Mobile Service Substitution on Modern Smartphones: Case Facebook

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Abstract

Social media services, including Facebook, have recently grown to be a substantial part of everyday communication for hundreds of millions of people. Mobile technology has evolved to a point where a modern smartphone can be constantly connected to the Internet, facilitating straightforward communication via mobile social media services. This can introduce service substitution, where users communicate through these services instead of mobile operator provided calling or SMS services. In this article, we have studied Finnish Facebook users and their mobile Facebook usage with quantitative methods. Based on a review of the existing research, seven hypotheses are proposed of which six have statistical differences when comparing modern smartphones and older phones. Using this comparison, the results include evidence of Facebook mobile being a substitute to the traditional calling and text message services, as well as the importance of push notifications. Based on the results, further research areas are proposed.

Keywords: Social media services; Mobile application usage; Service substitution

1   Introduction

The social media services of today have an important role in the everyday life of millions, if not billions of people. Many mobile social media services have been introduced during the recent years, rapidly gaining popularity. The technology has matured to enable useful mobile-specific features to attract users. At the same time, always-on mobile data connections and pricing plans have started to become more and more common. Mobile social media services can now be seen as potential substitutes to traditional mobile phone calls and text messages, and they truly have the potential to disrupt the core business of network operators.

The currently largest social media service, Facebook, has grown its user base to become a substantial communications medium with over 1.23 billion users as of December 2013. Even more interestingly, Facebook is reporting to have over 945 million mobile users as of December 2013 (Facebook, 2014a). With such a large user base, Facebook is bound to cause changes to the communication habits of people. Given the recent purchase of competitor WhatsApp in February 2014 (Facebook, 2014b), Facebook's strategy seems to have a very strong focus on mobile applications. Different devices allow the services to be used in different ways. This study is focused on finding differences in Facebook usage with modern smartphones and older phone models.

2   Background literature and hypotheses

2.1   Social media service research

The research of social media services has increased lately for quite a lot, even though the large-scale phenomenon is relatively new. A large part of the research, however, has concentrated on presenting novel services (Yu et al. 2011, Boix et al. 2011), which might stay as experimental and not have an impact on the society as whole. As Facebook's user base is massive, research concerning it is of great interest. Some studies have been published about the motivations on using Facebook, such as the one by Ryan and Xenos (2011), which extensively studies the characteristics of users and the different features, but does not include the mobile features. An interesting and novel comparison between history, the Hubble telescope and Facebook was presented as well (Vacker and Gillespie 2013). In the paper, Facebook users are seen as wanting to be in the center of everything and their walls seen as creating a permanent story into the time and space of the cyberspace, although the Hubble telescope takes pictures, which prove that humans are in the center of nothing.

As the mobile social media services are relatively young, research on them is sparse. Studies have been published which discuss the motivation of using mobile social media services in general (Lin and Lu 2011, Gao et al. 2012, Cui and Wang 2012). Foursquare, a significant social media service intended only for mobile devices, has been studied as well (Lindqvist et al. 2011). Some studies regarding the access of social media services from the mobile phone's native interface have been published (Cui and Honkala 2011, Karikoski and Mäkinen 2012), which have shown that users would be interested in such integration. Facebook mobile, on the other hand, has not been studied very much. A study on the influence of gender and English proficiency was published in 2011 (Leong et al. 2011).

Since Facebook can be used on the mobile phone wherever the user is, and technology evolution has enabled quicker access to Facebook, we propose the hypothesis one. De Reuver et al. (2011, 2013) have argued that people like to use similar services on their mobile phones as on the fixed Internet. We extend this argument to study whether the evolved phone technology has made Facebook on mobile phones so attractive that it is used even when a fixed Internet computer would be available. Additionally, we compare the usefulness of Facebook mobile on modern smartphones and older phones.

H1. In mobile use, the status updates are made with a reference to time and space due to an interesting context to a higher extent with modern smartphones than older phones.

H2. Facebook is used on modern smartphones even when a computer would be available for use.

H3. Facebook on modern smartphones is considered to be more useful than with older phones.

Modern smartphones feature push notifications, which allow applications to stay in background while producing usually customizable notifications to the user popping up when something interesting happens. Push notifications are reported to be the biggest Minutes on Network Use (MoNU) contributor in mobile networks currently (Ericsson 2013). We propose the following hypothesis to test their effectiveness:

H4. The push notifications on modern smartphones reduce the need to check status updates manually.

