Young mobile users: radical and individual – not

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Abstract

The use of mobile phones by youth has stirred a plethora of research in different fields. Literature has analyzed in length the changes and adoption patterns related to the evolving telecommunications industry. This body of knowledge often makes assumptions on the changes in consumer profiles and the value of different features. In this study we take an longitudinal approach by analysing the results of 1 928 responses to an online questionnaire conducted in Finland to students of a university in the Spring 2012 and on against the reanalysis of the responses of the Finnish students of upper secondary schools in the Spring 2001 and study on undergraduate students in 2006–2007. The results indicate that the youth and young adults of Finland, often argued to be an advanced country for mobile services, are surprisingly conservative towards new mobile devices and services. The changes in technology and service offering in a decade, has had a limited impact in attitudes and feature valuation, which sets significant implications to increasing adoption and usage.

Keywords: Mobile phone, Young users, Finland, Smart phones

1. Introduction

Mobile phone technology has evolved significantly since their invention. The device has evolved from a means of voice communication to a multimedia centre and a hub for accessing social networks — depictively called the "a kind of Swiss Army knife, which holds a number of useful tools—even if people almost always tend to use the same ones" (Stald, 2008). Increasing global penetration of mobile devices and more significantly the penetration of devices offering an abundance of features (e.g. feature and smart phones) have changed the nature of the devices. Recently introduced application ecosystems, which offers content for new smart phones, have yet again changed the value proposition of the mobile phone.

Mobile communication has attracted attention by the scientific community and industry. For example, previous studies have described the role of pre-adolescents (Davie et al., 2004), adolescents (Wilska, 2003; Oksman and Rautiainen, 2003) and effort has been invested in studying young adults (Kimiloglu et al., 2010), and quite often in a more narrow subset of young adults, that is, the university students (Economides and Grousopoulou, 2009; Khang et al., 2012; Haverila, 2013). Studies have often focused on different features of mobile phones (Economides and Grousopoulou, 2009; Haverila, 2013) or on identifying consumer groups (Wilska, 2003; Kimiloglu et al., 2010) while some studies have also taken a broader psychosocial viewpoint (Walsh et al., 2011). Our research is focused on understanding the rapid technological change and its impact to human behaviour. (Kock, 2004) Specifically we focus on if there is a visible cultural lag, or maladjustment, between the technological and non-material culture. (Brinkman and Brinkman, 1997).

With the rapid development of the mobile device, scientific studies are challenged with the pace of development in the telecommunication industry. For example, when Wilska (2003) published results on the mobile phone as a part of young people consumption styles, the devices had just settled in being a mass market product. Later, when e.g., Economides and Grousopoulou (2009) published results on the value of different features of mobile devices for

young users, we were seeing a vast increase in the technological features offered by the devices. Since we have seen a turning point with the emergence of mobile application ecosystems. Subsequently, there is a need to link the empirical findings and theoretical assumptions made in the plethora of studies to time, and frame the theoretical assumptions with an understanding on the impact of both social change and technological development. Literature has raised the question whether the evolution of technology, in this mobile phones, does change culture and consumer expectations (e.g. Wilska, 2003), and we hypothesize that there is clear evidence for this change in the attitudes and value of technological features.

In this study, we analyse the changes in perceptions and the value of different features after the significant changes in the adoption and technical capabilities of the devices (e.g. the emergence of the smart phone). Motivated by the changes in the devices itself, we strive to uncover how young adults, often perceived as early adopters, have taken up new mobile devices and services and how the attitudes toward the mobile phones have evolved. This study analyses the following research questions:

1. How have the perceptions of young users towards the mobile phones changed while the technology has remarkably advanced?
2. Has the value of different features of the mobile phones changed while the technology has developed?

Both of these questions are aimed to investigate the possible maladjustment between technological advancements and non-material advancements. There is little argument on the fact that mobile technology has advanced, different generations of mobile devices have diffused and been adopted, but to which extent do we see longitudinal changes in users is interesting. We review the changes both in the technology and in the ever increasing embeddedness of mobile devices in young consumers' life, we answer the above mentioned research questions based on data gathered from an online survey. The survey was designed using the studies of Wilska (2003) and Economides and Grousopoulou (2009) as a base. Wilska was chosen as a baseline due to the availability of the data which enabled us to compare a decade old results with a rather similar demography to the results of 2012 in order to answer the first research question. Our questionnaire replicates also parts of the study by Economides and Grousopoulou. Their study was conducted in 2006–2007, i.e. right before the launch of the first iPhone by Apple Inc. in Europe. Thus, their results enable us to compare how the rise of smart phones has changed the use of the mobile features and services in order to answer the second question.

In addition to analysing the responses to our survey (N = 1 932, thereafter referred as 'D2012'), we reanalysed the answers of selected questions of Wilska's (2003) survey (N = 637, respectively referred as 'D2001') with non-linear categorical principal component analysis, and Economides and Grousopoulou (2009) by using median and mode. The results from both of the analyses suggested that the students in Finland have a fairly conservative approach towards new devices and applications, although the country is often claimed to be advanced in mobile service offerings and consumption (see e.g. Wilska, 2003; Bouwman et al., 2007a). It seems that perceptions have remained static, suggesting a cultural lag (a maladjustment) between technological development and human perception.

The rest of the paper is structured as follows: Section 3 presents shortly previous studies in the area. Section 4 explains the methodology used as well as gives descriptive statistics for the questionnaire data. Section 5 goes through the results of the study, followed by Section 6 that includes the discussion of the results and the limitations of the study. Finally, Section 7 draws a short summary of the study.

2. Background

Technology, by definition, is the application of scientific knowledge to solve practical problems. This is to say that technology enables humans to solve a practical problem or it offers an improvement on an existing practical solution. Looking at the telecommunication industry, the problem that the mobile phone originally solved was related to communication, diminishing barriers for human interaction, but the industry has since rapidly evolved to solve a number of problems. This technological change has not only been rapid in telecommunication, but rather we have seen an overall increase in technological change and increased complexity of products (for a discussion refer to, e.g., Wang and von Tunzelmann, 2000). To say differently, we are offered new solutions to problems (or improvements to existing solutions) in an ever increasing pace. Some of the problems are familiar and well-known, and we can hance easily understand the value of their solutions, but for certains solutions the problem can be latent to us. Altogether, the process of adoption and the reason behind the decision to adopt technology has been of significant interest to scholars.

Would we look at the process of adoption through the Diffusion of Innovation theory (as a group phenomena) Rogers (1995)[1] or endeavored to explain the users' decision through the Technology Acceptance Model (TAM) (as an individual process) (Davis, 1989)[2], the adoption of technologies involves always a learning process. This learning process includes that the user understands how to utilize the technology and is therefore persuaded by its value. Arguably, the users and the users' social groups have a significant impact in this process (Cantisani, 2006). With the Diffusion of Innovation theory we would look at the communication channels, homophily and the role of category of the adopter to explain the adoption process (Rogers, 1995). At the individual level our focus turns to the perceived usefulness and the perceived ease-of-use, which are seen as factors influencing the adoption decision according to Davis (1989). When we look past the adoption to the point where the adoption has already occurred, we would expect that human behavior has changed because the technology has changed an offered us new problem solving tools (Kock, 2004).

Kock (2004) draws from a body of literature on the social presence theory (Short et al., 1976) and the media richness theory (Daft and Lengel, 1986) hoping two overcome some of the critique these two theories by formulating a theoretical model on computer-mediated communication, which is well fitted to the case at hand. Kock (2004) argues that users are able to change their schema of usage through cognitive adaptation, ultimately impacting human behavior. This adaptation is achieved through training, repeated use or, indirectly, through the ease of use (Davis, 1989) or self-efficacy (Compeau and Higgins, 1995). As noted before, technological change has moved the mobile phone from as a means of computer-mediated communication to serve other purposes such as entertainment. We argue that diffusion and adoption should have an impact on the perceptions that users have about the technology and that through learning the technology human behaviour changes.

The impact of changing technology might not, however, transfer simultaneously to human perceptions. The cultural lag theory (Ogburn, 1957), or socio-cultural lag as refined later, suggests that two parts of a culture might change in different paces creating a period of maladjustment. Discussed in length by Brinkman and Brinkman (1997) a cultural lag has been specifically seen between the material and non-material culture, where non-material culture tends to lag behind of the "...exponential accumulation of material culture, given by the dynamics of a science-fed technology." (Brinkman and Brinkman, 1997, p. 612) For example, the material culture of the mobile phone has sparked a number of scientific studies, reviewed in parts in Section 3, where a snap-shot in time has been taken. Whether there is a period of maladjustment between material and non-material culture should be looked by demonstrating the adjustment in the parts of culture, determining that one has changed and the other has not (in similar degree) and that there is a less optimal adjustment between the two parts of culture now than what earlier.

As noted by Wirth et al. (2008) the adjustment in the mobile phone technology has been so significant that for example the Diffusion of Innovation theory lacks the ability to explain its complexities. According to Wirth et al. (2008), the focus should not be on how many adopts new technology in the mobile phones but instead on how it is used. In addition, we argue that the discussion should focus on the question if there has been an adjustment in the non-material culture. Summarizing, although the group and individual aspect are relevant to the diffusion and adoption of the generations of mobile devices, our focus is on understanding the changes in users perceptions, or non-material culture, when the technology has advanced. Has the non-material culture, within the limitations of our study, had visible changes or does the non-material culture lag behind?

