$).

Coping - Handling stress with your mobile: “keep calm and play some Candy Crush!”

The amount of time spent with our phone is positively correlated with how much we utilise it to release stress

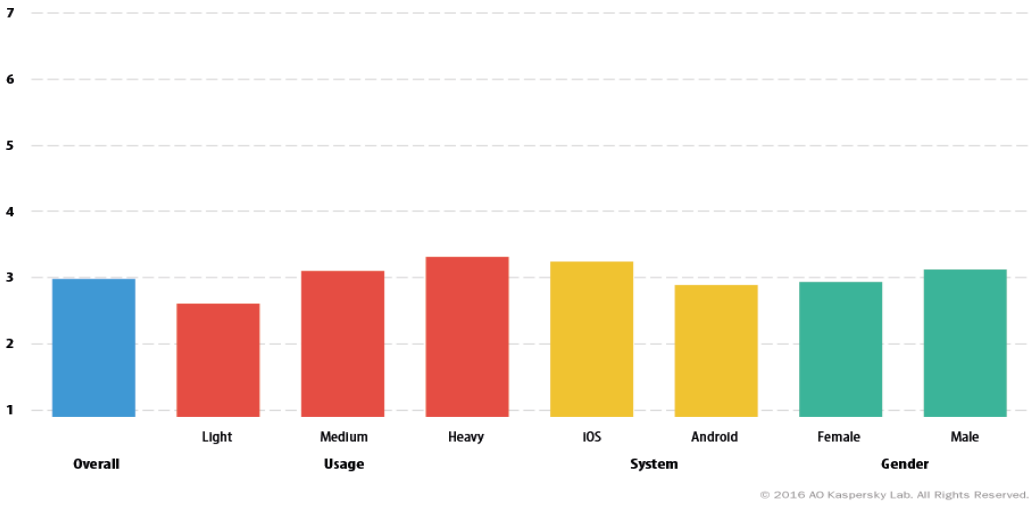


Figure 16: Mean values of the Coping scale by different groups

Scientifically speaking, on average, and in comparison to stress, smartphones are used rather less intensively for coping with stress (2.95 on a 7-point scale). In terms of group differences we find heavy

users scoring significantly higher on the coping scale, which means that heavy users use their phone more for coping with stress. This is further demonstrated by a significant one-way anova ($F(2) = 19.08$, $p < .001$).

Inclusion of mobile in the self: "it's like we are the same person!"

People spending more time with their smartphone perceive their phone as a more integral part of themselves, typically indicating more closeness and intensity in human-human relationships

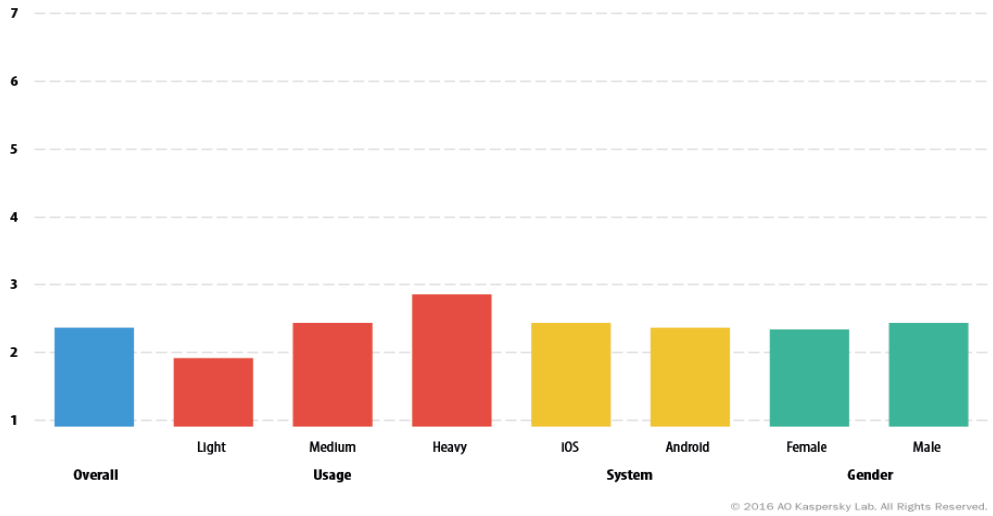


Figure 17: Mean values of inclusion of mobile in the self by different groups (on a 7 points scale)

From a scientific point of view: To interpret these results we need to take into account the fact that this instrument is typically used to assess our closeness to one's romantic partner or significant others.

