What's up with WhatsApp? Comparing Mobile Instant Messaging Behaviors with Traditional SMS

Karen Church
Telefonica Research
karen@tid.es

Rodrigo de Oliveira
Telefonica Research
oliveira@tid.es

ABSTRACT

With the advent of instant mobile messaging applications, traditional SMS is in danger of loosing it's reign as the king of mobile messaging. Applications like WhatsApp allow mobile users to send real-time text messages to individuals or groups of friends at no cost. While there is a vast body of research on traditional text messaging practices, little is understood about how and why people have adopted and appropriated instant mobile messaging applications. The goal of this work is to provide a deeper understanding of the motives and perceptions of a popular mobile messaging application called WhatsApp and to learn more about what this service offers above and beyond traditional SMS. To this end, we present insights from two studies — an interview study and a large-scale survey — highlighting that while WhatsApp offers benefits such as cost, sense of community and immediacy, SMS is still considered a more reliable, privacy preserving technology for mobile communication.

Author Keywords

Short Message Service, SMS, WhatsApp, Mobile Instant Messaging, Text Messaging, User Study, Interview, Survey

ACM Classification Keywords

H.5.m. Information Interfaces and Presentation (e.g. HCI): Miscellaneous

General Terms

Human Factors; Measurement.

INTRODUCTION

Since it's creation over 20 years ago, SMS or Short Message Service has revolutionized the way we communicate. In 2011, 7.8 trillion SMS messages were sent globally[1], highlighting that SMS is a mass communications medium used by billions of people around the globe. In recent times, however, a new wave of mobile communications services called *mobile instant messaging (MIM) applications* have gained considerable momentum. Applications like *WhatsApp*, *Viber* and *Line* allow mobile users to send real-time text messages to individuals or groups of friends at no cost. Driven by the evolution and rise in smartphones, along with the decreasing cost and convenience of mobile data plans, it is forecast that these MIM applications will continue to grow unabated and ultimately lead to significant decreases in SMS traffic[2].

There is already a vast body of research aimed at understanding how and why people, in particular teenagers, have adopted SMS communication in their daily lives. Using both quantitative and qualitative approaches, researchers have explored various factors behind the adoption, usage and language of SMS messages across different countries and demographics [15, 8, 10, 7, 5, 4, 3, 14, 1]. While this body of research has revealed interesting insights and helped informed the design of technologies that support text messaging, in contrast, our current understanding of MIM applications is very limited. If we can investigate which factors influence the acceptance, usage and growing popularity of MIM applications, in particular when compared to SMS, we can offer valuable insights into real-world usage and inform the design of new mobile communication technologies.

One of the most interesting MIM applications on the market today is *WhatsApp*[3]. WhatsApp is a cross-platform instant messaging application for smartphones. It enables users to send and receive location information, images, video, audio and text messages in real-time to individuals and groups of friends at no cost. At present WhatsApp handles over 10 billion messages per day[4] and is one of the most popular paid-for apps across all mobile platforms. Given the availability of WhatsApp across multiple mobile platforms and the fact that it has reached a critical mass of users, it provides us with an excellent opportunity to investigate how people really use such applications and how the messaging practices adopted in such services differ from traditional SMS.

In this paper we highlight key differences in the perceptions and motives of use between *WhatsApp* and *SMS* via an interview study and a large-scale survey. Our results show that adoption and usage of these services is influenced by a range of factors including cost, intent, community, privacy, reliability and expectation. While cost significantly impacts people's frequency of usage, social influence is one of the main reasons for today's migration to such MIM applications. We discovered strengths and drawbacks to both technologies, high-

[1]Mobile Messaging Futures 2012-2016, `http://bit.ly/QTVbQJ`

MobileHCI' 2013, August 27 - 30, 2013, Munich, Germany

`http://dx.doi.org/10.1145/2493190.2493225`

[2]SMS will remain more popular than mobile message apps over next five years, `http://bit.ly/KPGyyF`

[3]WhatsApp, `http://www.whatsapp.com/`

[4]WhatsApp hits new record with 10 billion total messages in one day, `http://tnw.co/TXjbqa`

lighting that neither is a substitute for the other. Finally we provide insights into how mobile users currently handle the abundance of mobile notifications generated by messaging services like SMS and WhatsApp, highlighting that more research is needed in this space so we can design better mobile notification services.

SMS VS. WHATSAPP

SMS is a ubiquitous capability built into the GSM wireless standard which allows short 160 character text messages to be sent to and from any GSM mobile handset, regardless of service providers. SMS has since evolved to include messages containing image, video, and sound content. Known as MMS or Multimedia Messaging Service, these tend to cost more than simple text messages.

WhatsApp on the other hand (see Figure 1), is a MIM application for smartphones. It allows you to send and receive images, video, audio and location-based messages to individuals or groups of friends using your pre-existing data plan and at no cost. WhatsApp requires a mobile internet connection to function and both parties must have the proprietary software installed on their mobile phone. WhatsApp also provides additional social information to its users, e.g., contacts can see when their friends are online, when they are typing and when they last accessed the application. Finally, WhatsApp provides delivery notifications, highlighting when a message is sent and when its delivered to the recipients device.

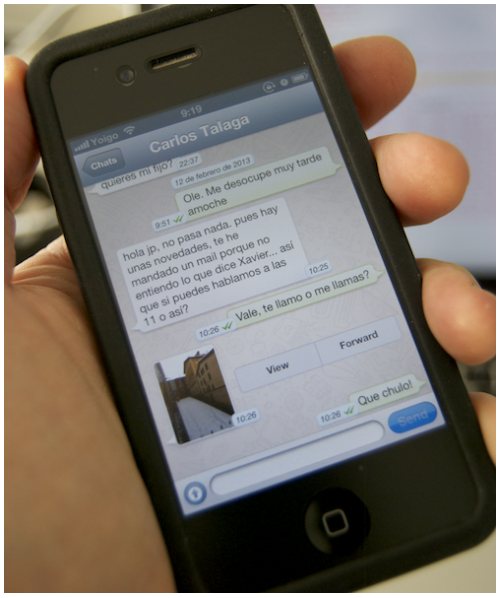

Figure 1. Illustrates a WhatsApp conversation between participant John and his friend where an image was shared. Note the 2 green ticks beside each message sent indicating the successful delivery of the message.

