

A Sticker is Worth a Thousand Words: Characterizing the Use and Abuse of Stickers on WhatsApp Political Groups in Brazil

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Abstract

Instant messaging platforms have become an important means of communication in our world. According to WhatsApp, more than 100 billion messages are sent daily through the app. Communication on these platforms has allowed individuals to express themselves in other types of media, rather than simple text, including audio, videos, images, and, more recently, stickers. This new multimedia format, in particular, emerged with messaging apps and gained considerable popularity among users, promoting new forms of interactions. Stickers range from static images of memes and emojis to animated images similar to GIFs, often used in humorous contexts. However, in the Brazilian context of WhatsApp, they are transcending their role as a mere form of humor to become an important element in political strategy. In this regard, we investigate how stickers are used, revealing unique characteristics that these media bring to public WhatsApp groups and, more specifically, the political use of this new media format. Furthermore, we found evidence of sticker abuse on WhatsApp, where users attack political opponents and spread hate speech and offensive content in public groups without any moderation. To investigate this phenomenon, we collected a large sample of messages from public political WhatsApp groups in Brazil and analyzed the sticker messages shared in this context. *Warning!* This paper contains images and terms that may be offensive to some audiences.

1 Introduction

“A picture is worth a thousand words” is a popular expression meaning that complex and sometimes multiple ideas can be transmitted by a single still image, which can convey their essence more effectively than a verbal description. Similarly, stickers are a form of visual media, popular in instant messaging services, through which users can express emotion, non-verbal language, and complex ideas (Wang 2016). With the increasing importance of online communication in our daily lives, especially after the COVID-19 pandemic (Zidjaly and Barhi 2023), users seek novel and more efficient ways to express themselves online through computers and smartphones, emphasizing the need for meaningful virtual emotional connections (Liu and Tong 2020). In this scenario, sometimes a simple text-based communication may not be enough to express every feeling we might want to

convey. Even with emoji characters in the text, this may prevent users from fully understanding the contextual subtlety and accuracy of the conversation. Users, however, may overcome such limitations with the usage of stickers (Lee et al. 2016), embodying some forms of interactions, gestures, and symbols with this emerging multimedia messaging format.

When it comes to WhatsApp, they introduced stickers on the platform, referring to them as something to “*help you share your feelings in a way that you cannot always express with words*”.¹ WhatsApp enables users to create custom stickers on any subject or occasion, allowing them to be quickly integrated into a variety of contexts on the platform. This flexibility has made stickers particularly prominent in political discussions, a widely popular topic on WhatsApp (Resende et al. 2019b). This becomes even more relevant considering that WhatsApp has recently gained attention due to campaigns that abuse this environment by quickly spreading misinformation on its network (Benevenuto and Melo 2024) and playing a central role in the dissemination of fake news during political events (Bursztyn and Birnbaum 2019; Melo et al. 2024).

In Brazil, the popularity of stickers has increased considerably. Brazilians hold the record for sending stickers (Cesso 2023), transcending their role as a mere form of humor to become a key element of political strategy. The 2022 Brazilian presidential election was the first major election in which stickers were massively used, playing a key role in addressing political campaigns from a different perspective (Couto 2022). Their influence has grown so significantly that the Brazilian Electoral Court has released an official sticker pack to aid in fact-checking news (Tribunal Superior Eleitoral 2022). In this direction, stickers have even been weaponized in political activism campaigns, with supporters of one political party using flooding and hijack attacks to spam and undermine their opponents within WhatsApp groups during elections (Kansaon et al. 2024).

Moreover, since users can create their own stickers on WhatsApp, this permissive model and unmoderated environment is also being abused by users to create offensive and hateful stickers threatening other group members, including child sexual abuse material (EuroPol 2019) and Nazi propaganda (Schmehl 2019), creating an unsafe environment for

¹<https://blog.whatsapp.com/introducing-stickers>

users. Recently, even the tool introduced by WhatsApp to automatically create stickers using AI was accused of generating stickers within the app with xenophobic representations of Palestinians and other cultures (Bhuiyan 2023).

Since stickers have become very popular among users, we have observed their increasing misuse on WhatsApp, ranging from misinformation campaigns to hateful harassment content. However, we still lack an analysis on a broader scale of their usage within the messaging platform ecosystem due to the closed, private, and encrypted architecture of instant messaging platforms. In this study, we characterize the political use of stickers on WhatsApp, focusing specifically on their role within political public groups during the 2022 Brazilian elections. Our analysis aims to address the following research questions:

- **RQ1:** Do stickers share the same characteristics as other media formats on WhatsApp, and do users use them in the same way?
- **RQ2:** How is political content expressed through stickers in public WhatsApp groups in Brazil?
- **RQ3:** How do users abuse stickers to spread offensive content through public groups on WhatsApp?

To answer these questions, we collected a large-scale dataset and analyzed over 6 million messages from 1,409 public political WhatsApp groups in Brazil during the 2022 presidential election period, identifying 650,000 sticker messages encompassing 57,031 unique stickers. Our findings reveal that stickers are not a supplementary form of media but play a distinctive role in political communication on WhatsApp in Brazil. We demonstrate their structural uniqueness and highlight distinct usage patterns, including their collectible nature and expressive flexibility. Furthermore, our study highlights a darker side of sticker usage, providing evidence of their abuse for spreading offensive, provocative, and political content. These insights contribute to understanding how stickers serve as tools for creative expression and mechanisms for political activism, propaganda, and abuse in the online discourse of public groups on WhatsApp, amplifying polarization and hate speech.