Respondents were asked to report on "their current relationship with their smartphone" by choosing differently overlapping circles representing themselves and their phone. The low overall scores on this scale are therefore not surprising ($M = 2.39$, $SD = 1.23$). Nevertheless, a significant one-way anova implies that the relevance of the smartphone to its owner's sense of self, rises with increasing usage ($F(2) = 50.57$, $p < .001$; light users: $M = 1.93$, $SD = .99$; medium users: $M = 2.46$, $SD = 1.14$; heavy users: $M = 2.86$, $SD = 1.44$).

Joining the dots: cross-connections among variables

Beyond the results for particular instruments and concepts presented so far, we must also take a brief look at cross-connections of the constructs. A selection of the most important connections is presented below. The statistical indicator used is the bivariate correlation (r).

→ Stress caused by one's smartphone is positively correlated with coping (r = .51)

Our data reveals significant positive correlations between the level of stress caused by one's smartphone on the one hand, and the level of using the smartphone as a way of coping with stress on the other hand. As a correlation does not imply a particular causal relationship we cannot determine what came first: stress or coping. However, we could cautiously assume that people use their phone to cope with stress, which they would not have without their phone.

→ There is a significant correlation between stress caused by one's smartphone and fear of missing out (r = .46)

Similarly, we find a significant positive correlation between stress caused by one's smartphone and fear of missing out: the more stress the higher the fear of missing out.

There is a conceivable explanation here: The more afraid you are of missing something important when you are not using your smartphone, the more stressed you will be by your smartphone.

→ There is a significant correlation between coping with stress through your phone and involvement in one's mobile phone (r = .50)

Here we would assume that using your phone for coping with stress could lead to an increased involvement with your phone. The more your phone helps you to handle life, the more relevant the phone becomes and, as a result, the more involved you are with the phone.

→ Involvement in one's mobile phone is positively correlated with fear of missing out (r = .52)

Again, we can only speculate on the direction of the correlation between the fear of missing events and involvement with your phone. Our speculation here is that more fear of missing out might lead to an increased involvement with your phone, because your phone is your primary connection to the world. However, as with all correlations, we cannot gain more insight into any underlying causal relationship.

PORD: “I wanna hold you tight”

The PORD experiment visualizes the importance of relevant persons and media devices by positioning pieces representing these persons and media devices in relation to oneself on a chessboard. The closer a piece is put to the one representing myself, the more important the person/device is to me. The most important findings from this study are presented in this section.

Figure 18: Sketch of the average distances and therefore the importance of humans and media devices visualized by PORD

The smartphone is the most important technological device – and even more important than many humans