RELATED WORK

As text messaging has soared in popularity over the past decade, numerous studies have been conducted to understand how and why SMS has weaved itself into daily mobile communication practices [15]. The vast majority of these studies have focused on the texting habits of teenagers. While the earliest of these studies date back to over a decade ago [5, 10, 8], more recent reports highlight that text messaging is still a key media type in the daily lives of young people[5].

The research to date has spanned various countries including Finland[8], Norway[10], Japan[7], the UK [5, 4, 3, 14] and the US[1]. While some differences have been found in text messaging habits across teenagers in these countries, all studies have shown that SMS is generally used primarily among close-knit friends or peers. Factors including cost, ease of use, social connection and the lightweight nature of text messaging have attributed to the increased adoption of SMS among teenagers [7, 5]. Teenagers employ text messaging for general chatting, planning and coordination [5] as well as for gift-giving rituals where certain text messages as exchanged as gifts among friends [14]. The general expectations among teenagers is to receive immediate responses to their messages [10]. Aside from patterns in communication, other research has explored how text messages are formulated and the language employed, focusing on written norms including abbreviations and slang [4].

Not all past work has focused solely on the texting habits of teenagers. For example, Kim et al. [9] highlighted that young people and older people use texting in different ways. Other research has explored the interactions between texting and other forms of communication. For example, both Reid and Reid [12] and Rettie [13] highlighted differences between *Talkers* and *Texters*, with texters preferring to send messages rather than communicating over the phone due to feelings of discomfort. Häkkilä and Chatfield [6] explored the perception of privacy of SMS, highlighting that people expect the receiver to understand the level of privacy from the message context. Similarly, Marques et al. [11] explored attitudes towards privacy and secrecy in text messaging and the strategies used to cope with these issues. The majority of these studies have taken a qualitative approach using interviews, diary studies, surveys and focus groups. One of the most recent studies by Battestini et al. [1] reports a quantitative analysis of almost 60,000 SMS messages collected over a 4 month period in the US. The authors classified these messages into almost 9,000 conversations and highlighted that conversations are often continued via other services, e.g. email.

Recent work has focused on the dynamics of text messaging habits among *smartphone users*. Do et al. [2] conducted a large-scale study with 77 users over a 9 month period, showing that SMS is the most frequently used application among their smartphone user sample. Tossell et al. [16] conducted a longitudinal study focusing on use of emoticons in the text messages of iPhone users, highlighting a lack of emoticon use overall (only 4% of messages), while some differences among gender were identified.

Overall, the research to date has revealed interesting insights into text messaging habits. In contrast, our current understanding of MIM applications is very limited. To the best of our knowledge, the work presented in this paper is the first to explore how and why people have adopted and appropriated MIM applications, specifically WhatsApp and how messaging practices differ between WhatsApp and traditional SMS.

[5]Nielsen, "How Teens Use Media", June 2009, See: `http://bit.ly/c2km3`

PHASE 1: INTERVIEWS

We began our research with a broad investigation into the use of SMS and WhatsApp, focusing on how people have adopted these messaging services in their daily lives. In this phase, we wanted to understand the motives and perceptions of usage, the value found in these services, and what circumstances one service is used or preferred over another.

Participants

We interviewed 9 active WhatsApp users, 5 men and 4 women, all living in Spain. We recruited people with diverse professions and attitudes towards technology and we sought to include a mix of individuals who we expected to use mobile communications frequently. Aside from WhatsApp, most participants had other messaging applications installed on their mobile phones (e.g. Facebook, Facetime, Skype, Viber, Tango and TuME). See Table 1 for participants details.

Interviews

Interviews were semi-structured, open-ended and covered three topics: (a) a review of daily mobile communications needs and use of mobile messaging applications in general, (b) the perceived value of WhatsApp, the reasons for adoption and history of usage, and (c) the motives and intent of using both WhatsApps and SMS for communication focusing on factors like cost, social interaction, trust and privacy. The interviews lasted from 30 minutes to one hour, depending on the scope and diversity of participants use of mobile messaging. Participants were given a 30 euro gift voucher (40 USD) for taking part.

The interviews were recorded via audio and photos were captured of participants' mobile phones, specifically the organization of mobile messaging apps on their phones. All interviews were then transcribed and the transcripts were analyzed in an iterative manner to extract emergent themes. This iterative approach took a number of rounds of analysis to identify and cluster reoccurring themes. The result was 8 themes, namely: cost; social influence; nature/intent; community & sense of connection; immediacy, privacy concerns & expectations; reliability & guarantee; choice of technology and coping mechanisms.

#	Name	Age	M/F	Job	Joined
P1	John	36	M	PhD Student	2 years
P2	Mike	29	M	Mobile developer	2 years
P3	Oliver	35	M	HR Development	2 years
P4	Cathy	24	F	HR Intern	2 years
P5	Laura	45	F	Teacher	3 months
P6	Beth	36	F	Business owner	2.5 years
P7	Dean	31	M	Researcher	1 year
P8	Eric	40	M	Project manager	3 years
P9	Ann	30	F	Personal Assistant	2 years

Table 1. Demographic information of participants from study phase 1. The joined column relates to how long each participant has been using WhatsApp. Note that pseudonyms are used to protect anonymity.

Findings & Discussion

In the following section we discuss aspects of the 8 themes that emerged from the interviews.

1. Cost

WhatsApp advertises itself explicitly as a mobile messaging app which allows the exchange of messages *without having to pay for SMS*. As such it is not unsurprising to find that all 9 participants indicated that one of the most valuable aspects of WhatsApp is cost. However, when we probed participants on this economic factor in more detail, we discovered that cost was at times multi-dimensional. The motivation for using WhatsApp was not just down to the cost incurred by the person in question, but rather the cost incurred by others as well. For example, in the case of Ann the fact that her primary phone was a company phone and paid for by work influenced her feelings of usage, *"I try not to use it with family and friends because of the cost for the company"*. While cost was no longer important to Dean, it remained important for others in his life, *"Using WhatsApp is a guarantee the other party won't pay. I might not care. And now I don't care because sending SMS for me is unlimited but maybe other people care. I do want to participate in a messaging experience where others don't have to pay"*. The cost incurred by the recipient was an important consideration among all interview participants who don't currently pay for SMS.