2 Background and Related Work

The growing popularity of mobile instant messaging applications has transformed the way users communicate online. Compared to the traditional short messaging service (SMS), instant messaging offers a more social, conversational, and informal communication environment (Church and de Oliveira 2013). Therefore, smartphone users felt closer to their correspondents through the exchange of messages (Zhou, Hentschel, and Kumar 2017). The change in the way people connect also came with more complex forms of expression, beyond text, images, and emojis, influencing the emergence of stickers.

Many studies on WhatsApp explored different content formats: text (Resende et al. 2019a; Machado et al. 2019), image (Resende et al. 2019b; Garimella and Eckles 2020; Reis et al. 2023) and audio (Maros, Almeida, and Vasconcelos 2021; El-Masri, Riedl, and Woolley 2022) are explored to understand user usage patterns and how each can

be abused to spread false stories on the platform, leading to the use of systems to monitor such contents (Melo et al. 2019a), evidencing a multimodal trait of misinformation within WhatsApp. It is worth noting that misinformation is a known issue on the platform (Benevenuto and Melo 2024), particularly in partisan political groups (Bursztyn and Birnbaum 2019). The app is seen as a pivot in the spread of misinformation during political elections in Brazil and India (Melo et al. 2019b; Reis et al. 2020a).

Another similar content well explored in the literature is humorous memes. But memes are not only used for entertainment, but also carry more in-depth meanings, such as political opinions (Koetse 2015). Zannettou et al. (2018) found a substantial number of politically related memes in both mainstream and fringe Web communities, reinforcing its role in shaping public opinion, which generates the need to study their propagation, evolution, and influence on the Web. Fernández (2020) examines an abusive meme in the context of WhatsApp, highlighting how it perpetuates platformed racism. The study links the meme’s popularity to long-standing racial stereotypes and demonstrates how an encrypted environment facilitates the spreading of harmful content. Similarly, Alvarez, Gonzalez, and Ubani (2021) analyzed gender representation in reaction GIFs, highlighting significant gender disparities and the implicit biases embedded in these alternative media formats.

Given the parallels between memes, reaction GIFs, and stickers, including that the latter has an even higher emotional link with users, and knowing the important role of WhatsApp in political scenarios, we also need to understand the implications of the usage of this multimedia format within the messaging platforms and its relationship with partisan context. Although there are some efforts dedicated to the study of memes (Ling et al. 2021; Zannettou et al. 2018), few are focused on stickers. Analyzing the use of stickers presents a particular challenge due to the format of the platform where they are used. A sticker is a common form of media in messaging apps, such as WhatsApp and Telegram. Given the private and closed nature of this environment, it is not trivial to obtain data from these platforms (Benevenuto and Melo 2024). Despite their viral potential (Melo et al. 2019b), there are no studies that systematically evaluate the use of stickers at scale on WhatsApp.

Most studies focus on why and how people use stickers on messaging platforms through a small sample of users, rather than characterizing the actual content. Lee et al. (2016) conducted semi-structured interviews to understand sticker usage patterns, observing individual and social characteristics of emoticon usage, showing that emoticons play social and strategic functions on message apps. Zhou, Hentschel, and Kumar (2017) presented a qualitative study focusing on the increase of emojis and stickers in mobile apps and the decrease in the reliance on text within the platform. Similarly, Hasyim, Gusnawaty, and Said (2024) analyzed language variation of sticker usage among students within WhatsApp groups. The stickers showcase non-formal language, innovative linguistic strategies, and emotional connections.

Given the importance of stickers in messaging services and their usage as reactions or responses, some studies have

explored predicting a sticker as a reply to a message in a conversation. Gao et al. (2020) trained a deep learning model to suggest the most suitable sticker in response to the conversational context, while Laddha et al. (2020) explored sticker recommendation in two steps: first, predicting the message a user is likely to send, and second, replacing it with an appropriate sticker. In addition, Al-Marouf et al. (2020) explored the social and cognitive factors that affect the use of stickers on WhatsApp, creating a unified model for the usage and acceptance of stickers in social media messaging.

Zidjaly and Barhi (2023) identify stickers as a new form of public discourse in Oman during the COVID-19 pandemic. They suggest that to encourage public cooperation, stickers struck a culturally imperative balance between keeping traditional norms intact while committing socially offensive acts. Stickers help convey intentions and emotions in messages, but their complexity and placement constraints can also result in miscommunication. For instance, Cha et al. (2018) explores the sticker misinterpretations, showing that most of the issues occurred due to stickers' ambiguous (multiple) facial/bodily expressions and different perceptions of dynamism in gestures. Tang et al. (2021) explore another aspect of miscommunication, showing that 34.7% of the stickers had differences between the sender's intention and the recipient's interpretation. Last, Klier and Baier (2024) examine the misuse of stickers on WhatsApp for abusive and illicit content. Their forensic analysis of WhatsApp's Android system explains mechanisms in which (abusive) stickers can be shared and downloaded through WhatsApp, highlighting key differences from other media formats.

Although many studies explore users' intentions and the characteristics of stickers through qualitative approaches with small samples or simulated scenarios, we still need a broader and more comprehensive characterization of this new media format widely used in WhatsApp groups to show how they appear within chat structures, their political implications, and potential threats to vulnerable groups. In this paper, we fill this research gap by conducting a large-scale analysis of the use of stickers in political WhatsApp groups. In doing so, we improve the general understanding of stickers and shed light on the specific mechanisms of political activism movements within the architecture of our contemporary digital communication, including the use of abusive and even illegal content circulating in the encrypted environment of the messaging platform.