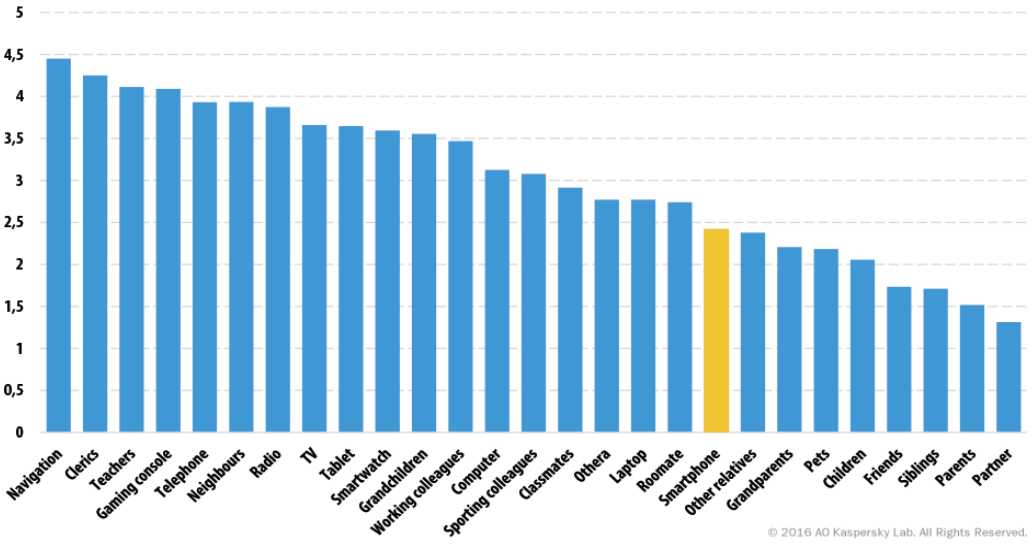


Figure 19: All possible categories of persons and devices with "distance to oneself"

Pets are more important than relatives. Smartphones are more important than roommates, classmates and sporting colleagues

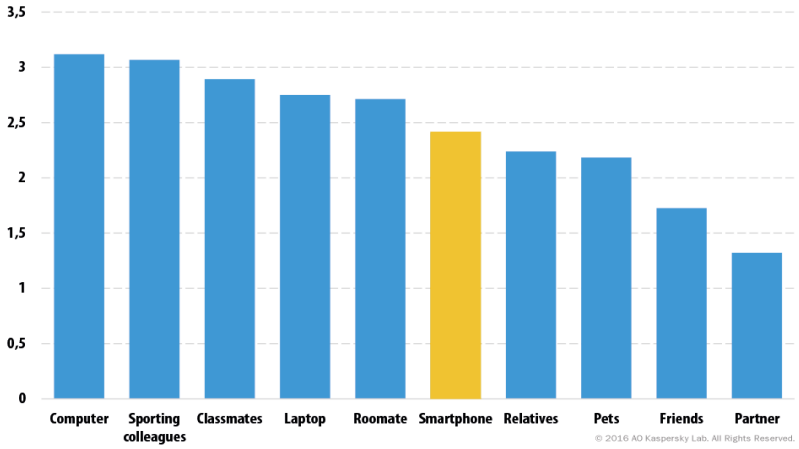


Figure 20: Top 10 people and media devices with the least "distance to oneself"

Within the top 10 humans and media devices: the partner was considered most important overall, followed by friends, pets and relatives (the 'relatives' category included siblings, children, and grandparents).

The smartphone followed in fifth position, making it more important than some real human beings including roommates, classmates and sporting colleagues, despite these people being selected as important in the first step of the test.

Roommates, classmates and sporting colleagues all ranked lower than an electronic device, namely the smartphone.

Part 2: laboratory Study - waiting, concentrating, and interacting with talking smartphones

This second main part of our research report concerns the laboratory-based experiments that complement the survey. This second study consists of three parts presented in order below, starting with a brief description of the procedure, followed by the results. We start with a few words on the sample and the overall procedure.

Sample

The experiment was conducted in Würzburg (Germany) and in Nottingham (United Kingdom). Therefore, our sample is binational (GER: 59, UK: 36). Overall, 95 participants (56 female and 39 male) took part, varying in age from 19 to 56 years (M = 27.97, SD = 8.01). Care was taken to balance experimental conditions and gender across laboratory sites.

We recruited participants within a data collection period of two weeks from 5 April until 29 April 2016 via online advertisements (e.g. Ebay classifieds) and social media platforms (e.g. Facebook, Google+). A compensation of at least 15€ (Würzburg) or £10 (UK) was advertised for one hour of participation. The participation was based on ethical guidelines.

Procedure

Participants were invited to professional laboratory facilities of the Universities of Würzburg (Germany) and Nottingham Trent (England) to pass through **three different sessions**: **a waiting session, a concentration test and interaction with talking smartphones**. Participants were guided by a researcher who followed an experimental procedure with a detailed script to ensure that each participant was addressed similarly, and encountered identical instructions.