2. Social Influence

Most of the participants heard about WhatsApp from friends. In many cases the application was recommended to them which instigated their migration to WhatsApp. However, for a number of the participants, social influence appeared to play a key role in terms of their adoption of WhatsApp. For example, Laura one of the newest users of WhatsApp, bought her smartphone explicitly for WhatsApp because *"all my friends were on it"*. Likewise, Cathy who despite being a long-term user of WhatsApp was the last among her group of friends to adopt WhatsApp. She expressed feelings of pressure from her social circle to install the app, e.g. *"I don't really use the latest things. I was using SMS and everyone had WhatsApp and everyone was saying, you are the last one and it costs money to talk with you so get WhatsApp"*.

3. Nature/Intent

Given that WhatsApp messages are free and not limited in terms of characters and content, it's not unsurprising to learn that all of the participants felt that they send a lot more messages with WhatsApp, especially when compared to SMS. WhatsApp was seen as more conversational in nature, more fluid and more natural when compared to SMS. Cathy, for example made comparisons to face to face conversations, *"With WhatsApp maybe you type more, but the conversation is more fluid. You type a sentence and someone sends a sentence and then you type another one. I have the feeling that if it's WhatsApp, it's an open conversation. It is similar to if you were talking in person"*. In contrast SMS was associated with having to say something very specific and trying to fit all information into a single packet due to cost, which at times felt unnatural. For example, Oliver commented, *"I can say much more things than 120 characters and I don't have to think about the whole message. I can be more natural"*. Likewise Mike mentioned, *"With SMS you have to be very concise because no-one*

wants to spend, even if it's very cheap. No-one wants to exchange 10 or 20 messages in SMS".

In terms of the intent of WhatsApp messages, our findings are in line with past work on text messaging [5]. WhatsApp, like SMS, is used for chatting, quick catch-ups, coordination and planning as well as sharing personal news and life events. Participants highlighted heavy use of WhatsApp for planning and coordination of social activities *on the fly*. For example, Laura mentioned *"I would definitely use it more for chit-chat, banter stuff, back and forth. I definitely use it more for planning than with SMS because of who's on it."*. Beth made similar distinctions but really emphasized the use of WhatsApp in her social life, *"I think it's a form of a quick catch-up, almost like instant message. Also to arrange social things constantly. I think that probably more than anything is arranging social things"*. While Oliver focused on the use of WhatsApp for arranging last minute things, *"We don't have to plan 3 days in advance. We can plan it on Saturday for Saturday evening. It's instant"*.

We also probed participants about the types of messages they exchanged beyond simple text. All participants indicated that they have sent images with WhatsApp. These photos were mainly linked to *silly things* or *jokes*. Media of this type was most commonly associated with communication among *groups* in WhatsApp. When asked about sharing media via MMS, all participants indicated that they had either tried it once or rarely use it due to perceptions of high cost associated with MMS. Images were not the only media type shared with WhatsApp. Participants mentioned videos, webpages, contact information and even location information. For example, one of the features that attracted Mike to WhatsApp was the location capability: *"With WhatsApp I can send the current location. This for me is really nice. If you are at some place and meeting with someone at a specific point, you can send 'I am here' and the person has the exact location of where you are"*.

4. Community & Sense of Connection

A number of social themes emerge from the interview data. Firstly, WhatsApp is used primarily with close friends, friends and sometimes family. SMS is seen as a more formal means of communicating or as a means of communicating with people who simply don't have WhatsApp. For example, Beth commented *"WhatsApp for me is very informal so it's friends and family. SMS is formal, with clients and then my friends and family who don't have WhatsApp"*. Likewise, Ann said, *"I think SMS is a more formal tool of communication. If I get a WhatsApp or an SMS at the same time I would assume the WhatsApp is from my husband and the SMS is from my boss"*. While Erik made the distinction of WhatsApp being more personal, *" I don't know why but for me to use WhatsApp I have to have a previous relationship with the person. It seems more personal"*.

Participants also expressed feelings of increased sense of community and connection on WhatsApp. For Cathy, the most valuable part of WhatsApp is: *"this sense that everybody's there"*. For Laura the most valuable aspect is: *"All my friends are on it"*. Likewise, Erik commented *"my community is here, my relationships are here, so it's easy to keep in contact"*. While all of the participants' friends also have the ability to SMS, participants didn't feel the same sense of community with traditional text messaging.

Finally, we found the creation and use of groups was a regular occurrence for most of the participants (8 out of 9 used this feature). Groups mentioned in the interviews include: a roommates' group, a colleagues' group, a father's group, a family group, as well as groups for specific social events, e.g. a basketball game. Most participants actively used WhatsApp groups to arrange social events. In general, the groups facility was seen as a very convenient way of connecting with smaller communities all at once. For example, before WhatsApp, Oliver only spoke to his brothers and sisters once every couple of months because it normally involved a 1 hour phone call. They have now setup a group which allows them to communicate and share news regularly without the pressure of having to commit over an hour of anyone's time: *"we have changed the way of saying important things. We don't say it through a call, we don't say it through an email, we send a WhatsApp"*. However, there was one issue. Even participants who actively use groups on WhatsApp pointed to message overload problems. For example, Cathy described her university classmates group which consists of around 8 girls where at times she feels there are too many silly messages shared. Likewise Laura, who is part of a group of girlfriends expressed similar frustrations, *"there's been a few times where it's bothered me...the ease with which people message, it's like they hadn't edited or thought about what they were saying. It's just blah"*.