3 Data Collection

WhatsApp has over 2 billion total users and 100 billion messages exchanged every day.² However, studying such an environment is a challenge due to its closed architecture and end-to-end encryption in private chats. On the other hand, instead of using WhatsApp only as a peer-to-peer messaging, users, especially Brazilians, have also appropriated the app as a platform for semi-private, and public group spaces (Pereira, Camargo, and Parks 2022), with many public groups shared online from which data can be explored.

²<https://twitter.com/WhatsApp/status/1364714386078621703>

Number of Messages	Number of Stickers	Unique Stickers	Number of Groups	Number of Users
6,039,760	659,576 (10.9%)	57,031	1,409	64,227

Table 1: Summary of data collected from WhatsApp.

Through an invitation in the form of a URL, any user can join a group and participate in public chats with hundreds of people, whose topics include, but are not limited to, politics, sports, work, and entertainment. Therefore, an emerging and effective methodology followed by this study to extract WhatsApp data, then, is joining these public groups and collecting messages shared within them (Garimella and Tyson 2018; Resende et al. 2019b; Melo et al. 2019a; Burszty and Birnbaum 2019; Machado et al. 2019). One of the most prominent topics discussed by Brazilians on WhatsApp in recent years is politics (Becari et al. 2021), with discussions ranging from more private family groups to places entirely dedicated to political discussion and campaigns.

We started with a list of politically related keywords provided by (Resende et al. 2019b), expanding with specific terms about the 2022 presidential elections, including the names of the candidates and the topics most discussed during this period. With this, we searched for public groups in various media, such as social networks (e.g., Twitter/X and Facebook), search engines (e.g., Google and Bing), specific websites to promoting WhatsApp groups,³ and also those groups shared within the groups themselves. After manually selecting and joining 1,409 public and relevant groups for our study, we collected messages exchanged within these chats during the four months of the Brazilian electoral campaign period, from June 2022 to September of the same year, storing, for each message, an anonymized user ID, group in which the message was posted, date, the content of the message, including the media type (i.e., sticker, image, audio, video or document) and, when available, (vii) the actual attached multimedia file. In Table 1 we show the summary of the collected data. In total, we collected more than 6 million WhatsApp messages, of which 659,000 were stickers sent within 1,409 different groups by more than 64,000 users.

Data Limitations. Collecting and analyzing stickers requires investigation of the instant messaging apps where they are used. However, it is known that, at least for WhatsApp, most of the conversations occur in private chats. As a result, the data collected may not fully represent the dynamics of the platform as a whole, especially since we are only able to observe public groups focused on political discussions. It should be emphasized that the findings are limited to stickers circulating in the public realm of the platform within the context of politics. To mitigate this limitation, public groups were selected to avoid bias by including both left-wing and right-wing groups, as well as those representing broader perspectives. Although WhatsApp does not provide any numbers to check the representation of our groups or dataset, a large survey in Brazil reported that 3 out of 10 citizens participated in groups created for political cam-

³<https://gruposwhatsapp.com> and <https://gruposdezap.com/>

campaign activities in the 2020 elections (Becari et al. 2021), while 81% admitted participating of any WhatsApp group and more than 60% shares political content, evidencing the relevance of the topic for the audience. Additionally, to the best of our knowledge, this study presents the largest dataset with a specific focus on stickers on WhatsApp, expanding the understanding of this still unexplored media format.

3.1 Processing Sticker Data

After collecting the data, we separated the messages by media type, filtering only stickers sent in the chats. For each one, we also used the pHash algorithm for the image content related to it,⁴ which calculates a 64bit-integer perceptual hash to each image, acting as a visual “fingerprint” to each file (Zauner 2010). This process allows us to visually compare two similar images and count the total shares of each sticker. By processing all 659,000K sticker messages, we found 57,031 unique stickers (i.e., with exactly the same hash). For each sticker, we finally extract an attribute of its dominant color by grabbing the main color from the palette of that image.⁵

4 Stickers as a Distinctive Form of Media

Multimedia messages are very popular on WhatsApp (Hoseini et al. 2020). While text messages remain the majority, users often share different kinds of media using images, videos, audio, and stickers. Although images and stickers are both visual media, some key changes distinguish them. Stickers may display animated images in chats. They are smaller than actual images and are stored in a different format by the app. Unlike regular images, stickers are usually displayed directly within the text, similar to emojis.

Stickers are usually described as emoticons in the form of colored images (Chen, Freeman, and Balakrishnan 2019), as both can be used as visual reaction messages or determine the feeling of the interlocutor during the conversation, but differ from in-line emojis in diversity, complexity, and usage (Lee et al. 2016), providing a richer communication (Wang 2016). Also, they differ from simple static images as they can be short animated movies. Stickers are also closely related to memes (Wang et al. 2019), which often present a combination of a picture and a statement, typically with sarcastic or humorous intention (Davison 2012). Usually, there is a template-based image that people modify, edit, and publish their version while keeping some key aspects so that the meme template is still recognizable.

Both memes and stickers can be created based on personal experiences, but inspiration can be obtained from popular cultural products such as television shows and video games (Ge 2020). Additionally, users publish memes on the Web to create an incentive for others to share by replicating the original (Ling et al. 2021). The origin of these stickers dates back to 2011, when LINE, a popular messaging app in Japan, mixed cartoons and “emojis” (Russell 2013). This tool allowed users to express social-cultural differences in

⁴Note that, for animated stickers, we convert them to a static one using the first frame so that it can be processed as an image.

⁵<https://pypi.org/project/colorthief/>

a more specific way, inspiring other applications to adopt stickers as well. In 2013, Facebook added stickers to its platform, but still with a limited set of pre-created images. This media was adopted by WhatsApp only in 2018.