3. Related Work

There is a plethora of extensive studies on mobile phone adoption in different regional context and specifically among youth. (Ling, 2004; Ito, 2005; Katz, 2006; Goggin, 2012) We have framed our study to focus on young consumers, gender differences and attitudes of users and selected relevant empirically focused papers in this frame for the background of our study. These can be seen in Table 1 which summarizes selected studies published in the 2000s and in the beginning of the 2010s. This frame focuses on the empirical, enabling future theory building.

Looking back a little more than a decade, Leung and Wei (2000) still compared landline telecommunication and mobile phone usage from a dataset gathered during the late 1990's, finding that the significant differences in gratification factors (when comparing landlines and mobile phones) were mobility and immediate access to use. This

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[1] for discussion on Diffusion of Innovation see for example MacVaugh and Schiavone (2010)
[2] for discussion and review on TAM and its extensions see for example Legris et al. (2003); King and He (2006); Turner et al. (2010)

work was shortly followed by the study of Aoki and Downes (2003), which pointed out that "mobile communication technologies are advancing rapidly" increasing the amount of devices with access to Internet or with different multimedia capabilities — already pointing out the role of consumers in the symbiotic relationship which exists between a developing technology and the humans who have adopted it.

With the increased penetration of the mobile phone to even younger generations, Davie et al. (2004) showed the role of children as pre-adolescents in engaging with mobile devices. At the same time Wilska (2003) published a study on the consumer role of young people in a mobile technology. As a part of a larger study on the consumer identity of young Finns (Autio, 2004; Wilska and Pedrozo, 2007), Wilska found that young people were developing a consumer identity early on. The study shows that the overall consumptions styles of young people had a relationship with their mobile phone usage. From the results, they identified three different mobile phone user groups: 'Addictive use', 'Trendy use' and 'Thrifty use'.

Sell, Walden, and Carlsson (2010a,b, 2012) have studied Finnish mobile phone users from several viewpoints. They found from a large-scale consumer survey sample, conducted in 2009 with a representative selection of 16–64 year old Finnish speaking mobile users, five different profiles: 'Skilful', 'Efficient', 'Trendy', 'Basic', and 'Social' (Sell et al., 2010a). When compared to the previous datasets from the years 2007 and 2008, the 'Trendy' and 'Skilful' were present but the others emerged later (Sell et al., 2010b). Although the target population is not same than in the study of Wilska (2003), the 'Trendy' group is a rather similar in both studies.

Recently, Sell et al. (2012) targeted to study active, medium and passive smart phones users of Finland. They found that a majority of smart phone owners, in their study, were either "interested but inactive" (47 %) or do not use any smart phones' advanced features (38 %). Carlsson and Walden (2012) summarized their long experience from the research of mobile services by noting "[b]y following the development of mobile technology over a 10 year interval we have found out — much to our surprise — that not much has changed in the actual use of mobile services despite the fact that we have had about three generations of mobile phones during these 10 years." This study seeks to further confirm this notion.

The discussion on users and identities was furthered later by Stald (2008) and Walsh et al. (2011). Stald (2008) focused on a large set of different studies on the "mobile identity", looking at how telecommunication supports the social group formation and feeling of belonging into a group. The study pointed out the impact the mobile phone had on the formation of social networks. Similarly, Walsh et al. (2011) have looked at the self-identity, finding that it is a predictor to both frequency of use and involvement with mobile phones.

Economides and Grousopoulou (2009); Kimiloglu et al. (2010); Balakrishnan and Raj (2012) and Haverila (2013) have taken a more feature-oriented approach to mobile devices. Economides and Grousopoulou (2009) found that there were several important features that young students were willing to pay extra for, while they remained conservative on the adoption of state-of-the-art features offered at that time. In their study, female respondents were even more unwilling to pay for extra features. It is also illustrative that in the study, published in 2009, most of the respondents did not use the Internet via a mobile phone. Similarly, Haverila (2013) showed that traditional services such as calling or SMS have remained as the most intensively used features. Dividing subject groups into heavy, medium and low usage groups Haverila (2013) showed that, for example, Internet use had grown from the study by Economides and Grousopoulou (2009) to be a medium usage, while several smart phone features such as E-mail, camera and games had low usage. Haverila (2013) also pointed out that female users were using "calendar, Internet, music and E-mail" more than the male respondents.

Kimiloglu et al. (2010) continued the research of the role of features and young consumers. They argued that the advancements in an engineering perspective (being able to offer several features) had increased the importance of technological, functional and physical aspects, but as the mobile phones have become a more integral part of our lives, the trendiness and image of the devices increase in their significance. Noted also by Balakrishnan and Raj (2012), brands and trends, in addition to the practical notion of price, have become important factors in selecting a device which is nowadays so embedded to a young consumer's life. In addition, comparing the results of Wilska (2003) with Khang et al. (2012) and Balakrishnan and Raj (2012), young users have become increasingly addicted to their mobile devices.

4. Approach and Data

4.1. Methodology

This study is based on two previous studies focusing on young consumers and mobile device usage by Wilska (2003), and Economides and Grousopoulou (2009). The data collected for the study by Wilska (2003) has been made available in the work of Autio and Wilska (2001). Their data was gathered from a questionnaire to people of 16–20 of age in middle-level educational institutes located in Finland. The availability of a decade old data allow us to perform a longitudinal analysis of the mobile usage as suggested by Kivi (2009); although there have been longitudinal studies before (c.f. Bouwman et al., 2007b; Walden et al., 2007; Sell et al., 2010b), this study focuses on a longer time period in its analysis. The study by Economides and Grousopoulou (2009) is based on the answers from 384 undergraduate students in a European Union country in 2006–2007.

Based on the two previously mentioned studies, we created a questionnaire replicating several questions from both of the previous studies. We assume that the respondents of the different studies form a group of subjects that can be regarded as early adopters, although being aware of the limitations of our cohorts in regard to age (Wilska) and geographical location (Economides and Grousopoulou). A preliminary version of the questionnaire was tested with a focus group consisting of undergraduate students in an engineering course at the University of Turku in the Fall 2011. The test version of the questionnaire was answered by 47 students. The final version was fixed based on the findings of the preliminary version, and tested for grammar and functionality with a second focus group which had seven respondents.

The questionnaire was then sent via email to the students of the University of Turku, Finland in the Spring of 2012. The email was sent by the university student services to the students' university email accounts. As the number of students and active email accounts varies daily, we do not know exact number of receivers. However, the university has approximately 20 000 enrolled students. The students were given one month to respond to the questionnaire. One new smart phone was used as an incentive and raffled among the respondents. At the end of the answering period, 2 022 students had answered to the questionnaire (response rate approximately 10 %). In this study we focus only on 1 932 answers from the students whose basic elementary education is from Finland. Exchange and foreign students were omitted as our aim was to replicate the study, and the demography, of Wilska (2003).

Similarly to Wilska (2003), we first give descriptive statistics for the data and then use principal component analysis to analyse the data. In the previous work of Wilska (2003) there is no assumption made on the type of data analysed and the nature of the relationships between the variables. Subsequently Wilska (2003) used linear principle component analysis to reduce the dimensions of the data (for principal component analysis refer to e.g. Jolliffe, 2002; Tabachnick and Fidel, 2001; Pearson, 1901; Hotelling, 1933a,b). Although the aforementioned approach is straightforward and often used, several authors (e.g. Allen and Seaman, 2007; Jamieson, 2004) have suggested that for data with non-linear relationships we should use a different approach. As suggested by (Linting and van der Kooij, 2012), we use a non-linear principal component analysis (NLPCA), known as CATPCA procedure in the SPSS statistical software (see e.g. Linting et al., 2007; Meulman et al., 2004), to analyze the data because the questionnaire data in this study is Likert-scale data. We saved the transformed variables from the CATPCA procedure in SPSS and submitted the transformed variables to linear PCA with Varimax rotation (refer to e.g. Tabachnick and Fidel, 2001), as suggested in Linting and van der Kooij (2012). This CATPCA based analysis procedure was done for both datasets. We also used the factors created by the NLPCA analysis in a regression model, with variable focusing on the type of user, which was used to validate the assumptions made about the factors. The models were built on ordinal regression models in SPSS 20 software.

We revisited several results by Economides and Grousopoulou (2009) in order to focus on how the respondents valued different functions in a mobile device. Although our approach is different in the sense that while Economides and Grousopoulou asked respondents to identify the value of different features or functions with a five point categorical system (none, little, enough, much, and very much), we used a numerical scale from one to five indicating to the respondents that five was the highest value. However, our analysis did not go so far as to evaluate the willingness to pay for different functionalities or features, but focused more on understanding the changes in mobile phones use occurring while the mobile devices are becoming more complex. The results of the questionnaires were evaluated against each other by using the median and mode values for both our results and the earlier results by Economides and Grousopoulou (2009).