Waiting Session

Participants were welcomed and given a short overview of the study (including obtaining informed consent and implementing ethical guidelines) without disclosing all aspects of the procedure or our expectations in any detail. After the welcome, they sat down in a room resembling a comfortable waiting space. Here they were filmed by a hidden camera to objectively capture any smartphone engagement.

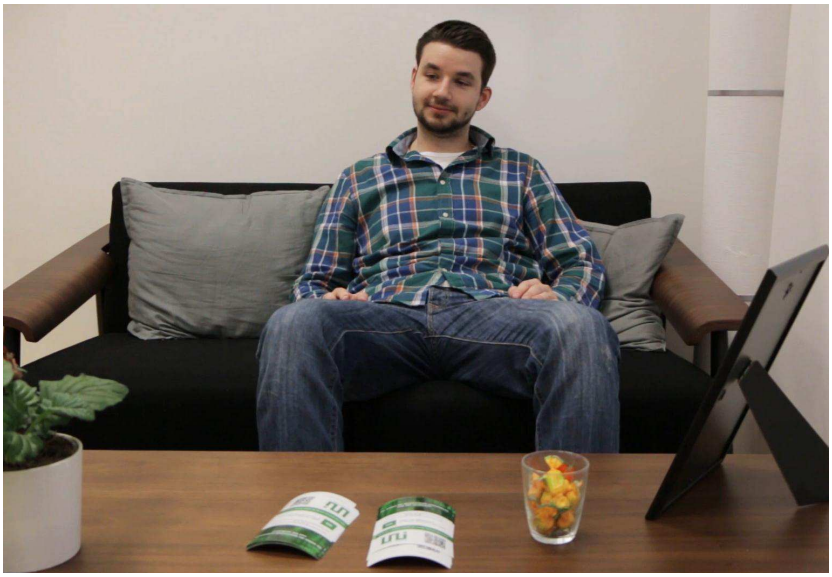


Figure 21: Waiting Session

Participants waited for ten minutes. After five minutes the experimenter entered and asked for the participants' body height (as a distractor) and their smartphone PIN. If they refused or asked for a reason, the procedural script specified exactly what to reply: *"Studies reveal significant correlations between height and the PIN", "We cannot continue without the information!", "You need to give us the PIN".*

We documented if, and how easily, the PIN was revealed. After waiting for a total of 10 minutes, the experimenter entered again to guide the participant into the next room where the second part of the study started.

Results: have we forgotten how to wait? Or is waiting perhaps unbearable?

#needtotouch

73% of all participants used their smartphone during the waiting session

#waitingunlearned

It takes only an average of 44 seconds of waiting before participants touch their smartphones for the first time. Men are faster than women, touching their phone after 21 seconds, compared to 57 seconds

Both men and women overestimate the period of time that passed before they touched their phone. Males estimated that they waited almost 3 minutes, females estimated at more than 2 minutes

During the 10 minute waiting session, the smartphone was used for almost 5 minutes (*M* = 4.63), with no considerable difference between men and women

#falsegenerosity

93% of all participants who have a PIN code for their smartphone gave this data away, the majority without questioning why. Only three participants refused to give away their PIN code and only five did not have a code at all.

Concentration Test

After being released from waiting, the second session was conducted in a separate laboratory room. In this part of the study we wanted to **test whether the presence or absence of their smartphone would have an effect on participants' task performance in a concentration test**. Previous studies have shown that on the one hand, insecure separation from one's smartphone has negative emotional effects such as increased anxiety (Cheever, Rosen, Carrier, & Chavez, 2014). On the other hand, studies have also demonstrated that one's smartphone may act as an distractor for attention when it is with us (Strayer, Drews, & Johnston, 2003).

In other words, both smartphone absence and presence could impair concentration. As a concentration test we used a modified version of the attentional blink task (Raymond, Shapiro, & Arnell, 1992), a routine method for studying attentional capacity (Dux & Marois, 2009; Shapiro, Arnell, & Raymond, 1997). During the attentional blink procedure, participants are confronted with a string of visual stimuli in fast succession at the same spatial location on the computer screen. The task consists of reporting on two targets in this string after each display, the letter X and a letter in a different color, and requires continuous and undistracted attention to the screen.