2.2   Mobile service and substitution research

The usage of mobile services has been studied relatively much recently. One of the key enablers of novel mobile services has been the diffusion of new technical features, and a model for these has been published (Riikonen et al. 2011). A large-scale user study of the adoption of mobile services combined actual usage data with survey research (Verkasalo et al. 2010), though the data were already collected in 2007, and technical barriers are significantly different nowadays. In a more recent study (Bouwman et al. 2013), the differences between survey self-reporting and actual usage data were analyzed. The usage differences between age groups were studied recently in Finland (Haverila and Haverila 2013). Studies based on usage data have been published even more, such as one Nokia N95 based study with location- and time-specific usage patterns (Do et al. 2011), and one very large-scale study based on an Android background application (Böhner et al. 2011). In a recent study amongst Finnish students at the University of Vaasa, 99% of the participants used Facebook as one of their communication methods (Lindberg-Repo 2013). In addition, 83% used WhatsApp, which is a mobile-only direct SMS replacement service. WhatsApp was also recently studied with multiple methods in Spain, where WhatsApp messages are more conversational than SMS messages, but do come with privacy concerns (Church and de Oliveira, 2013). Mobile social media service scenarios were studied to find a framework for new service creation (Mäkinen and Luukkainen 2009).

Service substitution can be defined as the consumption of one service instead of another, both of which provide similar technological affordances to the users. Contemporary mobile service substitution research has mostly focused on the fixed to mobile access substitution (Pedersen and Ling 2003, Rodini et al 2003, Suárez and García-Mariñoso 2013). In the mobile context, however, the focus at the moment is in the possible substitution of operator provided calling and text message services by over-the-top (OTT) third party services over mobile Internet, ultimately reducing the operators to bit-pipes. This is what the cellular network operators fear the most, as currently in some parts of the world unlimited or packages with a very large amount of cellular data can be added to the mobile subscriptions for a nominal monthly fee. The amount of transferred mobile data has doubled between Q1/2012 and Q1/2013, as well as predicted to grow 12 times in six years (Ericsson 2013). Without doubt, the mobile network operators will attempt to restrict the data packages and some have already ceased to offer unlimited packages entirely. This leads to hypothesis five:

H5. A continuous use of Facebook on modern smartphones requires an unlimited data connectivity package or a package with a substantially large amount of data transfer for a fixed fee.

One significant factor in service substitution is the price of the services. As a possible substitute should in theory be as cheap as possible, the services should have other sources of income. Mobile advertisements are one possible source. In 2014, Facebook reported that its mobile advertisement revenue represented 53 percent of total revenue in Q4/2013 (Mukherjee 2014). It is thought however, that the users might not react positively to them, which is why we constructed hypothesis six:

H6. The increase of advertisements in Facebook Mobile on modern smartphones would discourage usage.

However, so far the results have shown that no substitution has been observed on user-level (Karikoski and Luukkainen 2011), even indicating that mobile data usage and calling minutes are complementary to each other (Gerpott et al. 2012). Church and de Oliveira (2013) concluded that WhatsApp is not a substitute for SMS and vice versa. A study on Rich Communication Services (RCS), operator-provided enhanced IP-based communication services, concluded that users are interested in group messaging, presence information and transparent device switching (Nikou et al. 2012), which are already available in the OTT services. The GSMA and European mobile operators with Orange in the leading role have launched joyn, an RCS based chat and file sharing service built-in to some mobile phones (Joyn 2014). Joyn can be thought as an attempt to recapture some of the OTT service usage to the operators. As mobile technology evolves and phones are continuously connected to the Internet, it can be anticipated that the consumption of third-party services becomes easier, which calls for more research in this field.

As the service substitution studies have been based on older smartphone platforms, we predict that the Facebook features running on modern smartphones can act as substitutes to traditional mobile services, i.e., calling and SMS services.

H7. Using Facebook on modern smartphones has reduced the usage of traditional mobile services, resulting in substitution.