5. Immediacy, Privacy Concerns & Expectations

The general feeling of participants is that WhatsApp is quicker and more immediate when compared to SMS. Cathy likened this to people being more aware of WhatsApp than SMS *"I tend to think that SMS is not as fast as WhatsApp. I don't know why but I think maybe people are more aware of WhatsApp and not so aware of SMS"*. While Oscar likened this to feelings that WhatsApp messages will always be read, *"It doesn't need to be answered in that moment but I know you're going to read it"*.

As mentioned previously, WhatsApp provides status information that is not available in SMS. You can see when a person is online, when a person is typing and when the person last accessed the application. Given this information is somewhat revealing, we asked participants if they had any privacy related issues in using WhatsApp. Only one of the participants expressed privacy concerns with the last access facility in WhatsApp. Laura indicated that *"it seems like an invasion of privacy or something to the other person.* For Dean, the ability to see this information wasn't a privacy issue, but rather a source of frustration, *"people read too much into when you're online and when you replied to messages or why you didn't reply and they try to guess why and sometimes this is annoying"*. In fact Dean was the only participant who disabled the ability for others to see when he last accessed the application.

What proved to be a more pressing concern for participants was the *delivery* of WhatsApp messages. WhatsApp uses

green ticks to convey delivery information to the end user (Figure 1). According to WhatsApp, 1 tick means that the message was sent from the end users phone, while 2 ticks means that the message was delivered to the recipients phone. The perception of these 2 ticks was a source of confusion for many of the participants, e.g. 7 out of 9 participants thought that 2 ticks meant that the message was actually read. At times this created feelings of pressure to respond to the message. Beth highlighted, *"I don't like it very much because if I don't want to answer straight away, I don't want them to know that I've seen the message"*. Similar issues were identified in past work regarding *read receipts* in emails [17].

This visual delivery feedback, along with the status information provided by WhatsApp also appeared to play a role in terms of expectations of a response to messages. For some participants, knowing when a recipient was online or last accessed the application lead to frustrations when they don't receive an immediate response to their messages. For example, in the case of Ann, *"If I send a message and you are busy at least answer and say that you're busy....If you're offline then I don't expect but if you're online, it sort of means that it's in front of you and you are doing other stuff and you are ignoring me..."*. Cathy expressed similar frustrations, *"My boyfriend never answers WhatsApp, never. He doesn't answer anyone. He's not aware of his phone. I'm always checking mine, he's not. If I send a WhatsApp to him, I check for the 2 ticks and if I don't get a reply, then I think but he read it!"*. For others, expectations of a response depend on the nature of the message. For example, Dean mentioned, *"If I started a conversation and it's something urgent, then I expect them to respond immediately. If the message isn't important, I personally don't care. I think people respond whenever they find time or whenever they feel like it"*.

6. Reliability & Guarantee

Participants had mixed perceptions in terms of reliability when comparing WhatsApp and SMS. 6 of the 9 participants thought that SMS was more reliable and that their messages would always be delivered to the recipient. Ann associated this guarantee with the fact that SMS was a paid service, *"Since you pay for it there is someone behind it making sure that it's more reliable than a service you don't pay for"*. For others, the fact that SMS was an older, more mature service played a role. For example, Erik commented, *"It's a very mature service. All the problems for me in terms of delivery messages in SMS are solved. SMS is an old friend, something you believe in"*.

In the majority of cases, past problems with one service or another played a key role in terms of user perceptions towards the reliability of that service. For example, Laura has encountered many problems sending SMS messages to two friends in particular, *"Definitely with WhatsApp it's more guaranteed because I get quite a few failure things with SMS. The failure notices really bug me"*. Likewise, John has experienced delays with SMS that lead to feelings of mistrust, *"It's happened to me that I've sent messages and they arrived very late, like 1 day or 2 days late"*. Mike expressed similar feelings and felt the visual feedback provided by WhatsApp increased his perception of trust, *"I never had much trust in the delivery of SMS. I know that most times it works but there isn't any way to know if it was delivered or not. So this thing of WhatsApp, knowing that it was really delivered, that the person read what you sent or not, I think this kind of information is useful"*.

7. Choice of Technology

Given all participants had access to both SMS and WhatsApp, we were interested in learning more about how they choose to use one communications medium over another. For most, the decision starts with whether the receiver uses WhatsApp, i.e. if the recipient uses WhatsApp they would generally choose to use WhatsApp. Our participants appeared to have a clear mental picture of which friends use WhatsApp versus which friends use SMS. For others the decision relates to whether the communication is formal or informal. For example, Beth wouldn't use WhatsApp with clients, *"If I'm trying to get in contact with someone who's not a client, I would probably look on the list of WhatsApp to see if they're using it and contact them on that. As long as it's not a client"*. For others, the choice is down to whether they want the message to be delivered immediately. And in such cases, they choose SMS. For example, in the case of Dean, *"If I want to make sure it's delivered now, I will send it through iMessage or SMS. If I don't care about this or the other guy doesn't have iMessage I will send it by WhatsApp"*.

8. Coping Mechanisms

Both SMS and WhatsApp proactively notify users of incoming messages. These notifications are typically an audio signal, a vibration, or a visual signal. All of the participants had additional communications applications installed on their phones including Facebook, Skype and Viber. These applications also use proactive notifications to inform users of new messages. Participants who use such tools on a frequent basis are likely to be inundated by notifications. As such we wanted to learn more about how users configure their mobile phones to cope with mobile notifications and sources of mobile interruptions. We found that 5 of the participants almost always switch their phone to silent mode. In this case, the vibration mode is on but there is no audio signal. One of the issues with this coping mechanism is that most of the participants don't remember to turn the audio signal back on, leading to missed notifications and calls. A further 2 participants tend to have the audio signal enabled, except when in meetings or at night when they switch the phone to silent mode. Other coping mechanisms that emerged included switching the phone off completely, in particular at night to avoid too many notifications. This was the case with Laura, e.g. *"I used to put it on silent and then the vibration would kind of wake me up. Weird but it would because I'm a light sleeper and [a friend] sends messages at any old time. She's the reason I turn off my phone"*. Finally we discovered that John turns off all his data and internet connections while at work to avoid interruptions.

