Should I stay or should I go? Managing Brazilian WhatsApp groups
by Ana Cristina Bicharra Garcia and Adriana Vivacqua

Abstract
Instant messaging (IM) technology enables individuals to connect and maintain relationships with friends, family and colleagues, keeping participants updated on subjects of interest. It has rapidly become widespread in many countries and even been used for political activism. IM enables rapid, informal interaction between participants, but can generate message overload and notification fatigue, which leads to the adoption of different strategies to handle this problem. In this paper we report on an empirical study focused on the management of IM groups: reasons for joining or leaving, and the strategies adopted to manage the information flow. We distributed a survey that was answered by 442 WhatsApp users in Brazil. Answers help us understand the ways in which participants cope with message overload.

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1. Introduction

The widespread adoption of mobile technology and instant messaging (IM) systems has led individuals to adapt the ways in which they communicate with each other and in groups. Both social networking systems and mobile instant messaging (MIM) have become highly popular around the world (Watson, 2016), and their adoption has led to changes in how people communicate with each other and in a group context.

People have come to use MIM for multiple purposes, ranging from staying in contact with friends to keeping abreast of workplace news (Church and de Oliveira, 2013). Most of these systems warn users of incoming messages through notifications, sound-based, visual or haptic, which translates to a frequent demand for attention that users have to handle, an unwanted side effect that can lead to anxiety and social media fatigue (Church and de Oliveira, 2013; Dhir, et al., 2018).

One important feature of many IM systems is the ability to create groups and undertake group discussions. Group messaging are conversations involving more than two participants (Smith and Tang, 2015). While multiple studies report on IM usage for individual (one-to-one) communication (Battestini, et al., 2010; Brown, et al., 2018; Isaacs, et al., 2002; Nardi, et al., 2000; Trepte, et al., 2018; Venolia and Neustaedter, 2003) usage of groups has not been
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explored extensively, with a few exceptions such as studies looking at group coordination (Schuler, et al., 2014), daily dwelling (O’Hara, et al., 2014), group co-presence (Lampinen, et al., 2009) and activism (Pang and Woo, 2020; Milan and Barbosa, 2020).

WhatsApp has become one of the most widely adopted mobile instant messaging platforms worldwide (Watson, 2016; Baulch, et al., 2020; Ahad and Lim, 2014), with over one billion daily users (Darrow, 2017). In addition, it is the leading instant messaging platform in Brazil, for multiple reasons (Rafert and Mate, 2017; Statista, 2018). It has become entrenched in day-to-day life (Cruz and Harindranath, 2020) in such a way that any shutdown might become problematic (Santos, et al., 2020).

This paper reports on a study of WhatsApp users in Brazil, focusing on group participation. The objectives of our research are to better understand WhatsApp user behavior in Brazil, as it relates to groups. Our research questions are:

- What variables lead participants to join Brazilian WhatsApp discussion groups?
- What variables correlate with determine the co-existence behavior, such as silencing groups and sharing personal news, of Brazilian WhatsApp users?
- What variables correlate with the exit behavior from discussion groups of Brazilian WhatsApp users?

To answer our questions, we conducted a survey that was publicly announced on Brazilian computer science forums. Initially, we interviewed and analyzed WhatsApp group messages of a small group of seven people, to gain insight for a wider investigation. We then designed and conducted an online survey, disseminated via social channels. The survey was open for 10 days and collected over 422 valid responses. We removed responses 97 incomplete responses. Answers came from all over Brazil (13 different states). We arrived at very interesting findings, some expected such as the negative impact of age in the number of enrolled discussion groups and the number of controversial groups and some unexpected such as the greater likelihood male users will leave when receiving porn messages than female users. Our findings are not conclusive since the sample was small, but they provide evidence that opens up many interesting questions that deserve further investigation. People are jumping into WhatsApp discussion groups bringing old social interaction habits, but adjusting to the new possibilities of relationships.

2. Related work

Jason Fried, Basecamp CEO, states that the technologies we use also impact on our well-being, and lists the effects of group chat on organizations. On the positive side, group chats are good for quickly hashing something out, alerting people that something has happened, having fun and creating a sense of belonging in a group. However, it also leads to mental fatigue, a culture of immediacy and fear of missing out. It also tends to generate instinctive responses, over-messaging and rambling, among other unwanted behaviors. He wraps up his paper stating that attention is a valuable resource and that organizations should not use synchronous messaging as the norm (Fried, 2016).

In a critical paper, Captain (2016) refers to studies that point towards group chats generating better understanding among colleagues, but also reinstates that group chats tend to generate too many messages leading to stress. In fact, a 2015 study points to a significant reduction of stress in a group who checked e-mail only a few times a day (versus those who received notifications upon arrival) (Kushlev and Dunn, 2015).