Although they share similarities, stickers also diverge from GIFs in many ways. WhatsApp distinguishes between reaction GIFs and stickers by incorporating both separately in its interface, highlighting important differences in their nature and use. Reaction GIFs, a popular form of internet communication (Bay 2022), are integrated into WhatsApp via Tenor,⁶ an online GIF library owned by Google. When a user searches for a GIF in WhatsApp, they are searching in this database. The selected GIF from the cloud is then embedded in the message and sent. Stickers, on the other hand, are not hosted externally. Instead, they are static or animated WebP image files stored in the user’s private sticker collection on WhatsApp and also in their devices. As a result, users can prohibit the download of any kind of media file except for stickers (Klier and Baier 2024). Users can create their own stickers using WhatsApp’s built-in tool or third-party apps, or they can save stickers received in chats to their collections. Because of that, stickers on WhatsApp offer a much greater degree of flexibility, as they can be modified (gaining new details, texts, clippings), saved, and used in different ways, promoting a more personalized and creative expression in chats. That sticker will always be available to the user in their collection unless they choose to delete it.

Finally, while other image media formats have a typical rectangle format, stickers appear in much more diverse forms, with their edges often shaping the outline of the image they represent and without the need to click to enlarge the content. Unlike images, which users can choose not to show on chat directly, stickers are automatically downloaded and displayed to users in WhatsApp chats (Klier and Baier 2024), making them even more susceptible to abuse by malicious actors. These characteristics make stickers a powerful visual media format, easy to use, and more invasive than others, which may explain why they are being used for attacks within WhatsApp, as reported by Kansaon et al. (2024).

4.1 Stickers Usage Patterns

These characteristics, however, refer to the structure and format of the sticker media and not to their usage. We do not know whether the thought process employed by users when sending a sticker is similar to or not from other kinds of media. In this section, we evaluate some aspects of the stickers to investigate how members of the groups use this media.

In Figure 1, we compare stickers with images and texts regarding the volume of media sent per group and user. In the cumulative distribution function (CDF) of the messages per group (Fig. 1(a)), we observe that sticker messages were less popular in the groups than images. About 30% of the groups did not send any stickers in the chat, images were absent in less than 20% of them, and all groups had text messages. Moreover, 60% of groups sent no more than 100 stickers in total. On the other hand, we note that some groups have more than 10,000 stickers. The less frequent use of stickers

⁶<https://tenor.com/pt-BR/>

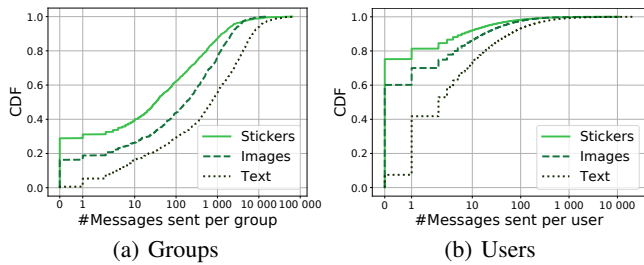


Figure 1: Cumulative Distribution Function (CDF) of stickers sent per group and user, compared with image and text.

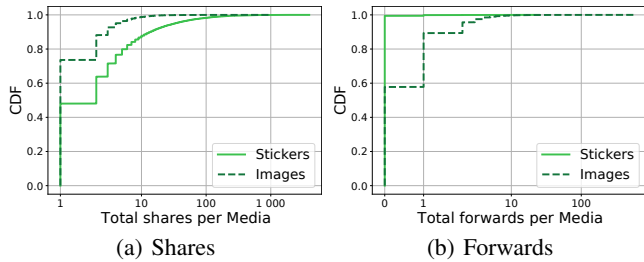


Figure 2: Cumulative Distribution Function (CDF) of total shares and forwarding per sticker and image media.

may be explained by the political nature of the groups monitored in this study, since some groups expect a more formal communication for the debate while stickers are often associated with a more casual or funny context. In contrast, not all political groups are made only of serious discussions, which can reflect a higher number of stickers.

In the distribution of messages per user (Fig. 1(b)), we have similar curves, with stickers being the least common media. Here, even more, users do not send any stickers (75%), but we also have users who individually sent around 10,000 stickers. Hence, we can observe that, as expected, in a messaging app, text format is much more commonly used than other types of media. However, it is interesting to note that users prefer to send images than stickers on the groups, even though both media are widely spread on WhatsApp, especially when considering that stickers are generally easier to send, as they do not need to select a file from the gallery and are more incorporated into the WhatsApp interface.

As we processed and merged stickers, we measured the number of shares each sticker has within our dataset. In Figure 2(a), we evaluate the distribution of total shares per media by comparing images and stickers. Even though we observed more unique image messages in the data, when looking at the total shares per unique media, we note that stickers, in general, have more individual shares than images. About half of the stickers appeared more than once, many of which were shared more than a thousand times. In contrast, about 75% of images have only a single appearance.