In contrast to research on smartphone distraction, in which the effects of explicit interruptions and of actual phone use have been studied (e.g., Clayton, Leshner, & Almond, 2015), our study aimed to establish more subtle effects by **varying the overall status of the smartphone throughout the task**. Prior to starting the task, participants were randomly assigned to one of the following conditions:

1.) **Natural condition - not in view**: smartphones remained in the possession of participants (pocket or bag); no further instructions.
2.) **Smartphone in view**: participants were asked by the experimenter to briefly hand over their smartphones; phones were then positioned next to the computer screen that participants needed to focus on for the concentration test.
3.) **Smartphone locked securely - not in view**: participants were asked to hand over their smartphones, which are then locked away in a metal container, remaining close to the participant during the test.

4.) **Smartphone taken away - out of the room**: participants were asked to hand over their smartphones after which the experimenter takes them out of the laboratory room for the duration of the task.

Upon completion of the task, participants proceeded to answer a short version of the state-trait anxiety inventory (Marteau & Bekker, 1992). Afterwards, participants who have been separated from their smartphones regained possession of them.

Results: worse concentration without separation

#BetterOffWithoutYourPhone

Performance in a concentration test significantly increases as distance from the smartphone increases

Performance increases up to 26% when the smartphone is removed, compared to when the smartphone is view

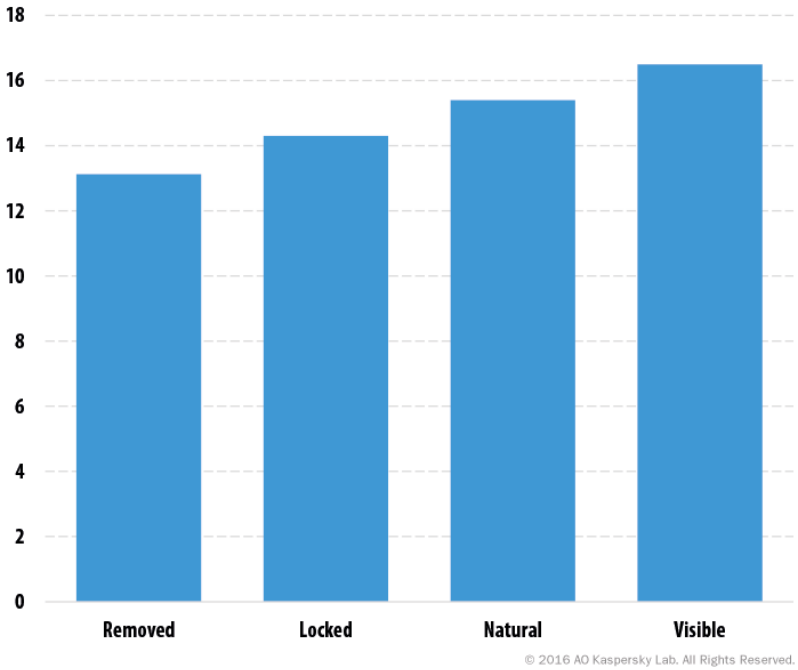


Figure 22: Mean values of task performance over all manipulations

From a scientific point of view: Performance, measured as the number of correctly identified letters in the attentional blink task, is lowest in the visible condition (M = 13.12, SD = 3.85), followed by the conditions with the phone not in view: the natural condition (M = 14.32, SD = 3.50) and the two conditions of separation where the smartphone is either locked away (M = 15.40, SD = 3.94) or removed from the room (M = 16.52, SD = 3.78).