Birnholtz (2010) interviewed 21 former users of instant messaging to elicit their reasons for joining, how they adapted as their life changed and what reasons led them to leave the platform. Among other findings, his study revealed that users tried to adapt their behavior to handle excessive interruptions, but ultimately the platform was not supportive, so they ended up leaving it. The study focused on individual messaging and not group participation, but the discussion mentions a need for better ways to manage contacts as a given users’ life and context changes. Quan-Haase and Young (2010) also stated that social influence was one of the main reasons for WhatsApp adoption. According to their study, the nature of WhatsApp tended to lead to high frequency usage, as it supports social, informal and conversational communication.

This is in line with Cruz and Harindranath (2020), who mention that WhatsApp has become an integral part of life in Mexico, and stresses its role in work and family environments, as well as safety and micromanagement. In these settings, WhatsApp groups have become an important part of daily life, enabling participants to stay in touch with family and freinds and get work done. Another study show that users experienced stress and anxiety, and had to learn
Should I stay or should I go? Managing Brazilian WhatsApp groups to use other tools during a WhatsApp blockage in Brazil (Santos, et al., 2020). WhatsApp has taken a central role in society in many countries.

Dhir, et al.’s (2018) research indicates that the fear of missing out tended to lead to compulsive media use, which in turn triggered social media fatigue, leading to elevated anxiety and depression. Social media fatigue is a condition where individuals feel exhausted after experiencing communication overload through their social media platforms. Message and notification overload was also illustrated in Hulick (2016), where he mentions one of the biggest problems in group messaging is its intrusiveness, and the expectation of constant availability (that one should always be ready to answer any messages received).

Church and de Oliveira (2013) conducted research to better understand the adoption and usage of WhatsApp and its relation to SMS systems. Through interviews and a survey, they established that cost of service and social influence played a significant role in its adoption. They also found that participants sent significantly more messages through WhatsApp than through traditional SMS (presumably because WhatsApp messages are free to send whereas, SMS messages are paid for.) Participants also state that WhatsApp was more conversational than SMS, which was seen as more restrictive as senders would try to fit the whole message into a single message to reduce cost.

In addition, interviews with active WhatsApp users revealed an increased sense of community and connection. Usage of groups in WhatsApp was very frequent, driven by the need to organize social events and communicate with small communities (e.g., families). However, users also pointed out that this usually led to message overload (possibly due to ease of communicating). To cope with the system’s proactive notifications, users would switching phones to silent mode or completely off (Church and de Oliveira, 2013). In their data, usage for work correlates negatively with turning the phone off or setting it to silent mode. More recently, studies have delved into WhatsApp adoption by activists (Milan and Barbosa, 2020; Pang and Woo, 2020). Instant messaging groups enabled digital activists to mobilize crowds rapidly, and allowed conversations to be extended beyond an initial group, cascading from one to the next through message forwarding.

Smith and Tang (2015) state that problems in messaging arise when people use the same technologies to communicate with people from different contexts. They report on a study with active group messaging adolescent users (ages ranged from 15 to 24), and use a set of three dimensions to classify groups: Focus, Membership and Duration. Like other studies before them, they find that participants experienced notification overload, and that their main strategy was to silence the group to avoid excessive notifications.

Karapanos, et al. (2016) examined the differences between Facebook and WhatsApp adoption and usage, from a perspective of need fulfillment. WhatsApp supported more intimate connections better fulfilling their need for relatedness. They reported that the most unsatisfying experiences on WhatsApp had to do with breaches of off-line social norms, such as broadcasting users’ context. The features that show an individual’s last logon or whether a message has been read led to incorrect assumptions about a person’s context and to monitoring behavior. Participants also mentioned the exposure when leaving a group or being added without approval as potentially leading to unsatisfying experiences.

3. Research methodology

Our research was conducted using a survey. Preliminary interviews were conducted to elicit the main questions that would drive further investigation. We then designed a questionnaire to elicit responses from a wider audience and analyzed questionnaire responses. In this section we briefly present survey design followed by an analysis of the survey data, as it relates to the research questions we posed earlier.

3.1. Survey design

Preliminary interviews were conducted with active WhatsApp users of different ages, gender and professional activities, to gain a sense of typical communication issues and group membership. Seven people from Rio de Janeiro were interviewed, recruited via personal connections. The goal of these interviews was to generate insights into the subject. Interviews were semi-structured and open-ended, and respondents provided a number of examples of their daily usage of group messaging.
We then designed a questionnaire: data for the survey were collected in March 2018 using an online survey tool [1]. We advertised the study on several Web sites of our universities and on three official e-mail lists of the Brazilian Computer Society and also on Facebook and WhatsApp. Participants signed a consent form prior to responding. The consent form explained the goals of our research and how data would be used. The consent form also guaranteed the data would be kept confidential and explained they were free to leave the survey at anytime. The questionnaire contained 24 questions. Questions were divided into four groups:

- Demographics: questions concerning gender, age, local of residency, education and professional activity;
- Membership: questions about the number and type of groups they are part of, reasons for joining or leaving a group;
- Behavioral: questions that concern the frequency with which users read and post messages, the way they react to inconvenient posts, situations where they decide to send private messages versus sending them to the entire group, and how they decide about which group to post messages to;
- Design issues: included open questions to identify functionalities users felt they needed to better communicate with groups. This was meant as a springboard for further research.