Another attribute we obtained for each message is whether it was forwarded or not. Forwarding is an essential tool in the WhatsApp ecosystem, in which users quickly

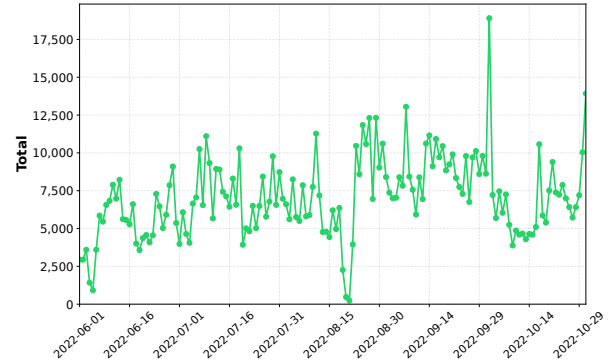


Figure 3: Stickers sent per day in the WhatsApp dataset.

share content with their contacts (Melo et al. 2019b). A recent study shows that about a quarter of all messages in WhatsApp groups are forwarded (Melo et al. 2024). By analyzing forwarded content on our dataset, we found that images are much more frequently forwarded than stickers. Almost none of the collected stickers were found in the forwarded messages, meaning that nearly all of them were sent directly from the users associated with a group. On the other hand, for images, we observe that 40% have been shared as a forward at least once. This reveals a key difference between these multimedia formats.

Stickers differ from images not only structurally but also in their usage patterns. While there are fewer stickers in total compared to other media types in WhatsApp groups, individual stickers are shared more frequently and directly (not using forwarding) by users in chats. This behavior suggests that stickers may present a collectible quality (Zhou, Hentschel, and Kumar 2017), in which users prefer to curate a collection of stickers that can be readily used in specific situations or as a form of self-expression (Wang 2016). To understand this, it is crucial to examine how stickers work on WhatsApp. Without the forwarding mechanism, users need to save them to their collection by marking them as favorite stickers. This process, described in detail by Klier and Baier (2024), involves selecting a received sticker and choosing the “mark as favorite” option, which adds it to the user’s favorites menu. WhatsApp interface reinforces this collection-based experience by providing a dedicated section for users to access their favorite stickers, enabling quick use in chats.

Last, we observed in Figure 3 the large volume of stickers posted per day within the public groups monitored from our dataset. Users send over 5,000 stickers per day on average within the groups analyzed, but three significant peaks stand out. The largest occurred on October 6, coinciding with the Brazilian presidential elections, when sticker usage surged to over 17,500, while the second peak was on October 30, during the second round of the elections, with over 13,000 stickers. The third was around September 7, Brazil’s Independence Day, an important date in the country’s political calendar. It is also interesting to note the gradual increase in the number of stickers as the election period approaches and the sharp drop right after voting day. These spikes underscore the political nature of the dataset and the strong con-

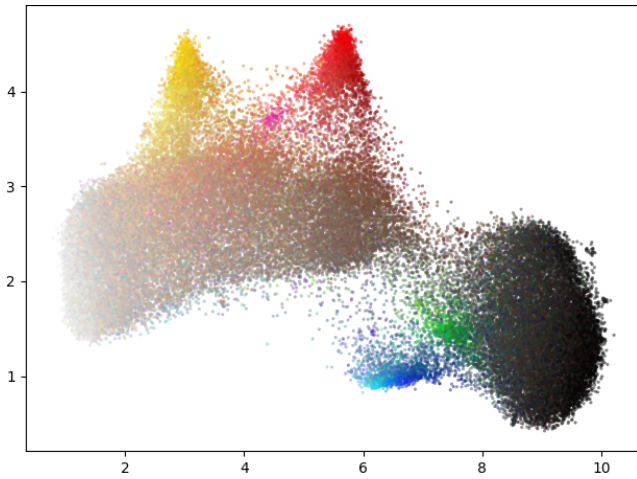


Figure 4: UMAP visualization of all stickers from the WhatsApp dataset.

nection between sticker activity and major political events.

5 Sticker Content Characterization

In this section, we evaluate sticker content, grouping them by visual similarity, and creating a graph of stickers according to the groups in which they were posted to evaluate.

A visual representation of all stickers collected is shown in Figure 4. We created a representation using both the pHash binary vector and each sticker’s dominant color. Then, we employed dimensionality reduction via uniform manifold approximation and projection (UMAP) to plot the sticker representations in a 2D space (McInnes, Healy, and Melville 2020). Each point is associated with the representation of a single sticker, and its color is the dominant color of the actual sticker. It is visible that there is a concentration of red stickers and also green and blue ones, which are related to the context we captured, and related to political campaigns for the 2022 Brazilian elections. The leading left-wing party in Brazil employs red colors associated with the party’s branding, while the leading nationalist right-wing party mostly uses green, blue, and yellow colors derived from the Brazilian flag. The stickers in our dataset reflect the partisan nature of the branding of the competing parties. A thorough manual investigation of the yellow chunk of stickers revealed the presence of many “emoji” stickers, which are faces drawn in emoji style representing existing emoji characters. The gray area in the plot encompasses many different sticker styles, and we do not point to a single characteristic of them.

5.1 Exploring Visual Similarity

To explore the similarity of these stickers, we leverage image features to cluster and investigate the patterns and characteristics of the stickers. A similar methodology has been employed to study memes in Web communities (Zannettou et al. 2018), annotating and mapping them to clusters. Since the perceptual hash (pHash) provides a comparable

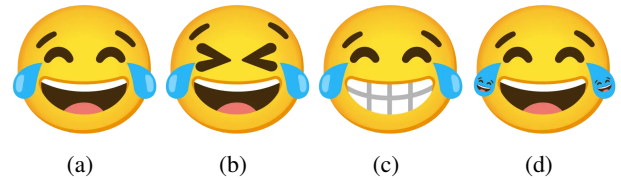


Figure 5: Cluster of grouped stickers representing emojis.