In summary, we saw several repeated themes emerge from the interviews related to cost, social factors, intent, privacy, expectations, reliability and guarantee. We chose to probe these issues more deeply with a large-scale survey, focusing on explicit comparisons between SMS and WhatsApp.

PHASE 2: SURVEY

We designed and deployed an online survey to further explore our main findings from phase 1, this time at a larger scale. The survey asked participants about their motivations for using WhatsApp versus SMS, their contexts of use, perceived value of both technologies, as well as users' perceptions in terms of ease of use, privacy, reliability, and social connection provided by these mobile messaging tools. Next we describe the methodology for this second phase.

Procedure

We advertised the user study recruitment phase on the front page of a famous web portal in Spain and collected an initial pool of candidates. Later on we sent email invitations to those candidates who: (1) have at least one mobile phone with data plan, (2) use their primary phone to send and/or receive text messages—among other things, and (3) have at least tried using WhatsApp and SMS in the past. Those who answered the entire survey were eligible to enter a raffle draw of three prizes of 100€ each (135 USD).

Participants

A total of 131 subjects (61 female) living in Spain signed up and answered all questions of the online survey. The sample is quite varied in a number of aspects. It includes participants from 20 to 60 years old ($\bar{x} = 33.7$, $s = 7.3$), covers all ranges of educational levels (from people that finished primary school to those who earned a PhD degree), as well as different jobs (*e.g.*, technicians, students, merchants, managers, entrepreneurs, police officers, doctors, *etc.*). Most participants had a close partner (36.6% married, 35.9% single in a relationship) and 27.5% were not in a relationship (single or divorced).

As per our recruitment criteria, all participants had at least one mobile phone (63.4%), while some reported use of two phones (33.6%) or three phones (3%) on a daily basis. While the majority reported using an Android phone (53.8%) as their primary phone, iPhone users accounted for 40.1% of the sample. The remaining 6.1% were either Blackberry or Windows Mobile phone users. Over half of the sample (54.2%) had a phone contract that requires them to pay for every SMS sent, whereas the remaining did not have to pay for sending text messages (37.4% had a free-SMS contract, 8.4% had someone or a company pay for SMS sent). All participants were users of both WhatsApp and SMS. In addition, most of them reported having other text messaging applications installed on their phone (*e.g.* Facebook: 78%, Skype: 52%, Line 8%, and TuME: 7%).

Results & Discussion

In this section we present the survey results grouped by the eight themes identified in the interviews.

1. Cost

Cost is indeed a major factor that influences people's behavior when using mobile messaging applications. In the survey we looked at it from two perspectives: (1) inquiring subjects about their *expected behavior* in the case of not having to pay for using SMS or WhatsApp, and (2) analyzing subjects' *actual reported behavior* grouped by participants that pay for using SMS ($N = 71$) versus those who do not pay for using SMS ($N = 60$)—from hereon called *SMS payers* and *SMS nonpayers* respectively. Note that SMS nonpayers are users who either (1) do not pay anything for their mobile phone plan, i.e. in the case of a company phone which is paid on their behalf or (2) have a free-SMS contract where they pay a flat rate monthly fee for their mobile phone plan which entitles them to unlimited text messages. Thus they are not charged per SMS message sent. The average age of the subjects in the SMS payers group was 33.9 vs. 33.4 for non payers ($s = 0.87$ vs. $s = 0.94$ respectively). 46.5% of the SMS payers were male compared to 61.7% for nonpayers[6].

When looking at *expected behavior*, we observed that the majority (57.7%) of the SMS payers believe they would not change their frequency of SMS usage even if SMS was free ($\chi^2 = 19,803$, $p < .001$). Moreover, there was no significant difference between the number of SMS payers who expect to use free SMS more often versus less often (25.4% vs.16.9% respectively; $\chi^2 = 1,200$, $p = .27$). These results further extend those from study phase 1 revealing that most SMS payers do not expect to change their frequency of SMS usage even if cost is no longer a factor.

When analyzing our participants' *actual reported behavior*, we observed a clear difference between SMS payers and nonpayers. At least three points are worth mentioning. The first point is related to the influence of cost when sending messages to contacts geographically dispersed. We found significant negative associations between paying for SMS and sending SMS to contacts in the same city ($\phi = -.23$, $p = .01$), in the same country ($\phi = -.18$, $p = .04$), and abroad ($\phi = -.19$, $p = .03$). This indicates that SMS nonpayers use SMS with more remotely-located contacts than SMS payers do. However, the need to pay for using SMS does not have a significant impact on contacting more people in the same city, country, or abroad using WhatsApp. This finding reveals that SMS payers do not necessarily have more remotely-located contacts in WhatsApp compared to SMS nonpayers.

The second important point is related to how cost affects the frequency of using SMS and WhatsApp. We found significant negative correlations between paying for SMS and frequency of SMS usage with clients ($\rho = -.35$, $p < .01$) and for business purposes ($\rho = -.22$, $p = .03$). Conversely, we found significant positive correlations between paying for SMS and frequency of WhatsApp usage with family members ($\rho = .20$, $p = .03$) and for planning/coordinating social activities ($\rho = .18$, $p < .05$). In other words, when compared to SMS payers, those who do *not* pay for using SMS tend to use SMS more often with formal contacts and use WhatsApp less often with informal contacts.

The final point relates to how cost influences people's perception of the most valuable aspects of SMS and WhatsApp. While the majority of SMS payers (40.8%) reported not seeing any value in SMS compared to WhatsApp, this proportion reduced by half when inquiring SMS nonpayers (21.7%). In

[6]Note the difference between males in SMS payers vs. SMS nonpayers is not significant. Also there is no significant association between gender and payer (male/female and nonpayer/payer: $\phi = .15, p = .083$).

fact, the majority of SMS nonpayers reported that the most valuable aspect of SMS compared to WhatsApp is privacy (38.3%). We have two hypothesis that could explain this finding: either SMS nonpayers care more about their privacy than SMS payers, or the difference in cost between these mobile messaging applications can significantly bias people's perception of the true value of these technologies in their daily lives. We would like to explore this in future work.