3 Research method

To gain insight into Facebook usage on different devices, the study was conducted as a quantitative web-based questionnaire. The questionnaire was advertised using the Facebook advertisement platform to obtain as heterogenic sample as possible. However, this produced a self-selected sample since the participants were not selected randomly. The advertising was targeted towards Finnish adult audience, as the questions were in Finnish. These questions have been translated into English for this research article. The results were then analyzed using IBM SPSS version 21.

However, differences between self-reporting and mobile device log data have been observed (Boase and Ling 2013, Bouwman et al. 2013). In self-report studies, it is noted that users answer inaccurately to questions related to usage frequency due to several reasons. Little systematic reasons were observed, though, and categorical measurement had better results than open questions. In our study, we have used categorical measurement and comparison as the main method, so the self-report inaccuracies can be tolerated.

The main part of the questionnaire was a set of questions regarding Facebook usage habits on the mobile device, using a five-point Likert scale. In addition, the questionnaire contained background questions for demographic data as well as a set of questions designed to measure innovativeness (Goldsmith et al, 1995).

The questionnaire was pre-tested on individuals belonging to the target audience, and the questions were adjusted based on the feedback.

3.1 Sample size

The Facebook advertisement had a reach of 344974 Facebook users, each with an average of 6.7 impressions. Out of these, the advertisement was clicked by 649 users, which resulted in a click-through-rate of 0.028%. Finally, the survey had 102 complete answers.

3.2   Sample demographics

Demographics on the sample can be found in Tables 1-4

Age	Frequency	Percent
18-24	25	24.5
25-29	9	8.8
30-34	12	11.8
35-39	12	11.8
40-49	12	11.8
50-59	15	14.7
60+	13	12.7
Did not want to answer	4	3.9
Sex	**Frequency**	**Percent**
Female	59	57.8
Male	41	40.2
Did not want to answer	2	2.0
Occupation	**Frequency**	**Percent**
Employed	39	38.2
Unemployed	12	11.8
Student	26	25.5
Retired	12	11.8
Did not want to answer	13	12.7

Table 1: Age, sex and occupation of the participants

The age distribution was quite heterogenic, though the youngest category represented almost a quarter of the participants. This can be attributed to the gift card prizes drawn, which can be more attractive to the younger audience than the more elder one. The gender distribution was a positive surprise. If the survey had been advertised in a more generic university student population, the sample would have most certainly had a skew to the male population. Like the age distribution, the occupation distribution was very heterogenic, albeit not matching exactly the general Finnish population.

Length	Frequency	Percent
Less than 6 months	1	1.0
6 months – 1 year	4	3.9
1 year – 2 years	8	7.8
2 years – 4 years	46	45.1
Over 4 years	43	42.2

Table 2: How long the participants have used social media services

The participants were already relatively experienced social media service consumers. In this category, self-reporting can also lead to higher results due to the human nature as mentioned in Section 3. Reporting a higher or dense value is due to the social desirability bias.

Age	Frequency	Percent
Less than 6 months	36	35.3
6 months – 1 year	13	12.7
1 year – 2 years	18	17.6
2 years – 4 years	26	25.5
Over 4 years	9	8.8

Table 3: How long the participants have used social media services with mobile phones or tablet devices

This result was interesting due to the higher variance than social media usage in general. The explanation is the adoption of Facebook mobile due to the recent mobile phone evolution, especially when the highest density was in the less than six months usage category.

Friends	Frequency	Percent
1-50	24	23.5
51-100	15	14.7
101-200	25	24.5
201-300	11	10.8
301-400	12	11.8
401-500	6	5.9
501-	9	8.8

Table 4: How many friends the participants have on Facebook

The distribution of the number of friends can be considered to be heterogenic and very typical of Facebook users. According to Facebook, the average amount of friends has been 190 in May 2011 (Ugander et al. 2011).

The users were split into two groups based on their phone model, in order to distinguish between users with relatively new smartphones (Android 2.2 or newer, iPhone, MeeGo and Windows Phone 7/8) and older phones with limited support for background usage (e.g., Symbian). The modern smartphone group had an n=59 and the older phone group had an n=43.

4 Empirical results

4.1 Research hypothesis one

This hypothesis was tested with two questions – one for location-based status updates and one for activity-based status updates.