The online survey was open for 10 days, and elicited a total of 442 responses. Out of these, 97 responses were discarded because respondents either took less than two minutes to answer or abandoned the questionnaire with less than 50 percent completed. As a result, we obtained 325 complete responses (individuals who got to the end of the questionnaire). The majority of respondents took between 10 and 20 minutes to answer the questionnaire. In this paper we present an analysis of a subset of the questions.

3.2. Demographics

Survey respondents were evenly distributed gender-wise, with 51 percent male respondents and 48.7 percent female respondents (0.3 percent of respondents chose not to answer this question.) We also noticed a concentration of highly educated people, which might be due to the way in which the questionnaire was distributed. About 87.7 percent of respondents had at least a college degree. We divided respondents into five age brackets: Post-millennial (age ≤ 20), Millennial (age 21 to 36), Generation X (age 37 to 52), Babyboomers (age 53 to 71) and Seniors (age ≥ 72 ) (Ceballos, 2017). Full demographic information can be seen in Table 1.
The majority of respondents (71.4 percent) lived in the state of Rio de Janeiro, which can be explained by the fact that the questionnaire’s distribution started in this state. Nevertheless, there were respondents in 12 other states, such as São Paulo (10.7 percent), Ceara (4.7 percent) and Minas (4.4 percent). There were also a few respondents in distant places such as Amazonas, Tocantins, Mato Grosso and Parana, as shown in Figure 1.
3.3. Group membership

Every respondent belonged to more than one group. Friendship, family and work groups account for the entire universe of respondents, i.e., every individual in our sample belongs to at least one of these three groups, with over 55 percent of respondents belonging to all three. The most frequently reported group ties were Friendship (91.8 percent), Family (83.6 percent), Work (68.6 percent), Study (such as courses, contests, exam preparation) (46.2 percent), Events (such as organization of birthdays, weddings or trips) (31.1 percent) and Leisure (hobbies and sports related) (28.6 percent), as shown in Figure 2. Other groups mentioned include sports fan clubs, political groups, religious groups, people who live in the same building or parents of kids who study at a given school. The remainder of our analyses correlates the data with participation in the six dominant groups.

Fig. 1 Demographics: Respondent Location
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Notable in these results is the usage of IM for work/business purposes. Previous research on IM indicated it was mostly used to keep up with family and friends, planning events and leisure activities (O’Hara, et al., 2014; Nouwens, et al., 2017). Apparently, between the time those investigations were conducted and now, IM adoption has grown beyond the confines of personal messages. Nowadays, it is also being used for work purposes, as can be seen from the fact that over 2/3 of our respondents (68.6 percent) used it for work. If we add those up with participants who use IM for study groups, we go up to 84 percent of participants using IM for business purposes. More recent work has investigated the usage of WhatsApp groups for activism (Pang and Woo, 2020; Milan and Barbosa, 2020; Baulch, et al., 2020). In the following sections, we look for patterns on participants’ entrance, permanence and exit behaviors.

4. Findings

The step-by-step process of data analysis is shown in Figure 3: we first run a correlation matrix to check for co-linearity among the independent parameters. If there is no co-linearity, we can use the LASSO method for selecting the relevant independent variables. LASSO (least absolute shrinkage and selection operator) (Tibshirani, 1996) is a linear regression method to predict relations between variables, but here we used its important sub-product of selecting the relevant variables. With these variables, we moved on to a logistic regression, which presented better accuracy than linear models. We ran a logistic regression on the set of selected variables, and the results inspired our hypotheses concerning the variables; for example if age resulted in a negative coefficient, we created the hypothesis that the younger the participant the more active they will be (from simple reading behavior to frequent posting behavior). Finally we looked at pvalues to confirm our hypotheses.
4.1. Joining a group

Our first inquiry is into factors that lead participants to join Brazilian WhatsApp discussion groups? According to our questionnaire, respondents join groups mainly due to affinity with the theme of the group, as can be seen in Table 2. Social influence is also present, especially in the case of groups of friends, but is surprisingly not the driving element in family and leisure groups. Prior research had documented social influence as a strong incentive for joining IM platforms (Quan-Haase and Young, 2010), as individuals want to join platforms where they were most likely to find their friends. Our findings indicate that, once everyone is using the same platform, users feel the need to manage their contacts and message load, and start deciding which groups to join based on content rather than other participants. WhatsApp being a predominantly informal means of communication, it makes sense that individuals would use it to keep in touch with their friends, the one case where social influence and group theme are balanced (Table 2, column 2).