2. Social Influence

Social influence was identified in study phase 1 as an important factor for the adoption of WhatsApp. In this second phase, we asked people how long they have been using WhatsApp. The majority of our participants reported their WhatsApp *lifetime usage* as 1-2 years (43.5%) or > 2 years (43.5%). Interestingly, we found a significant negative correlation between people's age and how long they have been using WhatsApp ($\rho = -0.26$, $p < .01$). This finding reveals that younger adults adopted WhatsApp before older ones. We found significant negative correlations between people's WhatsApp lifetime usage and how often they use SMS with family members ($\rho = -.24$), friends ($\rho = -.24$), close friends ($\rho = -.24$), as well as with their partner/spouse ($\rho = -.27$). That is people who have used WhatsApp for longer, communicate with close contacts less via SMS, highlighting that younger adults might have imposed a strong social influence on their close contacts towards migrating away from SMS. These findings corroborate that—besides cost—social influence has been one of the main reasons for the migration to WhatsApp.

3. Nature/Intent

We asked participants about how often they use either SMS or WhatsApp for six different intents which emerged during the interviews from study phase 1: *chatting*, *planning/coordination* of social activities, *sharing* personal news, interacting with *groups* of people, *business/work* related communications, and receiving *ads* (see Figure 2 for detailed results). When compared to SMS, WhatsApp is used significantly more often for all categories of intent ($p < .001$). With respect to which intent occurs more often, we found that 89.6% of the participants that use WhatsApp for chatting, reported using it at least once a day to chat with other contacts. This is the most frequent use of WhatsApp as all of the remaining intents occur less often and we found significant differences between medians of frequency of use ($p < .001$). This finding is in line with our earlier interview insights, highlighting that WhatsApp is perceived as more conversational in nature. While SMS is used less often than WhatsApp across all categories of intent, this technology is used more often for planning and/or coordinating social activities. The majority of particiapnts (50.5%) reported using SMS with this intent about several times per month.

Although these findings indicate that both WhatsApp and SMS are frequently used for social activities, SMS can be viewed as quite formal when compared to WhatsApp. For example, we found no significant differences between the frequency of SMS usage for business compared to sharing personal news ($Z = -1.616$, $p = .11$) and interacting with groups of people ($Z = -1.381$, $p = .17$). Conversely, WhatsApp is used more for sharing personal news and contacting groups of people rather than for doing business ($Z = -5.353$, $p < .001$; $Z = -6.167$, $p < .001$ respectively). In addition, significantly more participants considered WhatsApp better than SMS for informal communications (86.2%) rather than formal communications (38.1%). These findings are in agreement with our observations from study phase 1.

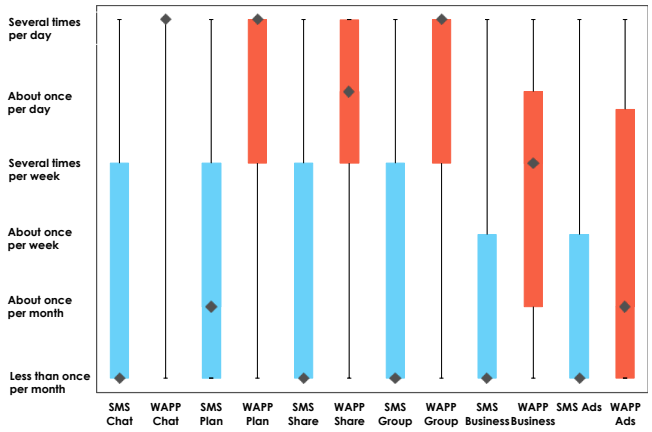

Figure 2. Boxplots for frequency of use of WhatsApp and SMS for six intents: *chatting*, *planning/coordinating* social activities, *sharing* personal news, interacting with *groups* of people, doing *business/work*, and receiving *ads*.

4. Community & Sense of Connection

In phase 1, our interviewees made a clear distinction between groups of contacts, as if they had communities with which they interact at a certain frequency using specific mobile messaging technologies. One of our goals with the survey was to identify the frequency of this interaction. Similar to our findings of intents, respondents reported using WhatsApp significantly more often than SMS with each of the following communities: *partner/spouse*, *family* members, *close friends*, *friends*, *work* colleagues, and *clients* ($p < .01$). Overall WhatsApp is used more with closely connected communities or more intimate communities compared to SMS. For instance, WhatsApp was reported to be used more often with partners than with any of the other communities ($p < .01$), and also to have higher frequency of usage with family, close friends, and friends, than with work colleagues or clients ($p < .001$). Conversely, we found no significant difference in frequency of SMS usage with work colleagues versus with friends ($Z = -.892$, $p = 0.37$), close friends ($Z = -1.5$, $p = .13$) or family members ($Z = -1.897$ $p = .06$). Similar results were obtained for SMS usage with clients compared to how often SMS is used with friends, close friends, and family. These findings reveal that—from the perspective of frequency of interaction—SMS usage is quite similar across different communities, while people tend to use WhatsApp more often with closely related contacts (see Figure 3 for more details).

The sense of connection with groups of people was also stronger for WhatsApp users rather than for SMS users. While 16.8% of participants reported that the best quality of WhatsApp compared to SMS is the way it enables interaction with groups of people, only 1% considered SMS to be better than WhatsApp for the same kind of interaction. This indicates that WhatsApp users appreciate its ability to enable

group messaging, which seems particularly useful for closely related communities (partners, family members and friends). This further supports our findings from study phase 1.