I create location-related status updates with Facebook mobile			
	Older phone model	Modern smartphone	Total
Strongly disagree	34	16	50
Somewhat disagree	4	18	22
Neither agree or disagree	3	19	22
Somewhat agree	1	6	7
Strongly agree	1	0	1
Total	43	59	102

	Value	df	Asymp. Sig (2-sided)
Pearson Chi-Square	29.821	4	.000
Likelihood Ratio	32.066	4	.000

Four cells (40.0%) had an expected count of less than five. Even if p=0.000, the hypothesis cannot be statistically confirmed with this question due the distribution of the answers.

I create activity-related status updates with Facebook mobile			
	Older phone model	Modern smartphone	Total
Strongly disagree	33	14	47
Somewhat disagree	4	18	22
Neither agree or disagree	5	20	25
Somewhat agree	0	5	5
Strongly agree	1	2	3
Total	43	59	102

	Value	df	Asymp. Sig (2-sided)
Pearson Chi-Square	29.130	4	.000
Likelihood Ratio	31.930	4	.000

Four cells (40.0%) had an expected count of less than five. Even if p=0.000, the hypothesis cannot be statistically confirmed with this question due the distribution of the answers.

4.2   Research hypothesis two

I use Facebook on my mobile phone even when a computer would be available			
	Older phone model	Modern smartphone	Total
Strongly disagree	33	17	50
Somewhat disagree	4	9	13
Neither agree or disagree	3	14	17
Somewhat agree	2	16	18
Strongly agree	1	3	4
Total	43	59	102

	Value	df	Asymp. Sig (2-sided)
Pearson Chi-Square	24.134	4	.000
Likelihood Ratio	25.829	4	.000

Two cells (20.0%) had an expected count of less than five. In this case as well, p=0.000, leading to a statistical difference between modern smartphone users and older phone users. This confirms the hypothesis that users with modern smartphones use Facebook on their mobile phones to some extent even when a computer would be available.

4.3   Research hypothesis three

This hypothesis was also tested using the Pearson's Chi-Squared test, split between the older and modern smartphone users.

The usage of Facebook on my mobile phone is greatly beneficial to me			
	Older phone model	Modern smartphone	Total
Strongly disagree	25	8	33
Somewhat disagree	1	5	6

Neither agree or disagree	10	14	24
Somewhat agree	4	23	27
Strongly agree	3	9	12
Total	43	59	102

	Value	df	Asymp. Sig (2-sided)
Pearson Chi-Square	26.606	4	.000
Likelihood Ratio	28.171	4	.000

Two cells (20.0%) had an expected count of less than five. In this case as well, p=0.000, leading to a statistical difference between users with modern smartphones and older phones. This confirms the hypothesis that Facebook on modern smartphones is considered to be beneficial to the end users.

4.4   Research hypothesis four

The phone's push notifications reduce significantly the need to manually check for status updates			
	Older phone model	Modern smartphone	Total
Strongly disagree	26	9	35
Somewhat disagree	1	12	13
Neither agree or disagree	11	17	28
Somewhat agree	4	17	21
Strongly agree	1	4	5
Total	43	59	102

	Value	df	Asymp. Sig (2-sided)
Pearson Chi-Square	26.849	4	.000
Likelihood Ratio	28.953	4	.000

Two cells (20.0%) had an expected count of less than five. In this case as well, p=0.000, leading to a statistical difference between modern smartphone users and older phone users. As only the modern smartphones enable push notifications, this confirms the hypothesis that the push notifications reduce the need to manually check for status updates.

4.5   Research hypothesis five

The need for having an unlimited data package or a package with substantial amount of data transfer was tested similarly using the Pearson's Chi-Squared test.

The size of my mobile subscription's data package affects my use of Facebook mobile greatly			
	Older phone model	Modern smartphone	Total
Strongly disagree	27	11	38
Somewhat disagree	2	4	6
Neither agree or disagree	9	12	21
Somewhat agree	1	14	15
Strongly agree	4	18	22
Total	43	59	102

	Value	df	Asymp. Sig (2-sided)
Pearson Chi-Square	26.141	4	.000
Likelihood Ratio	28.624	4	.000

Two cells (20.0%) had an expected count less than five. The p=0.000 confirmed that a statistical difference exists between modern smartphone users and older phone users, making the hypothesis correct.