One of the respondents left a comment stating that she was included without asking in most of her groups, which provided an example of social pressure or expectation to join a group at work. Another respondent mentioned he participated in five hobby-related groups for which he had to apply and wait for acceptance. We had not anticipated this case, we were expecting to find loosely created and coordinated groups. These groups have hundreds of participants, are created and managed by a central administrator who enforces interaction norms. Participants can be temporarily suspended or even removed from a group. This provided us with a subject for another study: the dynamics and moderation of large groups in MIM.

In order to better understand the joining patterns to WhatsApp groups, we ran logistic regression models considering five independent variables:

- Age: an integer value corresponding the age of the participant. It varied from 18 to 84, with an average age of 40 years old. We also subdivided the group into three generations: Millennial (younger than 40 years old), Generation X (between 40 and 60 years old) and Baby Boomer (older than 60 years old);
- Gender: Either male or female;
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Education: Based on the answers, we divided the group into two sets: participants with high school and participants with college degrees. There were 284 participants with a college degree;
- Work: We cluster the answers into three classes: Unemployed or free-lancers or consulting people; Students, Currently employed people and retired participants. There were 147 free-lancers, 59 students, 102 currently employed and 15 retired participants.

Initially, we investigated the correlation between independent variables, and found that they were weakly correlated. The entrance behavior was reflected by the number of discussion groups that users were enrolled and the controversial characteristics of those groups. To investigate that, we considered the following dependent variables extracted from participants’ answers:
- Many Groups: a Boolean variable. Participation in up to three groups: family, friends and work was considered standard. The data corroborates this premise. Users enrolled in more than these three groups will be classified as True for the “Many Groups” variable.
- Controversial Groups: this Boolean variable indicates if the user participates in groups where discussions often lead to a lot of controversy. We distinguish between formal groups (Work) and informal groups (Family and Friends).

We ran the LASSO algorithm (Tibshirani, 2011) to select relevant independent variables for creating an explanation model. Table 3 presents the LASSO coefficients of each independent variable (row values) for each explanation model (column values). As shown, Age, Place and Work may explain entrance behavior in many groups. All five variables may play important roles explaining entrance in controversial groups.

<table>
<thead>
<tr>
<th></th>
<th>Many Groups</th>
<th>Any Controversial Group</th>
<th>Controversial Formal Group</th>
<th>Controversial Informal Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>-0.004665</td>
<td>-0.001561</td>
<td>0.004164</td>
<td>-0.001561</td>
</tr>
<tr>
<td>Education</td>
<td>0</td>
<td>0.039260</td>
<td>0.037270</td>
<td>0.039260</td>
</tr>
<tr>
<td>Gender</td>
<td>0</td>
<td>-0.027266</td>
<td>-0.02296</td>
<td>-0.027266</td>
</tr>
<tr>
<td>Place</td>
<td>-0.007897</td>
<td>-0.004975</td>
<td>0</td>
<td>-0.004975</td>
</tr>
<tr>
<td>Work</td>
<td>-0.027569</td>
<td>0.026349</td>
<td>0.043431</td>
<td>0.026349</td>
</tr>
</tbody>
</table>

Logistic regression fine-tuned our analysis. We reached a model (AUC-0.66) that depended on Age and Work. As shown in Figure 4, the younger the person, the more likely they were to join groups other than family, friends and work. Furthermore, the less formal the work, the more likely the person was enrolled in more groups.
We further investigated the conditional probabilities difference when assuming one of the possible values for independent variables. For example, we were interested to know if the probability of enrolling in more groups would be higher for female participants, i.e., $P(\text{ManyGroup–Female}) > P(\text{ManyGroup–Male})$. As shown in Table 4, people with no formal jobs (shown in the table as Free) were enrolled in more groups than those formally employed. Female or employed people tended to be enrolled in more controversial groups at work than male or not formally employed users. Participants from Rio de Janeiro state were more likely to be enrolled in informal controversial groups, such as family and friends, than people that resided in other Brazilian states.

As far as enrollment in controversial groups, we could not build any statistically sound model (AUC $\leq 0.6$ and $p$-value $\leq 0.05$) considering the independent variables. However, we could build an interesting model relating enrollment on controversial groups and the number of groups a person participate. As shown in Figure 5, the more groups you are enrolled, the greater the chances to be in controversial groups.
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4.2. Staying in a group

In our second research question, we investigated reasons for staying in a group. Even when groups slow down and stop messaging, participants tend to stick around: after becoming a member, respondents tend to continue in the group for as long it lasts. Table 5 presents some of the main reasons for that behavior. According to the answers, 49 percent of the respondents would not leave a family group for fear of hurting the feelings of other participants and 54 percent equate leaving a friends group to losing contact with participants. As far as business-related groups go, 51 percent of respondents would not leave a work group for fear of missing opportunities, which also holds true for study groups (56 percent). Staying on top of the subject was a strong reason to not leave work and study groups, with 40 percent and 45

Fig. 5 Logistic Regression results - Number of groups affects the participation in controversial groups.