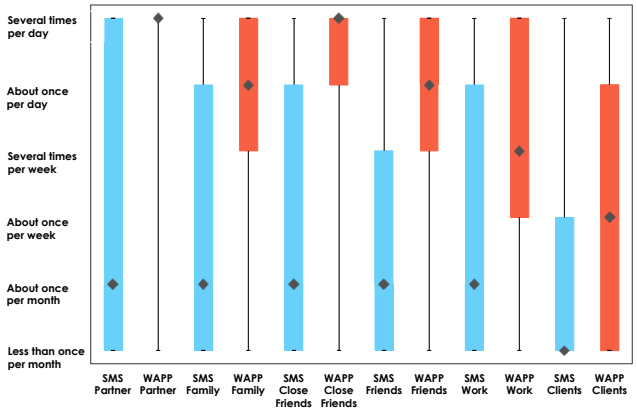

Figure 3. Boxplots for frequency of use of WhatsApp and SMS with six types of contact: *partner*/spouse, *family* members, *close friends*, *friends*, *work* colleagues, and *clients*.

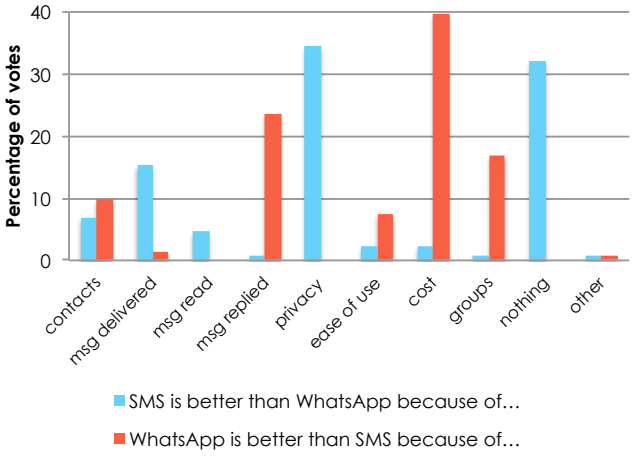

Figure 4. Most valuable aspect of SMS and WhatsApp when compared to each other: (1) the people that use it—*contacts*, (2) trust that message will be *delivered*, (3) trust that message will be *read*, (4) trust that message will receive a *reply*, (5) *privacy*, (6) *ease of use*, (7) *cost*, (8) ability to interact with *groups*, (9) *nothing*, (10) *other*.

5. Immediacy, Privacy Concerns & Expectations

The major privacy concerns identified during the interviews from phase 1 were associated with WhatsApp. Particularly those related to other contacts being able to see: (1) one's last access time, and (2) if a given message has been delivered/read, i.e. "2 ticks". This perception was supported by our survey respondents. While only 16.7% of the participants reported having fewer privacy concerns with WhatsApp compared to SMS, the majority (41.6%) considered SMS to have fewer privacy issues. In fact, the majority of the participants (34.4%) reported that privacy is the most valuable aspect of SMS compared to WhatsApp, while no one reported privacy to be the best feature of WhatsApp (see Figure 4).

Further complementing findings from the interviews, the survey results indicate that revealing one's last access time is the main privacy concern with WhatsApp. More specifically, participants considered this to raise more concerns than revealing if a message was received or not (47% versus 30% of participants; equal at $p = .03$). Other privacy issues mentioned by participants included: (1) a lack of security by allowing others to see the content of messages (*e.g., "WiFi access not encrypted"*, *"that a third-person could decipher the messages"*), (2) the fact that people can send you messages without previous invitation (*e.g., "that it does not require contact confirmation"*), and (3) that personal profiles are public (*e.g. "that people you don't know can see your profile, photo, etc."*).

With respect to the immediacy of people's replying behavior, we learned from the interviews that WhatsApp seems to create more expectations of real-time conversations. In the survey, 23.7% of participants reported that the best quality of WhatsApp compared to SMS is that WhatsApp messages usually receive a reply. This was not the case for SMS, since only one respondent (.8%) considered that guaranteed replies to SMS messages is this technology's most valuable aspect (see Figure 4). These results are consistent with our previous observation that the majority of participants (89.6%) reported using WhatsApp for chatting, hence requiring a more dynamic, fluid replying behavior. Interestingly, the expectation generated by this real-time replying behavior somehow also plays against WhatsApp, given that disclosing people's last access time raises most privacy concerns.

6. Reliability & Guarantee

We asked participants to compare their trust in WhatsApp versus SMS for guarantee of message delivery. According to their responses, only 30% think WhatsApp messages have better chances of being delivered to their corresponding recipients than SMS messages. This is further supported by the fact that significantly more participants reported that trust in message delivery is the best feature of SMS instead of the best feature of WhatsApp (15.3% versus 1.5%; see Figure 4).

7. Choice of Technology

Although WhatsApp was found to be used more often than SMS, they were both reported to be used with similar contacts (*e.g.,* family, friends, work colleagues) and for the same intents (*e.g.,* chatting, planing, business). We wondered whether other factors, such as the need to send messages with photos or videos, would further impact the choice of technology. In that sense, we found significant positive correlations between participants that send WhatsApp messages with videos and how often they use WhatsApp for chatting ($\rho = .18$, $p = .04$), with family members ($\rho = .20$, $p = .02$), with close friends ($\rho = .34$, $p < .001$), with friends ($\rho = .28$, $p = .001$), and with work colleagues ($\rho = .30$, $p = .001$). These results indicate that those who send WhatsApp messages sharing videos tend to use this technology more often in general. Furthermore, we found that those who share photos using WhatsApp potentially use SMS less often, particularly for planning activities ($\rho = -.26$, $p < .01$). This implies that people's needs to share different kinds of media may impact

their choice of technology, particularly between SMS[7] and WhatsApp.

8. Coping Mechanisms

In study phase 1, some of our interviewees reported being annoyed with the amount of notifications received by mobile messaging applications in general. An important mechanism mentioned for coping with these constant interruptions was to often turn on the phone's silent mode. In the survey, we investigated if the frequency with which people use WhatsApp and SMS is related to how often they keep their phone in silent mode. We found a significant negative correlation between how often participants use WhatsApp with clients and how often they turn on the phone's silent mode ($\rho = -.41$, $p = .001$). Similarly, the frequency of using WhatsApp for business is reversely related to the frequency of muting phone notifications ($\rho = -.23$, $p = .02$). The same applies to using SMS for business ($\rho = -.29$, $p = .006$). These results could indicate that the more people use WhatsApp and SMS for doing business, the more they keep audio notifications on, probably to avoid losing important business opportunities and/or to quickly respond to their customers. Age also seems to be related to this matter, given that participants' age was positively correlated with how often they use SMS for business ($\rho = .21$, $p < .05$) and negatively correlated with how often they mute their phone notifications ($\rho = -.18$, $p < .05$). These findings reveal that people's intent while using mobile messaging tools—particularly for business—might influence their mechanisms for coping with message notifications. Further research should be conducted to verify if such relationship indeed implies causation.