4.2. Descriptive statistics

Among the 1 932 respondents, who had their elementary education in Finland, 4 respondents did not have a mobile phone in their use. In the following, we focus only on these 1 928 who had a mobile phone. From these respondents, 65,4 % were female and 34,6 % were male. Divided into age groups, 3,4 % of the respondents were under 20 years, 46,6 % were between 20–24 years, 31,6 % were between 25–29 years, 10,7 % between 30–34 years and 7,8 % were above 35 years. On an median, the respondents were currently using their 5th mobile phone. In the survey, Nokia was the most popular brand amounting to 67,0 %, followed by Samsung with 15,6 %, Apple by 9,6 % and HTC by 4,0 %. The complete division to different brands is seen in Figure 1.
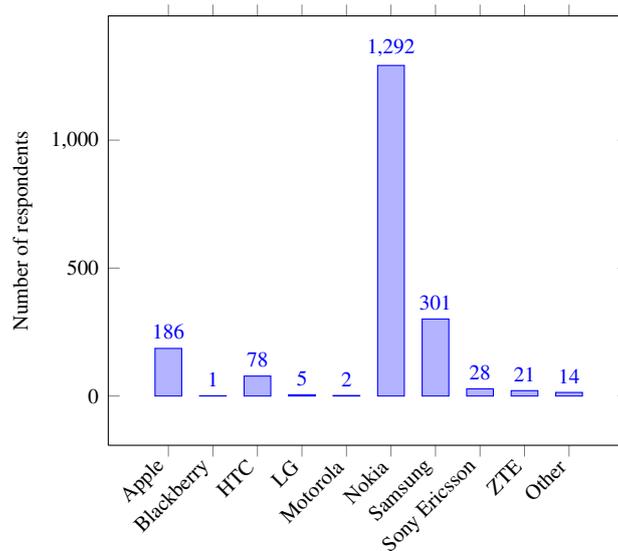

Figure 1: The dataset D2012 divided by the primary mobile phone brand (N = 1 928).

Looking at the division of brands further, we identified several operating systems used by the respondents, which is illustrated in Figure 2. However, we should note that a significant portion of the respondents, totalling 46,4 %, did not know their mobile phones' operating system. An assumption can be made, that these respondents who have knowledge on the operating system in their phone, are using a later model smart phone or otherwise are more interested in the type of the phone they are using. This assumption is based on the recent development, where the operating system of the mobile phone is becoming more and more important as it allows the consumer to download and install applications from the operating system's marketplace.

Although Nokia was the most popular brand of a phone, its operating system Symbian covered only 16,3 % and Nokia S40 covered 5,7 % of operating systems identified. This clearly shows that users did not know what their mobile operating system was. However, we were able to identify that, in addition to Symbian and S40, Android covers 15,8 % of the operating systems, iOS takes 9,3 %, Windows mobile 1,9 % and Linux only 0,5 %.

According to our survey, 29,3 % of the respondents were willing to pay up to 101–200 € for a new mobile phone and 23,4 % were willing to pay between 51–100 €. Thus, nearly half of the respondents were willing to pay a sum that compares to a low price range smart phone or a feature phone. In the upper bound, 17,8 % was willing to pay 201–300 €, 11,3 % was willing to pay 301–400€, 7,4 % was willing to pay 401–500 € and only 4,4 % was willing to pay over 500 €. In addition, 6,3 % of the users was only comfortable for paying under 50 € for a new device. A χ^2 test was performed to test the null hypothesis of no association between gender and the respondents willingness to pay for a mobile phone. An association between gender and the respondents willingness to pay for a mobile phone was found, $\chi^2(6, N = 1\ 928) = 178,354, p < 0,001$. Examination of the cell frequencies showed that male respondents were willing to pay more than female respondents.

A significant portion of the respondents paid for the cost of usage by themselves. However, there is also a portion of respondents, nearly one third, as seen in Table 2, which does not receive the invoice and subsequently did not
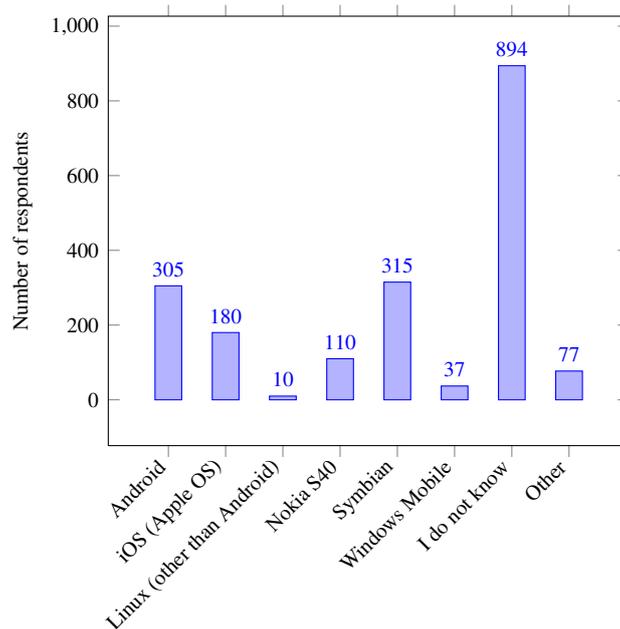
Figure 2: The dataset D2012 divided by the primary mobile phone operating system (N = 1 928).

pay for their expenses. When we focused on the respondents who paid for the cost of their mobile phone usage by themselves (N = 1 254), the observed that the monthly mean cost of usage was 22,33 € for the male respondents and 24,66 € for the female respondents. From these respondents, 42,8 % of the users paid for their mobile phone as a part of their telecommunication service deal. As the price of a device is easily bundled to a contract with the operator, and thus invisible to the customer, a χ^2 test was performed to test the null hypothesis of no association between paying monthly for the mobile phone as a part of the telecommunication service deal and the respondents willingness to pay for a mobile phone. We could reject the null hypothesis $\chi^2(6, N = 1\ 254) = 7,221, p < 0,301$.

In addition to the telecommunication service, new mobile application ecosystems enable the users to buy applications from mobile application marketplaces. From the respondents 63,8 % had not paid for any application for their mobile phone, and 22,2 % had paid less than 10 €. Interestingly, over 80 % of iPhone users have spent money on applications; in contrast, only under 50 % of Android users have bought applications. A χ^2 test was performed to test the null hypothesis of no association between the operating system of users, focusing on Android, iOS, Symbian, Windows Mobile and respondent who do not know, and if the user has used money on services or applications. An association, supporting the earlier argument, between the operating system and the users having used money on services or applications was found, $\chi^2(4, N = 1\ 790) = 330,147, p < 0,001$.

5. Results

5.1. Principal component analysis

The 17 variables of the D2001 dataset were taken into analysis, first running the CATPCA procedure to produce the transformed variables used in linear PCA. The three-factor solution explains 44,22 % of the variance in the data, and as illustrated in the scree-plot (Figure 3), it fits to the elbow of the plot. A similar analysis process was performed for the D2012 dataset. Limiting the analysis to a three-factor solution we were able to explain 46,99 % of the overall variance. Looking at the scree-plot in Figure 3, we found support for selecting the three-factor solution.

The resulted Rotated Component Matrices for the CATPCA analyzed datasets are seen in Table 3. The table also includes, for the readers convenience, the earlier results by Wilska (2003). First, we should note that the original linear PCA results by Wilska are fairly similar to the NLPCA reanalysis of Wilska's results. We could even argue if, by approaching the data originally with NLPCA, the author would have ended up with qualitatively similar results.
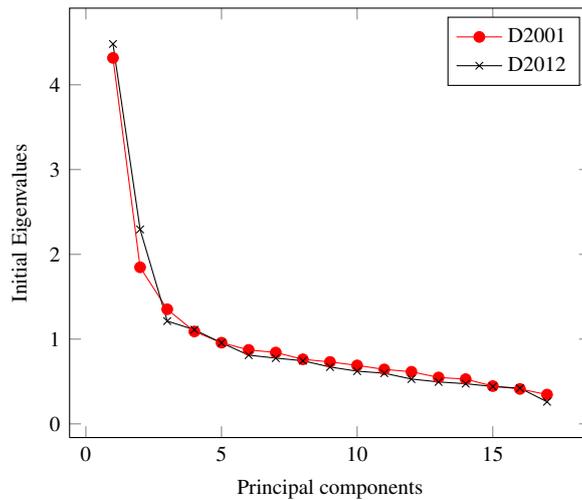
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Figure 3: Scree-plots calculated from the D2001 dataset, marked with dots, and from the D2012 dataset, market with crosses.

This similarity turns our focus to assess the difference the reanalysed and new data has to the original results by Wilska. Seen in Table 3, we have used a loading of 0,35 as a cut-off value for questions taken into the qualitative analysis of components. The value 0,35 is based on keeping in line with the earlier selection by Wilska, which was also supported by the visual evaluation of the component loadings.

Wilska (2003) called the original three factors as 'Addictive use', 'Trendy use' and 'Thrifty use' based on the different consumption patterns, explaining in length the theoretical background of these assumptions. When comparing the original results and our reanalysed results, there were only a few changes. With the analysis procedure we used, the only notable changes were: Statement 17 with negative loading is included into the first component, 'Addictive'. This is a rather interesting as the statement is almost a contradiction to statement S1, which also belongs to the first component. The other changes are that the second component, 'Trendy', contains now S7 with a positive and S15 with a negative loading. These, however, are rather undramatic shifts and in line with the other characteristics of the component. Therefore, we mostly adopted the original names for the components.

Wilska (2003) calls the third component as 'Thrifty', indicating that the users with high score in this category restrict to use of the mobile phone to the minimum. We, however, have broadened the assumptions made in the interpretation from a consumption pattern to include an attitude towards technology. Although this new component clearly weights the statements S15 and S16, thus indicating the economical behaviour, it also emphasizes the importance of using mobile phone to connect people. Therefore, we see a user who scores well in this component as one who does not care about the new features and stays in the traditional function of a phone: uses it just to connect people. This implies a conservative attitude towards the new technology, and thus we adopt the name 'Conservative' for this component. Although, we do not want to make to elaborate presumptions on small changes in the loadings, we see, as discussed further, an emerging trend of conservatism towards mobile technology. We tested the assumption that the 'Conservative' respondents have towards ICT with a ordinal Likert-scale variable 'I'm against ICT'. Using an ordinal logistic regression model (χ^2 176, 2, $df = 3$, $p < 0,001$; Nagelkerke Pseudo R-Square 0,099) the 'Conservative' ($p < 0,001$) and the variable 'I'm against ICT are associated at a statistically significant level. With a positive parameter estimate (0,411) we expect an increase in the odds of being in a higher level of the ordinal 'I'm against ICT' variable in the 'Conservative' group. This finding should be used in future conceptual studies.