Table 4 Entrance behavior: Conditional probabilities considering possible values of the independent variables. Values in black means no statistical significance. P-values ≤ 0.05 are written in green. Values in red and green represent the probability of an event given an attribute value (red shows values ≥ green values).

<table>
<thead>
<tr>
<th>Attribute</th>
<th>ProbAttribute</th>
<th>Age_50Plus</th>
<th>Young</th>
<th>Old</th>
<th>Education</th>
<th>HighSchool</th>
<th>College</th>
<th>Gender</th>
<th>Male</th>
<th>Female</th>
<th>Place</th>
<th>Placeム</th>
<th>Rio</th>
<th>NotRio</th>
<th>Work</th>
<th>Employed</th>
<th>Free</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mamy Group</td>
<td>58%</td>
<td>1.000</td>
<td>64.7%</td>
<td>50.3%</td>
<td>0.7311</td>
<td>0.6</td>
<td>37.7%</td>
<td>0.9668</td>
<td>66.2%</td>
<td>55.7%</td>
<td>0.4714</td>
<td>58.8%</td>
<td>58.1%</td>
<td>1.00E+00</td>
<td>49.9%</td>
<td>61.8%</td>
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</tr>
<tr>
<td>In_Family_Vent</td>
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<td>0.9334</td>
<td>20.2%</td>
<td>17.7%</td>
<td>0.0030</td>
<td>0.125</td>
<td>39.7%</td>
<td>0.0548</td>
<td>17.5%</td>
<td>20.3%</td>
<td>0.5365</td>
<td>18.7%</td>
<td>11.4%</td>
<td>4.44E-10</td>
<td>27.1%</td>
<td>14.0%</td>
<td></td>
</tr>
<tr>
<td>In_Family_Tell</td>
<td>53%</td>
<td>0.9088</td>
<td>54.9%</td>
<td>51.7%</td>
<td>0.7453</td>
<td>0.55</td>
<td>53.2%</td>
<td>0.9999</td>
<td>57.8%</td>
<td>40.7%</td>
<td>0.0011</td>
<td>55.7%</td>
<td>47.3%</td>
<td>1.00E+00</td>
<td>48.7%</td>
<td>56.0%</td>
<td></td>
</tr>
<tr>
<td>In_Both_Politics</td>
<td>04%</td>
<td>0.9678</td>
<td>66.5%</td>
<td>51.1%</td>
<td>0.1375</td>
<td>0.025</td>
<td>01.4%</td>
<td>0.3866</td>
<td>00.4%</td>
<td>04.0%</td>
<td>0.0008</td>
<td>02.0%</td>
<td>94.0%</td>
<td>1.73E-01</td>
<td>05.7%</td>
<td>03.2%</td>
<td></td>
</tr>
</tbody>
</table>
percent of responses, respectively. This was a also a strong reason for staying in events groups, which is understandable, as these groups are meant for planning and organization, and usually distribute time-sensitive information. From the data, we notice work and study groups are handled similarly, and considered spaces where one goes to stay on top of the latest information and also where opportunities tend to arise.

This co-existence behavior was reflected by the actions that a participant performed while participating in discussion groups. To investigate that, we considered as dependent variables:

- Frequency: how often users check their messages. We classified participants as “addicted” those that checked frequently, every 10 minutes up to every hour. Otherwise, they were classified as “non-addicted” users. We separated the analysis concerning formal (work) and informal (family and friends) groups: 53 percent of total users were classified as addicted and 47 percent as non-addicted users.
- Activity: how active users were in a group. “Active” users read and posted at least once a day (38 percent of users). Otherwise, they were classified as “non-active” users (62 percent of users). We also discriminated over user behavior in formal and informal groups.
- Silence: represents user behavior in configuring groups to silent mode (26 percent of users has at least one group on silent mode). We discriminated between the behavior in formal and informal groups.
- Sharing news: represents sharing behavior: whether they do not share good or bad news (8 percent and 21 percent respectively), share them with some special person (66 percent and 57 percent respectively) or within a discussion group (13 percent and 8 percent respectively). We discriminated between behavior in formal and informal groups.

We ran LASSO algorithms to identify relevant parameters, as described in Table 6.
We further analyzed the data and calculated conditional probabilities for different possible values of the independent variables. As shown in Table 7, our data indicated that older people and female were more active on groups (mainly posting) than young or male users. College and female users were more frequent on discussion groups than high school and male users. Users without a formal job were more frequent on work-related groups. College and formally employed people were more likely to silence groups than high school or not formally employed users.
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4.3. Managing messages

At the end of our survey, we added a question regarding missing WhatsApp functionalities and design, to collect evidence for further research. This question was optional and received few responses with new information. This was a single question with six pre-existing options (no new knowledge related to them) and an “Other” option for creative answers. The existing options were there to create a context. Possible answers consisted of:

- Silencing individuals within a group;
- Blocking messages from certain individuals (automatically delete these messages, as if they were spam);
- Blocking messages based on characteristics such as content, length, audio or video;
- Classifying messages;
- Organizing messages; and
- Prioritizing messages.