DISCUSSION

Combining insights from both studies, we have highlighted that current messaging practices differ between WhatsApp and SMS. We have shown that WhatsApp messages are exchanged more often, are more conversational in nature, are used to communicate within closer social circles and are used more often for group-based communication. The general feeling among participants across both studies is that WhatsApp is more immediate compared to SMS. While we found that the underlying intents of WhatsApp messages are in line with past work on traditional text message practices [15, 8, 10, 7, 5, 4, 3, 14, 1], we found that WhatsApp is perceived to support more social, natural interactions thus leading to higher frequencies of chatting, planning/coordination and group communications when compared to SMS.

While it's likely that WhatsApp has grown in popularity due to economic reasons, our hypothesis was that with prolonged usage, the motivation and perceived value of WhatsApp may change due to factors beyond cost. Our results indicate that while cost is definitely an important factor, when we remove cost from the equation, i.e. focusing on users who do not currently pay for SMS, we observe clear differences in usage and perceived value of WhatsApp. Our interviews revealed that nonpayers of SMS are still concerned about costs incurred by the recipients of their messages. Furthermore, our survey revealed that while payers of SMS saw no value in the SMS service, nonpayers of SMS highlighted that the most valuable part of SMS was in fact privacy. These changes in perceptions and use were strengthen further when we focused on long-term users of WhatsApp. Our findings revealed that younger adults have been using WhatsApp for longer than older adults, and these younger adults communicate with their close contacts less with SMS when compared to newer users of WhatsApp. Combined these insights imply that the motives of using WhatsApp is influenced by factors beyond cost.

While the general perception of WhatsApp was a very positive one, we also identified three problems with WhatsApp, namely: privacy, delivery and expectations. Each of these issues was closely tied to certain additional information WhatsApp provides to its users. For example, WhatApp provides status information like when a friend is online and when a friend last accessed the application. Furthermore, WhatsApp provides delivery information in the form of "2 ticks" indicating that a message has been delivered. According to our survey results, revealing one's last access time was seen as the biggest privacy concern. Additional concerns were raised in the interview study about the meaning of the WhatsApp delivery notifications. Many of the interview participants thought that "2 ticks" meant their message was actually read rather than just delivered which lead to enhanced privacy concerns and increased expectations of faster responses to WhatsApp messages when compared to SMS. In terms of delivery, SMS was perceived as more reliable than WhatsApp. Interviewees highlighted that the fact that SMS was a more mature, paid service, lead to increased feelings of trust. The survey further complemented these findings by revealing that significantly more users trust SMS rather than WhatsApp for message delivery. While privacy, delivery and expectations are not new concepts in terms of mobile communications, our findings reveal that these factors still need to be addressed in order to improve the messaging experiences of mobile users.

Finally we think it is worth noting an issue that arose from our study of WhatsApp which has implications for mobile communications in general. WhatsApp and SMS, like other mobile messaging services use proactive notifications in the form of audio/visual signals or vibrations. Some interview participants expressed concerns over having to deal with too many messages in WhatsApp. Through both the interview study and survey study, we discovered that users employed a range of mechanisms for coping with the abundance of messages and interruptions that arise from services like WhatsApp. The most popular coping mechanism we encountered was the use of the mobile phones silent mode, meaning no audio signal would arise. In interviews we discovered that while turning the phone to silent mode helped alleviate message overload, it often lead to missed notifications and calls. Our survey results strengthen this finding further by showing that users who employ either WhatsApp or SMS for business-related communication keep audio notifications on, most likely to avoid missing important business communications. These results imply that the underlying intent of mobile communications impact on the means used to cope with message notifications. Overall, we think that further work is needed in this space to understand the level to which mobile users are overwhelmed

[7]Bear in mind that our participants considered SMS and MMS (Multimedia Messaging Service) to be related to the same technology. This is why we talk about sending different media with SMS.

with mobile notifications. A deeper understanding of how mobile users cope with such notifications might help inform the design of more forgiving mobile communications services that strike the right balance between notifying users of communication versus overloading users with mundane alerts.

CONCLUSION

This paper investigates differences in the perceptions and motives of use between WhatsApp and traditional SMS via two studies, an interview study and a large-scale survey. The goal of this work is to provide a deeper understanding of how and why smartphone users have adopted and appropriated WhatsApp in their daily lives and to explore which factors influence the acceptance, usage and growing popularity of such MIM applications, in particular compared to SMS. Our findings highlight a dynamic set of factors that contribute to how users communicate via these services. While cost significantly impacts peoples frequency of usage, social influence is one of the main reasons for todays migration to such MIM applications. The nature and intent of WhatsApp messages tend to be more social, informal and conversational in nature, while SMS is seen as more privacy preserving, more formal and generally more reliable. Our evidence shows that neither technology is a substitute for the other. Overall this paper adds to a growing body of related work on how mobile technology influences peoples communication practices. We hope the valuable real-world insights provided can help inform the design of new mobile communication technologies.

In terms of future work, our goal is to explore usage of WhatsApp and similar services by conducting studies that combine self-reported methods (as used in this work), with logging studies to understand how perceptions of messaging behaviors map to actual usage. In addition, we would like to deploy similar studies in other countries and across different demographics to investigate if the findings reported herein can be extended to other cultures. Finally, we believe a fruitful area of research that arose from this study relates to how mobile users cope with the abundance of mobile notifications they receive from services like SMS and WhatsApp. As usage of these services increase, so too does the number of notifications provided by these services. A deeper understanding of how mobile users cope with such notifications will help inform the design of enhanced notifications for mobile messaging services.

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