Further looking at the reanalysis of Wilska's data, we see that the NLPCA approach has emphasized the interpretation of 'Addictive use' and 'Trendy use'. In 'Trendy use', the emergence of loadings in S7 and S15 complements the earlier findings made. Similarly in 'Addictive use', the loading in S17 does not make us to change the interpretation of the component. Methodologically, we can assume that the data had only limited non-linear relationships, which were not captured by the linear PCA approach. This does not limit the value of using such an approach when analysing the questionnaire data.

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Next we move to compare the components calculated from the dataset of D2012 to the ones resulted from the NLPCA analysis of the dataset of D2001, i.e. analysing the development that has occurred in a decade. The components turned out to be remarkably similar. Testing the factor similarity with Salient Variable Similarity Index (Cattell et al., 1969; Teel and Verran, 1991), the probability of an S of 0,8 for the first and second factor (p<0,001) and for factors three 0,66 (p<0,003), thus the factors were considered to be matched based on the Salient Variable Similarity Index. This was further supported by a correlation analysis seen in Table 4. The only differences found in the first component were the lack of S6 and S13. The component still describes addictive use of mobile phones, specially focusing on the importance of being continuously in social contact, supported by the findings by Lenhart (2012). Consequently, we named the component as 'Social Addict' to illustrate this kind of behaviour — and to make a difference to the use which leads to monetary problems as in the 'Addicted' component in the results of D2001. We tested the assumption that the 'Social Addict' respondents feel that the access to social networks is a significant function in the devices. Using a ordinal logistic regression model (χ^2 865, 218, $df = 3, p < 0,001$; Nagelkerke Pseudo R-Square 0,382) the 'Social addict" ($p < 0,001$) and the variable 'Importance of accessing to social networking sites' are associated at a statistically significant level. With a positive parameter estimate (1,071) we expect an increase in the odds of being in a higher level of the ordinal 'Importance of accessing to social networking sites' in the 'Social Addict' group. Our finding support the recent findings by Lenhart (2012), where a third of young students used social media as a form of daily communication and 63 % texted daily. The number of text messages sent and received daily was a sizeable 167 (mean value), supporting the assumption that there is a large 'Social Addict' – or communication addict – group among youth.

Similarly the second component has remained the same despite of a decade of technological advancements and series of destructive innovations in the field. The loadings are, actually, only strengthened. The component represents a trendy user pattern with focus on the general image and status created by the phone. Thus, we used the name 'Trendy' to depict this component as did Wilska (2003) in her original study.

For the third component, the changes are also fairly small. In the results of D2012, there is a significant negative loading for S9 meaning that the lack of Internet connection in the mobile phone is not important for the users in this kind of a usage pattern. The increased importance of the statement is not a surprise, as the Internet has became one of the major features in the mobile phone selling and in the tie-in deals in Finland. The role of Internet has been noted also by researchers: For example Kumar noted in 2004 that one of the industry's major challenges is that not all consumers value mobile internet, and West and Mace (2010) have argued that the success of iPhone was based on the mobile Internet. Going back to changing the earlier 'Thrifty use' interpretation to 'Conservative', we argue that the emphasis on S8 supports our earlier change.

As we were interested to study further whether the components are associated with the amount of money spent on the device, we used the ordinal logistic regression to identify a possible association. We used a seven category ordinal variable 'If you would buy a new mobile phone, what would be the price you would be willing to pay?' (Options were: '0–50 €', '51–100 €', '101–200 €', '201–300 €', '301–400 €', '401–500 €' and 'over 500 €') to analyse a possible association with the components. Using a ordinal logistic regression model (χ^2 1187, 352, $df = 3, p < 0,001$; Nagelkerke Pseudo R-Square 0, 474) the components and 'If you would buy a new mobile phone, what would be the price you would be willing to pay?'. For the 'Social addict' and 'Conservative' components the associations are statistically significant ($p < 0,001$) and with a positive estimate for the the 'Social addict' and a negative estimate for the 'Conservative' components we see an expected association of lower willingness for the 'Conservative' component and higher for the 'Social addict' component.

As shown in Table 5, we calculated mean values of component scores and selected variables of D2012. As the table shows, a user belonging to the group 'Conservative' is more likely a woman using a Nokia S40 mobile phone or is not aware of the operating system, and is willing to pay less than 200 € for a new device. Similarly, a 'Trendy' user is more likely a male using a modern smart phone, with iOS, Windows Mobile or Android operating system, and is willing to pay over 200 € for a new phone while a 'Social addict' user is a female without a clear pattern in mobile phone operating system and is willing to pay 50–200 € for a new phone. These results are well-aligned with our interpretation of these components.

5.2. Comparing our results to Economides and Grousopoulou

We have seen an evolution in the valuations by respondents when comparing our results to the results of the previous study by Economides and Grousopoulou (2009). It should be noted that the results by Economides and

Grousopoulou have been gathered during 2006–2007 and our results were gathered in the Spring of 2012. The results can, to some extent, capture the change in perception as smart phones have become increasingly popular. Also, during that time we have seen the emergence of social media services and mobile application ecosystems such as Apple App Store, Google Play, Windows Phone Marketplace etc.

The results have been divided based on gender, as in Economides and Grousopoulou (2009), to identify possible differences in perceptions. As seen in the medians and modes in Tables 6 and 7 there are differences in how male and female respondents answered the questions. Looking more closely at Table 6, we can see that the median values of the male responders have more variance, while the female respondents have a value 1 in both median and mode in several questions. This is most striking in the newer services, often associated with smart phones, such as file sharing and the use of antivirus software. Only a few smart phone features, i.e. Internet navigation and maps viewing, have growth in their importance. Comparing to the earlier findings by Economides and Grousopoulou, we see that several female respondents' median values have even diminished in many features, again most significantly with those associated with smart phones. With the male respondents, we did not identify a similar change. Table 6 also shows the increase in importance of rather elementary features such as a calculator and calendar. The results of the comparison support the findings of the component score evaluation, where female respondents are seen as more conservative and less likely to adopt high-end devices where technological advancements are made available.

In the factors listed in Table 7, females' relative importance towards the listed features has mainly decreased. There are a few exceptions, the importance of resilience, battery life, small size, and, simultaneously, of the large screen have increased. However, the major change has been in the importance of an easy to use interface. This most likely reflects the impact of new kinds of user interfaces, presented by Apple in iOS, as the change is clear also in the valuation of the males. As a whole, males' valuation has remained mostly the same with a few exceptions on technical features, such WLAN, 3G, GPS, search engine, and touch screen, which have all shown growth.

Looking at the value of social media applications, added to the questionnaire since the study by Economides and Grousopoulou (2009), we see yet again a fairly conservative approach to the importance of these applications. Although the number of users of social media services has increased, the lack of enthusiasm towards them is, in our dataset, significant. This questions to which extent young students are adopting social media services in their mobile phones, although the social aspect was emphasized in the NLPCA results.

6. Discussion and limitations

6.1. Reflections on empirical studies

The interaction between telecommunication technology and young consumers have been of interest to several scholars as was shown in Section 3. Understanding the changing perceptions of consumers with simultaneously analysing the effects of the ever developing mobile technology is challenging and at least partially outside the frame of, for example, Diffusion of Innovation theory. This study focused on both young consumers and the developing technology by replicating portions of two earlier studies.

Studies by Oksman and Rautiainen (2003) and Wilska (2003) have suggested several categorizations for mobile phone users. Trying to classify consumers by their type of use by identifying more general consuming patterns, researchers have found practical classifications to usage patterns. Even though the technology has evolved significantly, we see little to no change in the attitudes of young adults over a period of one decade. Data originally gathered by Autio and Wilska (2001) collected responses from participants now within the same age group of the respondents of our study, and even in the same country. Although our data is not from the same group, there is a significant demographic similarity within the respondent groups. Furthermore, the usage patterns found by Wilska (2003) were visible in the data, although a broader description – or rather change of the emphasis – was needed.

With the 'Thrifty' usage pattern we argue that rather than plain frugality, simultaneously extending the theoretical frame used by Wilska (2003) to take into consideration a technological approach, much has to do with conservative attitude towards technology. With the 'Addictive use' usage pattern the emergence of social or rather communicative aspect is predominant. In contrast to the decade old material, monetary problems do not belong to the usage pattern any more. Balakrishnan and Raj (2012) found that most of their studied youth have symptoms of addiction, i.e. continued checking of the phone, uncomfortable feeling when the phone is not with the user etc. Although we found similar behaviour, it was not a problem of a majority.

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Our findings support the results of Bouwman et al. (2007b) whose repeated study has shown a stable consuming pattern among the Finns. We did not perceive remarkable, or any, changes although we analyzed datasets before and after the event of smart devices. In the study of Verkasalo et al. (2010), 13 % were students indicating that they might be a group of early adopters of new technology. Similarly, our dataset shows a high penetration ratio of smart phones in the group of studied students as at least 27,6 % of answerers were using a modern smart phone operating system (e.g. iOS, Android, Windows Phone). However, only a small portion of the respondents had bought content to their phone. At the same time, the importance of games is low, and the functions of feature phones, e.g. clock and calendar, is increased. This might suggest that although students have smart phones, all of their capabilities are not yet adopted.