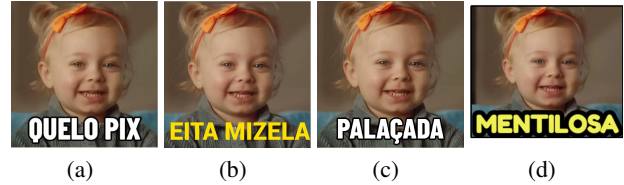


Figure 6: Example of the cluster with meme sticker template with small variations.

fingerprint of stickers, we can use it to cluster the stickers through the density-based spatial clustering of applications with noise (DBSCAN) algorithm (Deng 2020), merging them into visually similar groups of content shared on WhatsApp. Using DBSCAN allows us to investigate the popularity and diversity of stickers and gain insights into their content.

The pHash-grouped sticker clusters reveal sets with variations of images, emojis, or memes, evidencing the dynamics of sticker usage. Some clusters highlight a key characteristic of stickers: their role as both meme-like content and emoji substitutes, as seen in Figures 5 and 6. Emojis, which are pictorial representations of emotions or objects, often take the form of simple, round yellow faces (Zhou, Hentschel, and Kumar 2017). In the case of stickers, these are frequently more elaborated versions, with some evolving into animated versions. Like emojis, these stickers are commonly used as emotional reactions to messages, providing users with a more visually nuanced way to express themselves in conversations (Wang et al. 2019).

The meme-associated clusters, on the other hand, consist of a set of analogous images that follow a recognizable template, differentiated only by minor text changes or visual details to express humor or satire. This aligns with the typical behavior of memes, where a base well-known image is edited and remixed across the Internet, maintaining its core template while being adapted to various contexts (Ge 2020). This practice of remixing, transforming, and altering base images is central to the meme ecosystem on the Web, where visual elements are modified to reflect cultural or situational humor (Lee et al. 2016; Ling et al. 2021; Davison 2012). Stickers, in this context, also extend this behavior, serving not only as images but as part of a broader visual conversation that blends both expressive and cultural elements.

It is interesting to note that within certain clusters, very visually similar stickers may also portray opposing ideas. In the context of the public political groups encompassed in this work, many clusters are directly related to the poll-



Figure 7: Examples of visually similar stickers used by opposing political leanings.

leading politicians in the Brazilian 2022 elections and contain advertising/provocative material associated with their campaigns. Here, we can find examples of corresponding stickers that carry drastically opposing partisan content, as shown in Figure 7. This cluster grouped two visually analogous stickers, but they are shared in different contexts. The stickers portray an edited image of opposing candidates of the left and right-wing parties in a criminal mugshot, suggesting that stickers are co-opted by adversary groups and used with opposing semantics but adopted with the same visual aesthetics. These results alert us to the implications of grouping stickers (or any image content) exclusively based on their visual appearance. Small details often imply drastic changes in the semantic value of the sticker.

5.2 Political Alignment of Stickers

As exemplified in the previous section, visually similar stickers can convey drastically different ideas and be used in entirely different contexts. Since groups analyzed in our dataset expose differences in political alignment, activism level, or even in goals or topics discussed, besides the visual appearance of stickers, we also evaluate their similarity based on the context in which they are used. To evaluate the content of stickers from this perspective, and check whether stickers sent in similar groups express similar ideas, we build a graph of stickers shared within the same chats to create a network of stickers based on the groups in which they were shared. Figure 8 offers a graph visualization of this network assembled with the most popular stickers in our WhatsApp data. In this graph, each node is a sticker, and they are linked with an edge if both appear in the same group. We also applied a community detection algorithm based on modularity optimization (Blondel et al. 2008) to identify sticker communities within the network. For visualization clarity, we used only stickers shared more than 100 times in the observed groups and edges with at least 10 groups in common.

Even with a very dense network (density measured at 0.698), we could identify two main larger communities and a smaller one. These two main communities reflect the dataset’s polarization, featuring very similar stickers from both political leanings. There were two major candidates for the Brazilian 2022 presidential elections (Bolsonaro, a right-wing candidate, and Lula, a left-wing candidate). Most of the stickers found in the monitored public groups represent both sides of this dispute. While some stickers are symbols,

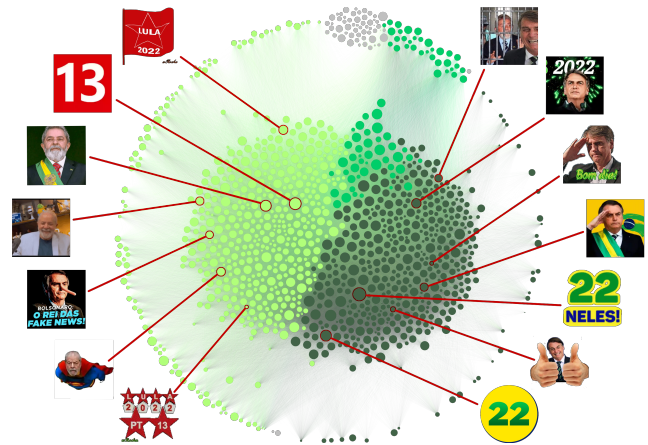


Figure 8: Stickers network.

numbers, draws, and colors associated with each political party, others portray both candidates as being in a position of leadership as president or in a position of defeat. Numerous stickers aim to criticize or anger members of the opposing political leaning. Together, these sticker archetypes form a unique and connected political community. In contrast, the smaller third community features more diverse content, including sexual content and generic stickers. To analyze the partisan leaning of stickers, we label each monitored group as left-wing, right-wing, or undefined, based on the political stance indicated in the group’s name and, when needed, its description. The group annotation shows that most groups support the right-wing candidate Bolsonaro (666 groups), while only 126 groups support a left-wing agenda. The remaining 617 groups were tagged as undefined, as their political alignment could not be determined (e.g., general debate groups or support for other political positions).