#AnxiousWomen

Women were more anxious in the concentration test than men

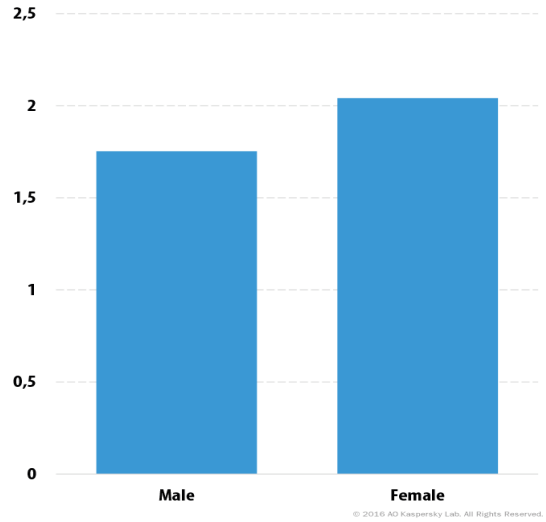


Figure 23: Mean value of anxiety for male and female participants

Scientifically speaking, across all experimental conditions the state of anxiety was significantly higher for females (M = 2.04, SD = .56) than for males (M = 1.75, SD = .58). Overall anxiety levels were on the lower side of the scale, with a score of four indicating the maximum anxiety level recorded. This may be due to the safe environment in which the test was taken. Anxiety levels did not differ between experimental conditions, nor did any effects emerge for the other measures of arousal, pleasure, and dominance.

In summary, our findings indicate that it is the absence, rather than the presence, of a smartphone that improves concentration

Interacting with talking smartphones

The idea of interacting with technology in a "human way" is not new, thus we can base our ideas on existing studies (Nass, Moon & Green, 1997). However, those previous studies focused on desktop PCs and were mainly conducted at the end of the last century. Living in today's digitalized world, with the ubiquitous internet and the internet of things, calls for a revival and an advancement of this research. The so-called CASA paradigm (Computers As Social Agents) assumes that users treat technical devices like human beings although they know that they are not interacting with humans, but with technology. We respond socially to computers which results in behaviors typical for human interactions (e.g. politeness or gender stereotypes).

In short: we equate media and real life. What does that mean for our interactions with smartphones and the way we are (emotionally) connected with them?

In this part of our study the participants interacted with two smartphones to test for behavioral patterns and stereotypes that are typical for interactions with humans, but not rational with technology. These two smartphones use either a **male or a female text-to-speech voice** to narrate ten factual statements regarding either a **stereotypically male or female topic** (soccer and fashion, respectively). To avoid any systematic gender bias, both voices and topics were balanced so that both male and female smartphones talked about soccer and about fashion equally.

After the first smartphone had reported ten facts regarding one of the two topics, participants were asked to complete a **short test** consisting of ten multiple-choice questions. This test contained five items that the smartphone just read out. However, the actual participant answers do not matter, as every participant received the exact same feedback: **5 out of 10 questions were answered correctly.**

Figure 24: Interacting with talking smartphones

Afterwards participants **evaluated the smartphone** via a brief questionnaire asking them to assess characteristics of the phone, e.g. competence, how informative they were, and valence. Having completed the evaluation, **participants switch to the second smartphone** to listen to another ten facts this time regarding the second topic, followed by another test and a second evaluation.

Results: women are nicer - even to smartphones. Male smartphones are the better smartphones

#WomenAreNice

Female participants rate smartphones as more informative than male participants

From a scientific point of view: an independent-samples t-test was conducted to compare female informative ratings and male informative ratings. There was a significant difference regarding these ratings ($t(93) = -2.58$, $p < .05$).

Female participants rate smartphones as more credible than male participants

From a scientific point of view: an unpaired t-test shows that female credibility ratings are significantly higher than male credibility ratings ($t(93) = -2.58$, $p < .05$).

Female participants attribute more positive sentiments to smartphones than male participants

From a scientific point of view: an unpaired t-test shows that female valence ratings are significantly higher than male valence ratings ($t(93) = -2.01$, $p < .05$).

In short: There seems to be some truth in the old quote by Herodotus, which says that men trust their ears less than their eyes

#MaleVoicesMakeYouMelt

A smartphone utilizing a male voice was rated better in almost any regard compared to a smartphone talking with a female voice

From a scientific point of view: unpaired t-tests show that participants rated male-voiced smartphones significantly more positively than female-voiced smartphones on multiple aspects. Significant differences are present in the ratings for friendliness ($t(93) = 2.36$, $p < .05$), for enjoyableness ($t(93) = 2.22$, $p < .05$), and for warmth ($t(93) = 1.99$, $p = .05$).