Respondents selected options as needed, and included new elements. The open answers indicated participants did not want people, within a group, to notice their actions of silencing individuals or content. This demonstrated a need for privacy, since WhatsApp informs the group when someone leaves. The most interesting responses are mentioned below:

- Find a message you don’t remember in which group you read it (search)
- Leave the group without being notified (privacy)
- Filter repetitive messages (filter)
- Prioritize messages by sender (prioritize)
- Store in a place you could retrieve later (retrieval)
- Configure posts’ filters (filter)
- Get to know what is going on without reading all discussion so far (summarize)
- Mark important messages for later review (tagging, organization, retrieval)
- Prioritize groups (prioritize)
- Organize messages per sender even among groups (organization)
- Offer a reputation system based on “likes” on posts (people would give likes in posts) (reputation)
- Offer an anti-spoiler functionality, so people would only be able to read the message when clicking on it (previews)

These responses reinforce the need for better organizational techniques. This is directly related to information overload: users have so many messages and contacts that they need ways to filter undesired ones, block unwanted
content, and better manage messages that they receive. E-mail went through a similar cycle, and the number of e-mails became so large that organizational mechanisms were needed to handle message influx (i.e., labels, rules, searches, priorities, etc.) These results indicated respondents would like to have more control over their communication and be able to organize messages and recipients. We will conduct further investigation into this problem and experiment with designs and solutions to help users manage message overload.

4.4. Leaving groups

Our last question regarded situations that would cause individuals to leave a group. *Personal offenses or threats* were mentioned as the main reason for leaving a group across the board (see Table 8). *Offenses* accounted for leaving non-familial groups in over 60 percent of responses and threats accounted for more than 50 percent, except in the case of family and friends groups. Also worthy of notice, comments that go against an individual’s *personal ethics or beliefs* were cited as a strong reason to leave a group. *Porn* appeared as a reason to leave *Work, Study* and *Events* groups.

<table>
<thead>
<tr>
<th>Table 8 Reasons to leave a group according to the type of group.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Porn</td>
</tr>
<tr>
<td>Long Msg</td>
</tr>
<tr>
<td>Conflict</td>
</tr>
<tr>
<td>Ideas</td>
</tr>
<tr>
<td>Ethics</td>
</tr>
<tr>
<td>Threats</td>
</tr>
<tr>
<td>Greetings</td>
</tr>
<tr>
<td>Offenses</td>
</tr>
</tbody>
</table>

The exit behavior was reflected by a scenario that would justify a participant leaving a discussion group. To investigate that, we considered the following dependent variables:

- No way out: a Boolean classification that represents a user’s inability to leave a group (either due to emotional or opportunistic reasons). We analyzed separately behavior in formal (work related) with informal (family and friends) groups.
- Exit — Porn: we investigate the user’s propensity to leave a group when receiving porn related messages.
- Exit — Conflicts: We investigate a user’s tolerance (and propensity to leave) to serious conflicts among participants, that may include himself or herself, and that may include personal offenses.
- Exit — Msg: We investigate a user’s intention to leave a group due to an overwhelming number of messages, *i.e.*, whenever the messages become too long or devoid of content (too many salutations).

As shown in Table 9, education played an important role for explaining many exit behaviors.
We also analyzed the behavior comparing possible values for each of the independent variables. As shown in Table 10, participants were more likely to remain in discussion groups of family or friends than work-related. They also were more likely to leave a discussion group due to conflicts than any other reason. Formally employed or college-level users were more likely to stay longer in work-related discussion groups (despite wanting to leave) than informally employed or high school-level users. Older people were more likely to remain in informal groups (family and friends) than younger people. Formally employed or those holding a college degree were more likely to leave groups due to either Porn, Conflicts or Long messages than those informally employed or holding a high school degree.

### Table 9 Exit behavior: Lasso coefficients showing the relevant independent variables to create an explanation model. Co-existence behavior: Lasso coefficients showing the relevant independent variables to create an explanation model. General means Generation; Educ means Education; Mag means too long messages or too many salutations.

<table>
<thead>
<tr>
<th>Age</th>
<th>Generat</th>
<th>Educ</th>
<th>Gender</th>
<th>Place</th>
<th>Work</th>
</tr>
</thead>
<tbody>
<tr>
<td>No-Way-Out-ALL</td>
<td>0</td>
<td>-0.0131</td>
<td>0.0048</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>No-Way-Out-Work</td>
<td>0</td>
<td>-0.0396</td>
<td>0.3092</td>
<td>0</td>
<td>-0.0108</td>
</tr>
<tr>
<td>No-Way-Out-FF</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>-0.6E-18</td>
<td>0</td>
</tr>
<tr>
<td>Exit-Porn</td>
<td>0.0001</td>
<td>0.0355</td>
<td>0.0408</td>
<td>-0.0642</td>
<td>-0.0121</td>
</tr>
<tr>
<td>Exit-Msg</td>
<td>0</td>
<td>0</td>
<td>0.0842</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Exit-Conflict</td>
<td>0</td>
<td>0</td>
<td>0.1971</td>
<td>0</td>
<td>-0.0057</td>
</tr>
</tbody>
</table>