As suggested by earlier findings by Li and Kirkup (2007), there is little or no difference in the access or ownership between the genders. However, as pointed out in the context of Internet use, there is a difference in the way devices are used and what features are actually valued. Surprisingly, the communication aspects were valued by male more than by female respondents. This supports the argument made by Li and Kirkup, that even though women are more involved with interpersonal communication, this is not the case if the communication is mediated by a "masculine technology" (Li and Kirkup, 2007). Altogether, there was a difference in gender in the component score evaluation, supporting the claim that men focus on trendy technology.

Since the study by Economides and Grousopoulou (2009), mobile technology has taken leaps in its technological development. Economides and Grousopoulou averaged that the monthly cost of mobile phone use is approximately 33 €. Our findings suggest that both females and males use less on mobile phones than this; in addition, the male respondents spent a bit more money than the female respondents. This suggests that the usage profile of male and female user varies significantly. Moving forward to if and to which extent young consumers are willing to pay for applications and services for their devices, we are confronted with a lack of enthusiasm. Descriptive statistics clearly identified that the respondents were willing to invest only a modest amount of money for their devices. In addition, the user group had used none or only a small amount of money on services and applications. Although it seems that Apple users are more willing to use money on applications, the overall majority of users are not willing to pay anything for them. This question is if, and to which extent, the monetization of applications can be based on the direct pricing model. This has managerial implications to the monetization plans of the application publishers which can be already seen in the monetization of applications (see e.g. Hyrynsalmi et al., 2012b).

Looking more in-depth to the factors studied by Economides and Grousopoulou (2009), we saw a decrease in interest on several features provided by mobile devices. The female responders showed an increased interest towards form factors, such as low weight and dimension, resilience to water and dropping, and design and elegance, while the male respondents focused on the value of technical factors such as IrDA or Wireless local area network feature. The difference with previous finding by Economides and Grousopoulou is also significant. When asked about technical features such as Bluetooth, Wireless local networks, 3G, 4G, GPS or Voice recording, the mode value of 1 suggests a total lack of interest or knowledge by the female users. These values were in several instances smaller than the previous findings by Economides and Grousopoulou (2009). The male respondents on the other hand, experienced an increase in most technical factors such as Wireless local networks, 3G, 4G, GPS, search engine availability and touch screen interface. Both of the genders valued the ease of use interface more than what was found in the previous studies. This division suggests that there is a clear division between the genders to the female respondents valuing form factors and the male respondents valuing technical factors. Continuing on the NLPCA and technical feature analysis, we argue that for male responders the adoption of technical features (or to be precise, their valuation) is based more on being trendy than the actual use – although we note that this needs further evidence. For female responders, the device is expected to enable a multitude of communication pathways and to emphasize form factors, but at no extra cost.

However, the study challenges perceptions by showing clearly that the functions provided by smart phones lack interest by the respondents. For example mobile games, which form the majority of application offerings in several ecosystems (Hyrynsalmi et al., 2012a), has a median value of 2 and a mode value of 1 in both genders. The only significant increase seen in the tables is the increase of map service usage by both genders. These findings suggest that the perceptions of young adults have not changed significantly since the previous studies — even though there has been a momentous development in technology. Nikou and Mezei (2012) suggest that adoption of new mobile services depends on the value find by the consumer. The combined results of their and our studies might indicate that the users expectation have not been fulfilled in the new services and features. From a consumer perception point-of-view we question if, even though adoption is high (Michalakelis et al., 2008), the consumer base is willing to welcome new

technologies and services. This reflects to the theory on cultural lag.

6.2. Reflections on theoretical studies

For answering the first research question, how the perceptions of young users have changed, our results suggest that there has been modest, if any, change in the perceptions of young consumers. Revisiting earlier findings and the new data suggests that the young users' usage patterns have mostly remained unchanged. This might suggest that the mobile technology development, in a time frame of a decade, has not created new patterns nor has it changed the existing patterns.

For the second research question, has the value of different features changed while the technology has developed, our results suggest that although the smart phones offer an abundance of services, the basic telecommunication service is still even more valuable. We also found, that there was even a lack of enthusiasm towards new smart phone features. Also the unwillingness to pay for top-end devices and the lack of money used, for example, to buy software products or services through ecosystem suggests a fairly conservative approach to the new services by the young consumers.

Although our paper is empirical in nature, the findings highlight several points in connection to the theoretical points made. The discussion on diffusion and adoption rate in the context of mobile phones is practical up to a point, but as Wirth et al. (2008) noted the explanatory value of either Diffusion of Innovation theory or TAM on the post-adoption perception changes is limited. The objective of the empirical study was to highlight changes in perceptions and feature appreciation as mobile technology has transitioned to being a 'Swiss Army Knife'. Without a doubt, there have been significant changes in the material culture, but looking at the cultural lag theory, we would ask if the non-material culture has remained unchanged or has it adjusted (changed) less than the material culture. Our results suggest that the non-material culture lags the technological development as the operationalizations used to measure changes in the non-material have remained relatively same. Similar results have been suggested for example by Bouwman et al. (2007b), although not providing evidence for it. The found stagnation in human perceptions, while technology has changed, opens avenues for discussion.

If the strong emphasis on communicative aspect is a stable factor, with limited adjustment towards the smart phone frame occurring, the adoption of new more complex functionalities might be difficult. Technology moving farther away from the non-material culture, with for example augmented reality based applications, can be difficult to accept by users. It might be that new features working in an established frame, such as games, message services, music players, are easily adopted as there is a culture for them. Offering truly radical innovations via the mobile phone might be a challenge. We could even argue the new smart phone technology is still under its technological maladjustment phase in that hardware and software innovations have reached a new level while content innovations are still lacking. That is, the possibilities offered by the technology are not yet fully understood and it is used mostly to redo the innovations of the previous technological generation. However, in the post-maladjustment phase, we should see major changes both in the offered services and content, and later as changes in the human behavior. However, the validity of this argument will be seen in the future if the content and the usage patterns of the smart phones will or will not change in the future.

Another explanation for the lack of changes might be, although our datasets do not allow us to study the reason of the lack of changes, that the smart phone was not, from the user point-of-view, a disruptive innovation. The new 'smart phone paradigm' enhanced usability for both the end users and the content producers but the device's means of use did not change – it is still used to connect people. In this case, the vast technological development of the last decade is only a small incremental innovation to the overall mobile revolution.

Altogeher, our results suggest a stronger research focus on giving theoretical explanations to the longitudinal transformations of non-material culture. Studies that focus on a snapshot of time give a worthwhile explanation how a technology has been adopted and what are users' views at that time. In support of the notion made by Wirth et al. (2008), a more complex model explaining the transitions of non-material culture might elaborate on the future of mobile technology.

6.3. Limitations of our study

The study is limited by the bias set by the group of respondents. In this study the respondents were university students from Finland and this sets at least five significant limitations. First, university students are a group which does not model a true random sample of the age group and they present a fairly narrow subset of young adults. The

second limitation is that university students as consumers are limited by the fact that they have only a limited amount of financial resources at their use in any given time. Third, the study is located in Finland. This sets a significant bias to the generalization of the results as the country has often claimed to be one of the most advanced markets for mobile services (Wilska, 2003; Bouwman et al., 2007a). However, offsetting the limitations are the factors that the sample size and the fact that in many senses the group studied in this work should rather be an active user and an early adopter group.

The fourth limitation is the reliability of the self-reported data. Recently scholars (e.g. Kobayashia and Boase, 2012; Boase and Ling, 2013) have discussed on the limitations of the self-reported data in mobile phone studies. For example, Kobayashia and Boase (2012) noted that self-reported data often overestimates the actual use. Although in this study we are surveying perceptions of the consumers — and not the the actual use — the correctness of self-reported values is still questionable. Utilizing an application, similar than the one used by e.g. Kobayashia and Boase (2012), that logs the use of different features and comparing these logs to the perceived value by respondents could, in future work, improve our understanding in these issues.

The fifth limitation of the results is the changed analysis method from the previous studies by Wilska (2003) and Economides and Grousopoulou (2009). Not to make the argument that the methods used in the previous studies were inadequate, we instead approached the data from a different point of view and were forced to recalculate the results. This makes our results a bit challenging to compare directly with the previous studies. However, we have made every effort to accommodate this within this study.

7. Summary

Motivated by several studies and constant development in the mobile phones, we studied the Finnish youth's use of mobile phones. For the study, we conducted an online questionnaire based on the surveys of Autio and Wilska (2001) and Economides and Grousopoulou (2009) and received 1 932 respondents. Furthermore, we reanalysed the answers of Autio and Wilska (2001) with CATPCA method. The results of these analyses show that the students have a very conservative approach towards new devices and applications. Finally, the generalization of the results is limited to the special group of responders which does not necessarily represent the whole youth population. The empirical result of this study, along with others (c.f. Carlsson and Walden, 2012), opens research avenues for further theoretical studies on how the technology will change the user perceptions. It also offers a more complex explanation to adjustments in culture.

References

Allen, I. E., Seaman, C. A., 2007. Statistics roundtable: Likert scales and data analyses. Quality Progress 40 (7), 64–65.

Aoki, K., Downes, E. J., November 2003. An analysis of young people's use of and attitudes toward cell phones. Telematics and Informatics 20 (4), 349–364.

Autio, M., September 2004. Finnish young people's narrative construction of consumer identity. International Journal of Consumer Studies 28 (4), 388–398.