Next, we analyze each sticker to determine its political leaning based on the groups that shared it. Then, using the labels of these groups, we calculate the proportion linked to each political side and assign the sticker a label based on the side with the highest proportion. This label indicates whether the sticker is primarily used in right-wing or left-wing contexts. Note that some stickers may be used equally by both sides of the political spectrum or predominantly by groups without a clear political alignment. To prevent mislabeling in such cases, we introduced the third category, “undefined”, for stickers without at least 60% majority on either side. This approach allows us to better identify stickers that are closely linked to a political alignment. Through this annotation, we found that 18,000 stickers are strong biased towards usage in right-wing groups and 6,000 towards the left, as shown in Table 2. Note that the difference could be explained by the fact that, in Brazil, the right-wing movement is seen to be actively mobilized on WhatsApp (Bursztytn and Birnbaum 2019).

6 Political Attacks with Stickers

Given the potential for stickers to convey strong partisan sentiments, our analysis delves into the scenarios in which

	Right	Left	Undefined
Total Groups	666	126	617
Total Stickers	18,158	6,704	32,169

Table 2: Political alignment of groups and sticker context.

political stickers serve as tools for provocation or even direct attacks against opposing political groups using our methodology. Kansaon et al. (2024) analyzed political activism on WhatsApp in Brazil, revealing common types of attacks performed by partisan public groups towards opponent campaigns on WhatsApp. Their results found that 62% of flooding attacks on WhatsApp are executed using stickers. The public nature of these political groups easily allows individuals from adversarial political positions to join, establishing a channel for launching targeted assaults against individuals aligned with opposing ideologies. The ease of one-click sticker sharing may explain why these initiatives are particularly conducive to flooding group chats with divisive content. By identifying the political leaning of stickers, we can examine whether they are being misused in public groups by political campaigns to harass opposing users. To investigate this, we analyze whether stickers predominantly associated with a specific political alignment appear in groups aligned with the opposing spectrum.

Our analysis shows that most politically annotated stickers were used exclusively within their respective ideological circles. However, we also found cases where political stickers transcended party boundaries, appearing in groups with opposing leanings, suggesting politically motivated attacks. Based on these criteria, we identified 869 partisan stickers, with a notable majority (794) exhibiting right-wing bias and being shared in leftist groups. In contrast, only 75 left-wing biased stickers appeared in right-wing groups. A manual evaluation revealed that many of these stickers are either political propaganda supporting the opposing candidate or “humorous” memes intended to provoke group members. We also observed stickers portraying both candidates in derogatory and humiliating ways, including edited images with sexual connotations, highlighting the offensive nature of some attacks. Notably, creating WhatsApp stickers using a person’s face without permission, particularly when intended to insult, harass, or damage their reputation, is already considered illegal in countries like Indonesia (Kurniawan 2024). In Brazil, this issue is regulated by broader defamation laws, and there is no specific regulation for WhatsApp. Nonetheless, the Superior Electoral Court has criminalized the massive spread of political content through message applications.⁷ In Germany, police reported that child sexual abuse stickers were shared in a climate activism group, putting all members at risk of having illegal content on their devices (Klier and Baier 2024).

Figure 9 shows examples of these “political attack” stickers, which promote a partisan candidate in rival environments. The presence of such stickers in politically oppos-



Figure 9: Example of stickers used to “provoke” or “attack” opposing political groups on WhatsApp.

ing groups suggests a deliberate act of confrontation by users, trying to cause reactions and distress among individuals holding contrasting political views. For instance, Figures 9(a), 9(b), 9(c), and 9(d) depict stickers featuring the right-wing presidential candidate Bolsonaro, perceived as provocative within leftist groups. One sticker even includes the text “Leftists will infarct with hate”, tailored to instigate distress. Similarly, leftist stickers depicted in Figures 9(g) and 9(h) endorse Lula and are also incongruous with right-wing ideologies. Of particular concern are images such as those in Figure 9(e), depicting Bolsonaro wielding a firearm, and Figure 9(f), featuring heavy boots crushing a red star with the words “This is our fight. Communism, not here!”. These images evoke menacing connotations, thereby exacerbating tensions within a polarized online political discourse.

Our findings reveal that clustering stickers based on their image pHashes, which denotes visual similarity, enables the identification of image sets exhibiting even minor variations. However, this may not capture the subtle political context carried with them and may also inadvertently put together stickers with opposite political messages. On the other hand, examining stickers through the perspective of the groups in which they are shared, and thus their political alignment, exhibits a strong association with the contextual environment rather than solely relying on visual resemblances of the images. This highlights the importance of considering the broader sociopolitical context in understanding sticker usage patterns. Furthermore, we observed that stickers often demonstrate remarkably partisan alignments and are frequently utilized as tools for provocation and abuse within political public groups on WhatsApp. This highlights the pivotal role of stickers in expressing and perpetuating political ideologies and tensions within this network.

Moreover, the asymmetric distribution of stickers aligned with right-wing ideologies may reinforce echo chambers and polarization within WhatsApp groups. Users who predominantly encounter content aligned with their own political beliefs may become further entrenched in their viewpoints, hindering dialogue and deepening division in online communities. Sharing biased stickers also raises important questions about political engagement and manipulation on social

⁷<https://folha.com/zdu068gh>

media platforms. The deliberate dissemination of partisan content, particularly in the form of stickers designed to provoke or attack opposing political groups, shows a strategic usage of digital media for political propaganda and agitation.

In conclusion, our dataset’s prevalence of right-wing biased stickers sheds light on the complex interplay of digital media, political discourse, and ideological polarization on WhatsApp in Brazil. Understanding this ecosystem is crucial to fostering inclusive dialogue within online communities and mitigating the risks of manipulation and division.