### Table 10 Exit behavior: reasons for leaving or unwillingly staying in discussion groups.

---

5. Discussion

Our studies ratified the idea that most people are suffering from the Fear of Missing Out (FOMO) syndrome (Przybylski, et al., 2013). They engaged in many discussion groups possibly as a reaction of being socially excluded from a given group (Przybylski, et al., 2013). As our study has shown, they stayed connected, mostly, not to miss opportunities in either groups related to the work or more informal groups as family and friends. Since WhatsApp is a smartphone app, groups become omnipresent. As Elhai, et al. (2016) argue, people have become addicted to smartphone interaction. Sometimes, people might even ignore a companion to remain connected to the smartphone interaction (phubbing) (Balta, et al., 2020). FOMO can explain enrolling in many groups and staying in the groups despite wanting to leave. Nevertheless, it remains an open issue to understand the reasons that justify people not silencing groups. Would it be for FOMO? Maybe the reason lays on another problem concerning digital literacy. We could not find patterns relating to age, gender or education. However, we are wondering if this behavior was due to technology illiteracy or semi-illiteracy. People got into IM without any training and keep learning by practice. There
are some studies (Santos, et al., 2020; Kenning, 2010) discussing the impact of digital literacy and how a user can remain on an island of knowledge. Consequently, a possible hypothesis is that people did not silent their groups for not understanding functionally. This deserves further study.

An unexpected finding was related to the exit behavior related to receiving porn messages. We were expecting a stronger reaction from women, but it was not confirmed by our data, especially on work-related discussion groups. According to Attwood (2005), porn messages create an environment in which women are viewed as objects, and may even be considered a type of implicit sexual harassment. There might be a cultural issue here that also deserves further research.

Additional questions explored participants’ behavior. According to our survey, more than 50 percent of respondents set all of their groups to Silent mode, reading posts on demand a few times a day, as illustrated in Figure 6. By setting groups to silent, users avoided excessive notifications and handled incoming messages periodically.

![Figure 6](image)

**Fig. 6** Frequency with which respondents check messages according to type of group.

In comparison to other types of groups, work-related groups were less frequently set to silent, presumably because members feel they needed to stay informed of what was going on. As can be seen in Figure 7, the most important reason for setting a group to silent was not wanting to be disturbed all the time, followed closely by groups being too “noisy”. This was an indication of social media fatigue, which has also been reported elsewhere (Han, 2018; Dhir, et al., 2018; Yao and Cao, 2017). As groups gain size and traction, the number of messages increases and so does the number of notifications. Silencing a group or the whole phone is a reaction and a way to deal with notification overload. Interestingly, work and study groups were the ones considered least “noisy” (possibly more focused on the themes with fewer off-topic/random posts), and were sometimes set to silent because respondents habitually set all
their groups to silent mode. Curiously, some respondents said they weren’t sure why they set their groups to silent. We assumed these were respondents who habitually silenced all their groups (or even the whole phone), so they didn’t even consciously think about it.

**Fig. 7** Reasons to set groups to silent mode according to type of group.

For all groups, most respondents said they read frequently but rarely posted (**Figure 8**). This lurking strategy is very common in social media (Nonnecke and Preece, 2001) and also in communities of practice, which are usually made up of a core group of participants and a much larger set of peripheral members (Wenger, 1998; Preece, 2001; Lai and Chen, 2014; Sun, *et al.*, 2014). **Table 11** shows our findings regarding silencing certain groups.
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More than 50 percent of respondents choose to ignore inconvenient or long messages in every group, as seen in Tables 12 and 13. For about 30 percent of respondents, long posts might have drawn some attention, depending on who was the sender of the message (Depend on Sender in the table). When respondents decided to complain about inconvenient posts, they did so publicly (Table 12, row Complain Publicly) rather than privately (Table 12, row Complain Privately), and this happened more frequently in work or study groups. These groups should have been more focused, so complaining publicly was a reasonable choice, as it steered the group back to focus and reinstated the group’s

**Fig. 8** Read and post behavior in Whatsapp

<table>
<thead>
<tr>
<th>Table 11 Groups on silent mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silence Mode</td>
</tr>
<tr>
<td>Family</td>
</tr>
<tr>
<td>--------</td>
</tr>
<tr>
<td>59%</td>
</tr>
</tbody>
</table>
One interesting note could be made about long messages: because WhatsApp is an IM system, and these were originally inspired on SMS (Short Message Service) (Church and de Oliveira, 2013), there was an implicit expectation that messages would be kept short and direct (Brown, et al., 2007). Typing lengthy messages is certainly not easy on a smartphone, but WhatsApp is also accessible via a Web interface, which makes it a lot easier to compose and post long messages.