Autio, M., Wilska, T.-A., 2001. FSD2041 youth consumer cultures in information society. Tech. rep., Finnish Social Science Data Archive, Tampere, Finland.

Balakrishnan, V., Raj, R. G., August 2012. Exploring the relationship between urbanized Malaysian youth and their mobile phones: A quantitative approach. Telematics and Informatics 29 (3), 263–272.

Boase, J., Ling, R., 2013. Measuring mobile phone use: Self-report versus log data, in Press.
   URL http://dx.doi.org/10.1111/jcc4.12021

Bouwman, H., Carlsson, C., Molina-Castillo, F. J., Walden, P., May 2007a. Barriers and drivers in the adoption of current and future mobile services in finland. Telematics and Informatics 24 (2), 145–160.

Bouwman, H., Carlsson, C., Walden, P., Molina-Castillo, F. J., 2007b. From WAP services to mobile video: Trends in mobile services in Finland. In: Proceedings of the Sixth International Conference on the Management of Mobile Business. ICMB '07. IEEE Computer Society, Washington, DC, USA, pp. 33–39.

Brinkman, R. L., Brinkman, J. E., 1997. Cultural lag: Conception and theory. International Journal of Social Economics 24 (6), 609–627.

Cantisani, A., 2006. Technological innovation processes revisited. Technovation 26 (11), 1294–1301.

Carlsson, C., Walden, P., 2012. From mcom visions to mobile value services. In: Clarke, R. (Ed.), Proceedings of the 25th Bled eConference. Online Proceedings, pp. 217–234.

Cattell, R. B., Balcar, K. R., Horn, J. L., Nesselroade, J. R., 1969. Factor matching procedures: An improvement of the s index; with tables. Educational and Psychological Measurement 29 (4), 781–792.

Compeau, D. R., Higgins, C. A., 1995. Computer self-efficacy: Development of a measure and initial test. MIS quarterly, 189–211.

Daft, R. L., Lengel, R. H., 1986. Organizational information requirements, media richness and structural design. Management science 32 (5), 554–571.

Davie, R., Panting, C., Charlton, T., November 2004. Mobile phone ownership and usage among pre-adolescents. Telematics and Informatics 21 (4), 359–373.

Davis, F. D., 1989. Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS quarterly, 319–340.

Economides, A. A., Grousopoulou, A., February 2009. Students' thoughts about the importance and costs of their mobile devices' features and services. Telematics and Informatics 26 (1), 57–84.

Goggin, G., Aug. 2012. Cell Phone Culture: Mobile Technology in Everyday Life. Routledge.

Haverila, M., May 2013. Cell phone usage and broad feature preferences: A study among Finnish undergraduate students. Telematics and Informatics 30 (2), 177–188.

Hotelling, H., September 1933a. Analysis of a complex of statistical variables into principal components. Journal of educational psychology 24 (6), 417–441.

Hotelling, H., October 1933b. Analysis of a complex of statistical variables into principal components. Journal of educational psychology 24 (7), 498–520.

Hyrynsalmi, S., Mäkilä, T., Järvi, A., Suominen, A., Seppänen, M., Knuutila, T., June 2012a. App Store, Marketplace, Play! an analysis of multi-homing in mobile software ecosystems. In: Jansen, S., Bosch, J., Alves, C. (Eds.), Proceedings of the Fourth International Workshop on Software Ecosystems. IWSECO'2012. CEUR-WS, MIT Sloan School of Management, Cambridge, MA, USA, pp. 55–68.

Hyrynsalmi, S., Suominen, A., Mäkilä, T., Järvi, A., Knuutila, T., 2012b. Revenue models of application developers in Android Market ecosystem. In: Cusumano, M., Iyer, B., Venkatraman, N. (Eds.), ICSOB 2012. No. 114 in Lecture Notes in Business Information Processing. Springer, Heidelberg, pp. 209–222.

Ito, M., 2005. Mobile phones, japanese youth, and the re-placement of social contact. In: Mobile Communications. Springer-Verlag, London, pp. 131–148.
URL http://link.springer.com/content/pdf/10.1007/1-84628-248-9_9

Jamieson, S., 2004. Likert scales: how to (ab)use them. Medical Education 38 (12), 1217–1218.

Jolliffe, I., 2002. Principal Component Analysis, 2nd Edition. Springer, New York.

Katz, J. E., Sep. 2006. Machines that Become Us: The Social Context of Personal Communication Technology. Transaction Publishers.

Khang, H., Woo, H.-J., Kim, J. K., Dec. 2012. Self as an antecedent of mobile phone addiction. International Journal of Mobile Communications 10 (1), 65–84.
URL http://dx.doi.org/10.1504/IJMC.2012.044523

Kimiloglu, H., Nasir, V. A., Süphan, N., 2010. Discovering behavioral segments in the mobile phone markets. Journal of Consumer Marketing 27 (5), 401–413.

King, W. R., He, J., 2006. A meta-analysis of the technology acceptance model. Information & Management 43 (6), 740–755.

Kivi, A., Mar. 2009. Measuring mobile service usage: methods and measurement points. International Journal of Mobile Communications 7 (4), 415–435.
URL http://dx.doi.org/10.1504/IJMC.2009.023692

Kobayashia, T., Boase, J., 2012. No such effect? the implications of measurement error in self-report measures of mobile communication use. Communication Methods and Measures 6 (3), 126–143.

Kock, N., 2004. The psychobiological model: Towards a new theory of computer-mediated communication based on darwinian evolution. Organization Science 15 (3), 327–348.

Kumar, S., May 2004. Mobile communications: global trends in the 21st century. International Journal of Mobile Communications 2 (1), 67–86.
URL http://dx.doi.org/10.1504/IJMC.2004.004488

Legris, P., Ingham, J., Collerette, P., 2003. Why do people use information technology? a critical review of the technology acceptance model. Information & management 40 (3), 191–204.

Lenhart, A., March 2012. Teens, smartphones & texting. Tech. rep., Pew Internet & American Life Project, Washington, D.C.
URL http://wwww.pewinternet.com/~/media/Files/Reports/2012/PIP_Teens_Smartphones_and_Texting.pdf

Leung, L., Wei, R., June 2000. More than just talk on the move: Uses and gratifications of the cellular phone. Journalism & Mass Communication Quarterly 77 (2), 308–320.

Li, N., Kirkup, G., February 2007. Gender and cultural differences in internet use: A study of China and the UK. Computers & Education 48 (2), 301317.

Ling, R., Jun. 2004. The Mobile Connection: The Cell Phone's Impact on Society. Morgan Kaufmann.

Linting, M., Meulman, J. J., Groenen, P. J. F., van der Kooij, A. J., September 2007. Nonlinear principal component analysis: Introduction and application. Psychological Methods 12 (3), 336–358.

Linting, M., van der Kooij, A., 2012. Nonlinear principal components analysis with catpca: A tutorial. Journal of Personality Assessment 94 (1), 12–25.

López-Nicolás, C., Molina-Castillo, F. J., Bouwman, H., September 2008. An assessment of advanced mobile services acceptance: Contributions from TAM and diffusion theory models. Information & Management 45 (6), 359–364.

MacVaugh, J., Schiavone, F., 2010. Limits to the diffusion of innovation: A literature review and integrative model. European Journal of Innovation Management 13 (2), 197–221.

Meulman, J. J., Van der Kooij, A. J., Heiser, W. J., 2004. Principal components analysis with nonlinear optimal scaling transformations for ordinal and nominal data. In: Kaplan, D. (Ed.), Handbook of quantitative methodology for the social sciences. Sage Publications, Inc., London, Ch. 3, pp. 49–70.

Michalakelis, C., Varoutas, D., Sphicopoulos, T., 2008. Diffusion models of mobile telephony in greece. Telecommunications Policy 32 (34), 234 – 245.
URL http://www.sciencedirect.com/science/article/pii/S0308596108000116

Nikou, S., Mezei, J., 2012. Evaluation of mobile services and substantial adoption factors with analytic hierarchy process (ahp). Telecommunica-

tions Policy (0), –, in Press, Corrected Proof.
URL http://www.sciencedirect.com/science/article/pii/S0308596112001772

Ogburn, W. F., 1957. Cultural lag as theory. Sociology & Social Research 41 (3), 167 – 174.

Oksman, V., Rautiainen, P., 2003. "Perhaps it is a body part": How the mobile phone became an organic part of the everyday lives of Finnish children and teenagers. In: Katz, J. E. (Ed.), Machines That Become Us: The Social Context of Personal Communication Technology. Transaction Publishers.

Pearson, K., 1901. On lines and planes of closest fit to system of points. Philosophical Magazine Series 6 2 (11), 559–572.

Rogers, E. M., Feb. 1995. Diffusion of innovations. Simon and Schuster.

Sell, A., Walden, P., Carlsson, C., 2010a. Are you efficient, trendy or skilful? an exploratory segmentation of mobile service users. In: Giaglis, G. M., Zwass, V. (Eds.), Ninth International Conference on Mobile Business and Ninth Global Mobility Roundtable (ICMB-GMR). IEEE Computer Society, pp. 116–123.

Sell, A., Walden, P., Carlsson, C., December 2010b. An exploratory three year segmentation of finnish mobile service users. In: Rosemann, M., Green, P. (Eds.), Proceedings of 21st Australasian Conference on Information Systems. AIS Electronic Library, p. Paper 85.

Sell, A., Walden, P., Carlsson, C., June 2012. I am a smart phone user — key insights from the finnish market. In: Bouwman, H., Tuunainen, V. (Eds.), Proceedings of the 11th International Conference on Mobile Business (ICMB 2012). Delft university of technology, pp. 265–276.