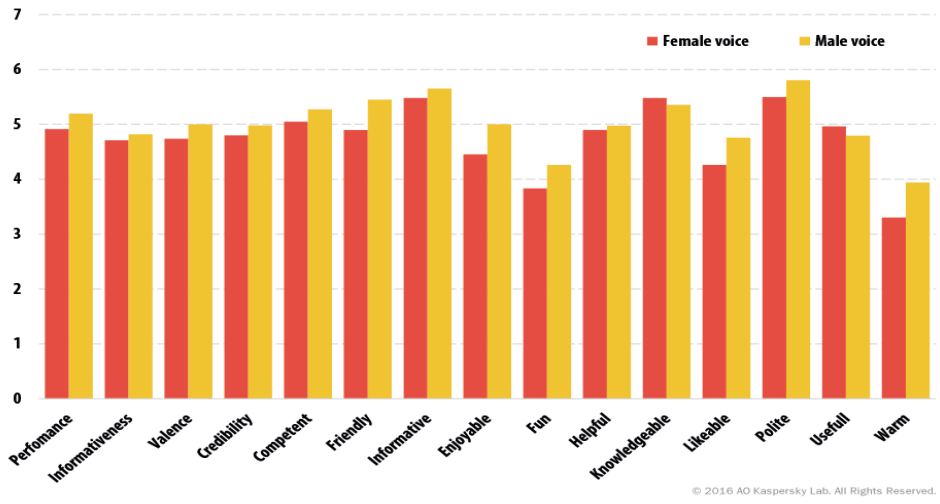


Figure 25: Mean scores of all evaluation dimensions for "female" and "male" smartphones

This seems to be a rather surprising result as most talking devices use female voices (e.g. navigation systems or Siri). Nevertheless, our results show the male voices are preferred. Further research is needed here. Perhaps voice preference is affected by the task in hand, as female voices are perhaps more

preferred in terms of social interactions (e.g. consolation) vs. male voices for information-related tasks (e.g. instructions).

#SmartphoneLove

We are not sure if it is love, but women do prefer male smartphones. If a smartphone speaks with a male voice women will credit it with a higher competence, knowledge and usefulness

From a scientific point of view: an unpaired t-test shows that women rate male smartphones significantly more positively than men in almost any regard. There was a significant difference in overall competence evaluation scores $t(46) = -2.08$, $p < .05$.

Also, if a smartphone uses a male voice not only is it rated better overall, its performance is rated to be higher as well, especially from women

From a scientific point of view: an unpaired t-test shows that women rate male smartphones as having a significantly better performance than men rate them: $t(46) = -3.28$, $p < .01$.

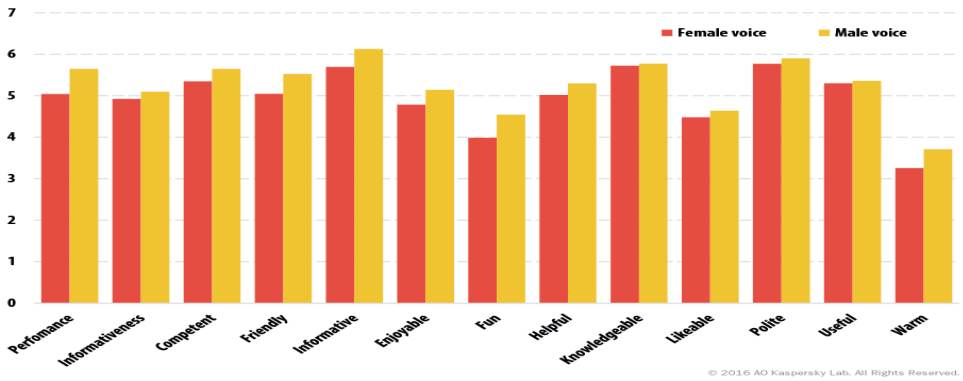


Figure 26: Mean scores of all evaluation dimensions for "female" and "male" smartphones reported by women

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b) Smartphone Dossier
http://www.statista.com/study/10490/smartphones-statista-dossier/