<table>
<thead>
<tr>
<th>Table 12</th>
<th>Participants’ reaction to inconvenient messages that don’t conform with their moral/ethical code</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reason:</strong> Against moral/ethical code</td>
<td><strong>Family</strong></td>
</tr>
<tr>
<td>Depend on sender</td>
<td>24%</td>
</tr>
<tr>
<td>Read the message</td>
<td>22%</td>
</tr>
<tr>
<td>Forward the message</td>
<td>29%</td>
</tr>
<tr>
<td>Delete the message</td>
<td>17%</td>
</tr>
<tr>
<td><strong>Ignore the message</strong></td>
<td>47%</td>
</tr>
<tr>
<td>Complain publicly</td>
<td>15%</td>
</tr>
<tr>
<td>Complain privately</td>
<td>13%</td>
</tr>
<tr>
<td>Leave the group</td>
<td>10%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 13</th>
<th>Participants’ reaction to long messages or video/audio</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reason:</strong> Long or Audio/video</td>
<td><strong>Family</strong></td>
</tr>
<tr>
<td>Depend on sender</td>
<td>37%</td>
</tr>
<tr>
<td>Read the message</td>
<td>23%</td>
</tr>
<tr>
<td>Delete the message</td>
<td>24%</td>
</tr>
<tr>
<td><strong>Ignore the message</strong></td>
<td>65%</td>
</tr>
<tr>
<td>Complain Publicly</td>
<td>5%</td>
</tr>
<tr>
<td>Complain Privately</td>
<td>3%</td>
</tr>
<tr>
<td>Leave the group</td>
<td>0%</td>
</tr>
</tbody>
</table>

In an open question, we investigated functionalities that users would like to have. The ability to silence individuals within groups was the top mention, followed by organizational functionalities, such as classifying messages, searching for messages (in multiple groups), prioritizing certain users, blocking certain content and being able to leave a group without being noticed. These comments indicated that users were not interested in others, within a group, observing their diverse actions such as silencing or filtering certain individuals or content. They also exposed a need for better privacy and organizational techniques. A side effect of the way in which WhatsApp exposes members leaving or joining groups is that participants might feel embarrassed to leave a group because others will see and question those decisions. Thus, they will often stay and silence the group rather than leave, or let people now they are leaving
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providing justification for doing so. Social pressure plays a part in the decision to leave a group. These initial results require further investigation.

6. Conclusions and future work

This paper presented an exploratory survey study of WhatsApp users in Brazil. Its purpose was to understand the interaction dynamics within groups in IM, and how individuals handle message and notification overload. WhatsApp is the most popular communication media in Brazil, one that enables people to stay connected on a daily basis. Our study sheds light on interaction issues of MIM groups and raises design issues to be addressed in the future.

Individuals joined groups due to affinity either with a given subject or with people, and they stayed in a given group until it dissolved. Some set notifications to silent so they would not be disturbed. This action seemed easier than leaving a group, as departing a given group is a public action that sometimes has repercussions. Our study with WhatsApp users reinforced previous observations that lurkers dominate populations in communication media (Nonnecke and Preece, 2001; Nonnecke, 2000). Lurkers read, but rarely post. To reduce overload, participants decided to set groups to Silent, or alternatively checking messages periodically, a few times a day. This is curious, as it takes the “instant” out of “instant messaging”: what was meant to be a synchronous communication becomes asynchronous because of overload. This points to other lines of inquiry, such as how to manage message and notification overload, and determining when it sets in.

Groups are open spaces in which members are considered to have the same degree of intimacy so any news will be equally shared with all. The indiscriminate addition of new members may lead to a weakening of ties between some participants and the group as a whole. New communication media have changed the way people communicate with groups and with each other (Cruz and Harindranath, 2020; Santos, , et al., 2020). Aristotle observed that “Man is by nature a political animal” (Hatemi and McDermott, 2011; Mulgan, 1974), and that is reflected in attitudes towards IM groups to a certain extent. Most WhatsApp users avoid posting messages that might create conflict in heterogeneous groups and try to avoid embarrassment or break personal ties.

Our findings point to a need for better organizational techniques. They are directly related to information overload: users have so many messages and contacts that they now need better ways to manage their daily diverse digital feeds.

Our study is limited to small and medium sized group interactions of Brazilian users using WhatsApp for IM. This implies three limitations: cultural, group size and diverse instant messaging tools. Even though the study consisted only of Brazilian participants, we believe some of our findings may be relevant beyond Brazil. Future work includes studying cross-cultural comparisons including other countries that favor WhatsApp. We would also like to investigate if our findings persist in other IM systems (e.g., Telegram), and establish requirements for designing MIM systems that address difficulties noticed by respondents in our study. We believe large groups with hundreds of people may present different interaction dynamics that deserve further analysis, specifically concerning the spread of fake news. By further interacting with our respondents that participate in larger groups, we can start looking at the dynamics of large group interaction in MIM.

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Note

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