Short, J., Williams, E., Christie, B., 1976. The Social Psychology of Telecommunications. Wiley.

Stald, G., 2008. Mobile identity: Youth, identity, and mobile communication media. In: Buckingham, D. (Ed.), Youth, Identity, And Digital Media. The John D. and Catherine T. MacArthur Foundation Series on Digital Media and Learning. The MIT Press, pp. 143–164.

Tabachnick, B., Fidel, S. L., 2001. Using Multivariate Statisitics, 4th Edition. Ally and Bacon.

Teel, C., Verran, J. A. ., 1991. Focus on psychometrics. factor comparison across studies. Research in Nursing & Health 14 (1), 67–72.

Turner, M., Kitchenham, B., Brereton, P., Charters, S., Budgen, D., 2010. Does the technology acceptance model predict actual use? a systematic literature review. Information and Software Technology 52 (5), 463–479.

Verkasalo, H., López-Nicolás, C., Molina-Castillo, F. J., Bouwman, H., August 2010. Analysis of users and non-users of smartphone applications. Telematics and Informatics 27 (3), 242–255.

Walden, P., Han, S., Carlsson, C., Majlender, P., 2007. The sleeping giant - a longitudinal study surveying the mobile service market in finland. In: Österle, H., Schelp, J., Winter, R. (Eds.), Proceedings of European Conference on Information Systems 2007. University of St. Gallen, pp. 1875–1885.

Walsh, S. P., White, K. M., Cox, S., Young, R. M., January 2011. Keeping in constant touch: The predictors of young Australians' mobile phone involvement. Computers in Human Behavior 27 (1), 333–342.

Wang, Q., von Tunzelmann, N., 2000. Complexity and the functions of the firm: breadth and depth. Research Policy 29 (7), 805–818.

Wei, R., February 2008. Motivations for using the mobile phone for mass communications and entertainment. Telematics and Informatics 25 (1), 36–46.

West, J., Mace, M., June 2010. Browsing as the killer app: Explaining the rapid success of apple's iphone. Telecommunications Policy 34 (5–6), 270–286.

Wilska, T.-A., 2003. Mobile phone use as part of young people's consumption styles. Journal of Consumer Policy 26 (4), 441–463.

Wilska, T.-A., Pedrozo, S., November 2007. New technology and young people's consumer identities: A comparitive study between Finland and Brazil. Young 15 (4), 343–368.

Wirth, W., Von Pape, T., Karnowski, V., 2008. An integrative model of mobile phone appropriation. Journal of Computer-Mediated Communication 13 (3), 593–617.

Table 1: A comparison of publications, selected by the frame used in the study, on mobile phone use.

Study	Meth.	N	Age	Target population	Notes for this research	Framework
Leung and Wei (2000)	TS	834	> 18	Probability random sample from Hong Kong	Users divided into groups (Fashion/Status, Affection/Sociability, Relaxation, Mobility, Immediate access, Instrumentality, and Reassurance) by gratification factors	Attitude
Aoki and Downes (2003)	I/Q	32/137	NA	Second or third year college students from middle to upper class families	Homogeneous group produced five distinct groups (cost conscious, safety/security conscious, sophisticated, dependent and practical users) on their usage and integration to everyday life.	Attitude & Young consumers
Wilska (2003)	Q	637	16–20	Middle-level students in Finland	Young consumers divided into general consumption styles;	Attitude & Young consumers
Oksman and Rautiainen (2003)	I	800	< 18	Children and adolescents in Finland	Describing the meaning mobile communication has to children.	Attitude & Young consumers
Davie et al. (2004)	Q	157	10–11	Pre-adolescents in the UK	Descriptive statistics on usage behaviour.	Young consumers
Bouwman et al. (2007b)	Q	484	16–64	Finnish citizens	The longitudinal data of three years shows stable consumption patterns.	Attitude
López-Nicolás et al. (2008)	Q	542	NA	Dutch citizens	Innovative people adopt more easily advanced mobile services.	Attitude
Wei (2008)	TS	208	> 18	A city in USA	Most of non-voice uses is Games and Internet.	Attitude
Stald (2008)	M	NA	15–24	Danish youth	Social meanings of the mobile and identity formation by youth.	Attitude & Young consumers
Economides and Grousopoulou (2009)	Q	384	18–25	University students in a EU country	Importance of device features divided by gender.	Attitude & Gender
Kimiloglu et al. (2010)	Q	302	> 18	Turkish e-group members	Four consumers groups; pragmatic, abstemious, value conscious, charismatic. Mobiles are high involvement products with varied purchasing considerations.	Attitude
Verkasalo et al. (2010)	M	579	< 40	Finnish citizen	Different patterns among early adopters of smart phones.	Attitude & Gender (male)
Walsh et al. (2011)	Q	292	16–24	Australian youth	Psychosocial factors influencing young people's mobile use. Impact of self-identity, in-group norm, need to belong, self-esteem, and demographic factors to mobile phone use.	Attitude & Young consumers
Khang et al. (2012)	Q	313	Av. 21	University students in USA	"[S]tudy demonstrated that gender difference was a salient factor influencing one dimension of mobile phone addiction".	Attitude & Young consumers
Balakrishnan and Raj (2012)	Q/D	417	NA	Undergraduate and post-graduate students in Malaysia	Majority of respondents exhibited addiction symptoms towards mobiles, but had never been in debt because of excessive use.	Attitude & Young consumers
Lenhart (2012)	TS	799	12–17	Teens and their parents in the continental US	Texting is the dominant style of communication. One in four own a smart phone, and 77 % have an mobile.	Attitude & Young consumers
Haverila (2013)	Q	263	19–25	Undergraduate students in Finland	Calling and messaging features remained as most significant. Females heavier users of "calendar, Internet, music, and E-mail".	Attitude & Young consumers & Gender

Q = Questionnaire, TS = Telephone survey, I = Interviews, D = Usage diary, M = Multiple methods utilized

Table 2: How the respondents pay for their telecommunication services (N=1 928).

	Pays for the expenses	Receives the invoice, but does not pay	Does not receive the invoice and does not pay	Does not have to pay	Total
Male	23,1 %	1,9 %	9,4 %	0,2 %	34,6 %
Female	42,0 %	2,6 %	20,6 %	0,2 %	65,4 %
Total	65,0 %	4,5 %	30,1 %	0,4 %	100,0 %

Table 3: Rotated component matrix for D2012's and D2001's components. In addition, Wilska (2003)'s original results are presented in the table.

Questions	D2012			D2001			Wilska's (2003) results		
	Social Addict	Trendy	Conservative	Addict	Trendy	Conservative	Addictive	Trendy	Thrifty
S1 It's important for me to receive a lot of phone calls and text messages	0,773			0,680			0,694		
S2 I write lot of text messages	0,735			0,681			0,679		
S3 I keep checking for possible phone calls and messages all the time	0,759			0,629			0,614		
S4 I often make mobile phone calls without any particular purpose	0,643			0,529			0,557		
S5 I feel very uncomfortable if, for some reason, my mobile phone is not with me	0,496			0,575			0,553		
S6 I often have difficulty in paying my mobile phone bills				0,565			0,549		
S7 I often talk over my phone in public places (such as buses, trains, cafés)	0,481			0,516	0,377		0,491		
S8 It's important that there is Internet connection in my mobile phone		0,558	-0,530		0,701			0,719	
S9 It's important for me that my mobile phone uses the latest technology and is 'posh'		0,760	-0,379		0,717	-0,395		0,671	-0,409
S10 It's important for me that my phone fits my clothing style and general image		0,672			0,641			0,619	
S11 I'll probably use a mobile phone even more in the future		0,422			0,484			0,520	
S12 A three year old mobile phone looks too old-fashioned for me		0,740			0,557			0,516	
S13 I often change the appearance of my phone (themes, logos, ringtones etc.)		0,660		0,424	0,471		0,447	0,443	
S14 Some operators or types of connections are more trendy than others		0,624			0,417			0,440	
S15 The cheapest model is good enough for me			0,499		-0,362	0,757			0,745
S16 Price is the most important issue when choosing a phone			0,792			0,788			0,788
S17 A mobile phone is necessary for staying in contact with people and organizing things		-0,387	0,630	-0,355		0,486			0,493
Kaiser-Meyer-Olkin Measure of Sampling Adequacy			0,854			0,836			
Bartlett's Test of Sphericity Approx. Chi-Square			8752,965163			2054,92			
df			136			136			
Sig.			0			0			

Table 4: Correlation analysis of factor loadings.