4.6   Research hypothesis six

I would use Facebook on my mobile phone less if the service would have more advertisements			
	Older phone model	Modern smartphone	Total
Strongly disagree	23	12	35
Somewhat disagree	0	3	3
Neither agree or disagree	11	17	28
Somewhat agree	0	16	16
Strongly agree	9	11	20
Total	43	59	102

	Value	df	Asymp. Sig (2-sided)
Pearson Chi-Square	21.974	4	.000
Likelihood Ratio	28.832	4	.000

Two cells (20.0%) had an expected count of less than five. In this case as well, p=0.000, leading to a statistical difference that users with modern smartphones would use Facebook less if it had more advertisements. As usually only the modern smartphones allow the use of advertisements, the hypothesis can be confirmed.

4.7   Research hypothesis seven

This hypothesis was tested using the Pearson's Chi-Squared test, split between the older and modern smartphone users.

The use of Facebook on a mobile phone has replaced more traditional communication methods, such as calling or sending text messages			
	Older phone model	Modern smartphone	Total
Strongly disagree	27	10	37
Somewhat disagree	4	11	15
Neither agree or disagree	8	10	18
Somewhat agree	2	21	23
Strongly agree	2	7	9
Total	43	59	102

	Value	df	Asymp. Sig (2-sided)
Pearson Chi-Square	27.951	4	.000
Likelihood Ratio	30.448	4	.000
N of valid Cases	102		

One cell (10.0%) had an expected count of less than five. As p=0.000, the results are statistically conclusive that a difference exists between users with modern smartphones and older phone users. In practice, this means that Facebook has indeed been a substitute to calling and text messaging for some users. If considering both those who somewhat agree and those who strongly agree, the amount of users is 47.4% of the sample.

4.8　Summary of results

A summary of the hypotheses can be found in Table 5.

Hypothesis number	Hypothesis	Result
1	In mobile use, the status updates are made with a reference to time and space due to an interesting context to a higher extent with modern smartphones than older phones.	Not confirmed
2	Facebook is used on modern smartphones even when a computer would be available for use	Confirmed
3	The use of Facebook on modern smartphones is considered to be more useful than with older phones	Confirmed
4	The push notifications on modern smartphones reduce the need to check status updates manually	Confirmed
5	A continuous use of Facebook on modern smartphones requires an unlimited data connectivity package or a package with a substantially large amount of data transfer for a fixed fee.	Confirmed
6	The increase of advertisements in Facebook Mobile on modern smartphones would discourage usage.	Confirmed
7	Using Facebook on modern smartphones has reduced the usage of traditional mobile services, resulting in substitution.	Confirmed

Table 5: Summary of results

Six of the hypotheses were statistically confirmed. Even though hypothesis one had a *p=0.000* in both questions, the amount of participants was not large enough for it to be statistically confirmed.

5　Conclusion and limitations

As the study was done using a web-based survey, which was advertised on Facebook, important limitations exist. As mentioned in Section 3, self-reporting can lead to incorrect answers when frequencies are measured, compared to objective device report based studies. This survey was advertised towards Finnish adult Facebook users, i.e., to users who are 18 years old or older. The age limitation was due to the legal issues with minor-targeted advertisements. Thus, the results cannot be generalized across the world. However, compared to usual research where the sample consists of university students, this study represents a significantly larger population. Still, the results cannot be generalized to the entire population nor even Finnish Facebook users due to the relatively small and self-selected sample.

Given the limitations, this study provides answers to important questions regarding the use of Facebook on mobile devices. As shown in Section 3.2, the technological development on mobile devices has accelerated the adoption of Facebook Mobile. Additionally, with the features enabled by modern smartphones, Facebook is considered to be more useful than with older phone models. Push notifications provided by the mobile platform reduce the need for manual update checking, which have not been possible without a phone constantly connected to the Internet.

A significant advance in this field is the confirmation of service substitution. Though based on self-reporting, we claim that the substitution exists already to some extent. In previous studies, the older smartphone platforms used have not enabled service substitution easily enough for the end users (Karikoski and Luukkainen 2011) or the study has not differentiated between MI services, such as web browsing or instant messaging (Gerpott et al. 2011). As the sample represents a wide variety of end users and not just early adopters, this result is important for both the network operators and OTT service providers. The mobile network operators need to focus on enhance their own services to meet

the current demand, or alternatively co-operate with the OTT service providers to be part of their value network. As Facebook Mobile is not the only service with substitutive features, further research in other similar services as well is needed to extend these results.

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