		D2012		
		Social addict	Trendy	Conservative
D2001	Addict	0,878**	-0,018	-0,296
	Trendy	-0,190	0,861**	-0,784**
	Conservative	-0,392	-0,650**	0,859**

** Correlations are significant at the 0,01 level

Table 5: Mean values of component scores for genders, operating systems and the willingness-to-pay price for a new phone

		D2012		
		Social addict	Trendy	Conservative
Sex	Male	-0,425	0,172	-0,213
	Female	0,225	-0,091	0,113
Operating system	Android	-0,185	0,362	-0,449
	iOS	0,179	0,529	-0,725
	Linux	-0,406	0,083	-1,235
	Nokia S40	0,029	-0,049	0,370
	Symbian	0,340	-0,229	-0,272
	Windows Mobile	-0,017	0,695	-0,410
	Do not know	0,129	-0,386	0,381
	Other	-0,227	0,145	-0,003
price for a new	0-50	-0,161	-0,587	0,816
	51-100	0,038	-0,547	0,580
	101-200	0,071	-0,062	0,114
	201-300	-0,022	0,197	-0,268
	301-400	-0,032	0,494	-0,560
	401-500	-0,118	0,817	-0,807
	500-	-0,073	0,729	-1,139

p-values of Kruskal-Wallis test for equality of means.
H0: Means are equal. H0 is rejected as $p < 0.05$ for all

Table 6. Percentages of females and males considering the relative importance of different services and features. Results also include the median (Md) and mode (Mo) values of both the current study and the prior work of Economides and Grousopoulou (2009).

| | Female | | | | | | | | | Male | | | | | | | | |
| | D2012 | | | | | | | 2009 | | D2012 | | | | | | | 2009 | |
	1	2	3	4	5	Md	Mo	Md	Mo	1	2	3	4	5	Md	Mo	Md	Mo
Sending and receiving e-mails	49.3%	16.7%	11.8%	14.6%	7.6%	2	1	2	1	26.1%	15.3%	15.0%	23.3%	20.4%	3	1	2	1
Sending and receiving MMS and SMS messages	1.1%	0.7%	3.2%	13.5%	81.5%	5	5	–	–	2.1%	3.8%	7.6%	27.6%	58.9%	5	5	–	–
Sending and receiving MMS messages	–	–	–	–	–	–	–	3	2	–	–	–	–	–	–	–	2	2
Chat services	69.4%	13.5%	7.5%	5.7%	3.9%	1	1	1	1	56.4%	19.1%	10.4%	7.1%	7.0%	1	1	2	2
Teleconferencing	77.8%	14.6%	5.5%	1.4%	0.6%	1	1	1	1	67.4%	20.2%	9.2%	2.4%	0.8%	1	1	2	1
Internet navigation	29.9%	10.4%	16.8%	21.1%	21.8%	3	2	2	1	16.3%	7.4%	14.0%	24.4%	37.9%	4	5	2	1
Open software (e.g. Windows mobile)	60.1%	13.2%	13.5%	9.4%	3.8%	1	1	1	1	29.5%	15.6%	19.3%	23.4%	12.2%	2	2	2	1
Variety of supported file types	50.0%	16.5%	17.4%	11.5%	4.6%	2	1	2	3	24.8%	14.7%	23.3%	23.3%	14.0%	3	1	2	1
Encryption and cryptography for exchanging data	51.0%	20.5%	15.1%	8.1%	5.3%	1	1	1	1	37.5%	23.7%	22.1%	11.9%	4.8%	2	1	1	1
Anti-virus and anti-spam protection	51.1%	20.9%	15.7%	8.1%	4.2%	1	1	2	1	39.3%	26.2%	21.2%	10.0%	3.3%	2	1	2	1
Conversion of voice-to-text and vice versa	83.7%	11.6%	4.1%	0.3%	0.2%	1	1	2	1	73.4%	19.5%	4.8%	1.7%	0.6%	1	1	2	1
Translation of foreign languages	65.6%	19.0%	10.5%	3.7%	1.1%	1	1	3	1	56.4%	21.6%	14.5%	6.1%	1.4%	1	1	2	1
Common use and sharing files	50.5%	18.7%	18.6%	9.4%	2.9%	1	1	2	1	38.6%	20.0%	19.7%	15.2%	6.5%	2	1	2	1
Calculator	3.4%	11.0%	29.2%	35.1%	21.3%	4	4	3	3	6.2%	17.6%	29.4%	31.4%	15.4%	3	4	2	2
Clock, Calendar, Organizer, & Reminder	1.2%	3.3%	13.7%	31.8%	50.0%	4	5	3	3	1.2%	3.6%	13.9%	31.5%	49.8%	4	5	3	3
Playing games	41.4%	29.2%	17.8%	9.0%	2.7%	2	1	2	2	34.1%	28.8%	22.2%	12.5%	2.4%	2	1	2	1
Watching television	83.7%	11.7%	2.9%	1.2%	0.6%	1	1	2	1	71.5%	18.4%	6.9%	2.3%	0.9%	1	1	2	1
Printing (e.g. documents)	85.8%	9.1%	4.2%	0.6%	0.4%	1	1	2	1	73.6%	16.3%	6.9%	1.8%	1.4%	1	1	2	1
Viewing maps	35.7%	11.9%	19.0%	22.3%	11.2%	3	3	2	1	19.5%	6.9%	20.5%	33.5%	19.5%	4	4	2	2
Locking the user interface (keys or touch screen)	4.5%	5.0%	12.0%	24.9%	53.5%	5	5	3	3	5.0%	6.7%	13.9%	27.2%	47.2%	4	5	3	3
Locking the device with password	27.7%	19.5%	20.1%	16.9%	15.8%	3	1	3	1	22.3%	21.4%	21.9%	16.3%	18.1%	3	1	2	2
Access to social networking sites (Facebook, LinkedIN, Twitter etc.)	39.6%	13.6%	13.4%	16.4%	17.0%	2	1	–	–	32.6%	14.2%	17.6%	18.9%	16.7%	3	1	–	–

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Table 7: Percentages of females and males considering the relative importance of different features. Results also include the median (Md) and mode (Mo) values of both the current study and the prior work of Economides and Grousopoulou (2009).

| | Female | | | | | | | | | Male | | | | | | | | |
| | D2012 | | | | | | | 2009 | | D2012 | | | | | | | 2009 | |
	1	2	3	4	5	Md	Mo	Md	Mo	1	2	3	4	5	Md	Mo	Md	Mo
Low weight and dimensions	1,0%	7,3%	28,0%	45,6%	18,0%	4	4	3	3	2,0%	15,0%	36,9%	34,4%	11,7%	3	3	3	3
Battery life	0,0%	0,7%	7,8%	35,9%	55,6%	5	5	4	4	0,2%	1,4%	11,1%	45,5%	41,9%	4	4	4	5
Resilience of water, dropping, etc,	2,6%	16,1%	29,8%	34,9%	16,6%	4	4	3	3	4,1%	19,2%	37,3%	28,9%	10,5%	3	3	3	2
Design and elegance	3,2%	11,0%	22,7%	39,4%	23,7%	4	4	3	3	6,6%	20,9%	33,1%	28,2%	11,1%	3	3	3	3
Wide screen	4,0%	11,6%	28,4%	38,3%	17,8%	4	4	3	3	3,9%	11,7%	26,5%	41,9%	16,0%	4	4	3	3
Large storing capacity (memory)	12,5%	22,2%	27,5%	25,7%	12,2%	3	3	3	3	9,9%	16,4%	26,7%	34,2%	12,8%	3	4	3	3
High processing speed	21,5%	25,3%	27,9%	18,9%	6,4%	3	3	3	3	13,0%	15,8%	29,9%	29,3%	12,1%	3	3	3	3
Bluetooth technology	30,9%	23,1%	22,5%	16,9%	6,5%	2	1	3	3	17,8%	26,5%	22,0%	22,2%	11,5%	3	2	3	4
Infrared (IrDA)	51,5%	28,8%	15,8%	3,0%	0,9%	1	1	3	2	56,4%	27,8%	11,0%	4,2%	0,5%	1	1	2	1
Wireless local network (Wi-Fi)	32,7%	12,9%	15,2%	17,1%	22,0%	3	1	2	1	15,4%	8,7%	12,3%	21,5%	42,0%	4	5	1	1
3G	27,3%	10,4%	19,7%	21,6%	21,0%	3	1	3	2	15,0%	6,7%	12,9%	24,4%	41,1%	4	5	2	1
4G	40,7%	18,0%	23,4%	12,5%	5,4%	2	1	–	–	27,3%	17,1%	25,2%	19,6%	10,7%	3	1	–	–
GPS	33,1%	17,1%	20,3%	18,8%	10,7%	2	1	2	1	17,6%	7,2%	17,1%	30,5%	27,5%	4	4	2	1
Sound recording	42,1%	27,3%	18,2%	10,1%	2,3%	2	1	2	2	28,7%	31,7%	23,7%	11,9%	3,9%	2	2	2	2
Photo camera	8,0%	12,3%	23,4%	30,1%	26,2%	4	4	4	4	9,5%	13,7%	21,3%	34,7%	20,8%	4	4	3	4
Video camera	24,2%	20,7%	24,0%	21,2%	10,0%	3	3	3	1	18,3%	19,6%	25,5%	24,3%	12,2%	3	3	3	3
MP3 player	19,7%	15,4%	19,9%	23,0%	22,0%	3	4	4	4	16,6%	14,0%	17,8%	27,2%	24,3%	4	4	3	4
Search engine	36,4%	15,3%	18,7%	18,2%	11,4%	2	1	2	5	21,7%	12,7%	18,4%	28,8%	18,4%	3	4	2	1
Touch screen	38,3%	16,6%	16,3%	17,0%	11,8%	2	1	1	1	23,9%	11,5%	17,7%	25,4%	21,5%	3	4	1	1
Voice commands	70,9%	20,1%	6,7%	1,8%	0,6%	1	1	2	1	59,9%	28,4%	7,8%	3,0%	0,9%	1	1	1	1
Hands-free or Bluetooth earphone	32,1%	20,1%	19,7%	17,7%	10,4%	2	1	3	3	32,3%	21,8%	19,2%	17,6%	9,1%	2	1	3	3
Easy to use interface	8,8%	7,5%	22,7%	33,4%	27,6%	4	4	2	1	5,3%	7,2%	26,4%	35,1%	26,1%	4	4	2	1

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