7 Abusive and Hate Stickers on WhatsApp

Although politically motivated attacks are one form of sticker abuse, others involve offensive and inappropriate content on WhatsApp. In this section, we delve deeper into these pathways, shedding light on the various forms of abusive behavior facilitated by stickers on the platform, including the spread of hate speech. We use the NSFW Yahoo model (Mahadeokar and Pesavento 2016) to measure information on how “explicit” each sticker is. We also use SafeSearch detection with Google Vision API⁸ to get complementary data about potentially harmful content being posted on WhatsApp through the stickers.

On WhatsApp, users can freely create customized stickers based on any image they want. However, this model is not unanimous among all messaging apps. Most of them have only predetermined and limited sets of stickers that users can use during conversations. Facebook and its messaging system “Messenger” do not allow any users to add their own creations as stickers (Facebook 2022). The mobile messaging app LINE even sells millions of curated sticker packs per month, and stickers have long been one of LINE’s key revenue drivers (Russell 2016). Despite Meta restricting stickers on its other platforms and selling stickers can be a highly profitable economic model, for WhatsApp, particularly, Meta chose to let users freely create and share their own stickers. However, this permissive model has some challenges, as it opens the way for the dissemination of offensive and inappropriate content. Not surprisingly, stickers are used to distribute not only memes, but also illegal content such as child sexual abuse material (EuroPol 2019) and Nazi propaganda (Schmehl 2019). Even worse, WhatsApp automatically saves every sticker received in a chat, hence users may have incriminating stickers on their devices without knowing or wanting to (Klier and Baier 2024).

WhatsApp’s terms of service, however, state that stickers created must be legal, authorized, and acceptable images. Furthermore, users are not allowed to use WhatsApp services in ways “that are obscene, defamatory, threatening, intimidating, harassing, hateful, racially or ethnically offensive, or instigate or encourage conduct that would be illegal, such as promoting violent crimes”. Although WhatsApp’s TOS does not allow for offensive stickers, a quick manual inspection of the top 5,000 most popular stickers shared within our dataset revealed clear examples of stickers that do not comply with these rules. There were instances of

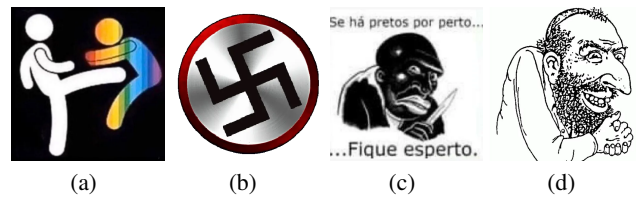


Figure 10: Example of offensive stickers sent by users that violate WhatsApp’s terms of use.

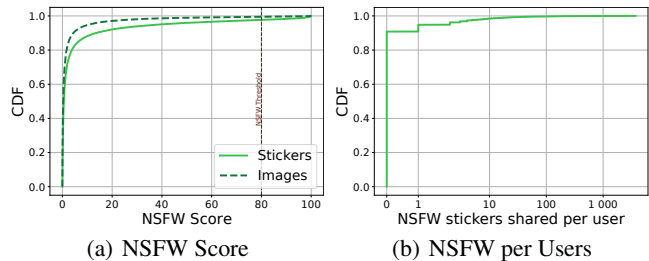


Figure 11: Distribution of NSF stickers sent.

stickers depicting extreme violence, hate symbols, degrading pornography, and highly repulsive images.

Figure 10 presents hate stickers found in our dataset. Sticker 10(a) is an example of a homophobic image against LGBTQIA+ people; Sticker 10(b) depicts a swastika, symbolizing Nazism; Sticker 10(c) shows a black man holding a knife alongside the phrase “around blacks never relax”, which is a recurring racist remark on the Web. Similarly, Sticker 10(d) portrays a derogatory caricature of a Jewish man, reflecting antisemitic stereotypes, which is also a widely known hate symbol.⁹ These examples demonstrate that stickers, freely sent and shared between users on WhatsApp, can be used as media for targeted harassment and attacks against marginalized communities.

In our data, we also found a considerable presence of stickers with sexually explicit content. To evaluate this, we apply the convolutional neural network model for Not Safe for Work (NSFW) proposed by Yahoo Inc. (Mahadeokar and Pesavento 2016) to identify adult-themed stickers. Images with a score greater than 80% are labeled as explicit. Figure 11(a) presents the volume of NSF stickers. Compared to images, stickers are five times more likely to depict explicit content (0.5% of images and 2.3% of stickers are NSF). In total, we discovered 33,335 messages containing NSF stickers, accounting for 5.5% of all sticker messages. As shown in Figure 11(b), around 10% of users in the monitored groups shared NSF sticker, and some individuals posted hundreds of NSF stickers. There is even a peculiar user who shared more than 3,000 NSF stickers. These findings suggest abusive behavior, particularly given that these public political groups are typically not intended for adult content, with some even explicitly forbidding it in their descriptions.

Furthermore, we evaluate other categories of NSF con-

⁸<https://cloud.google.com/vision/docs/detecting-safe-search>

⁹<https://www.adl.org/resources/hate-symbol/happy-merchant>

	Unique Stickers	Number of Shares
Yahoo_NSWF	1,322 (2.3%)	33,335 (5.05%)
Adult	1,423 (2.5%)	30,828 (4.6%)
Violence	416 (0.7%)	4,583 (0.7%)
Racy	4,503 (7.9%)	55,476 (8.4%)
Medical	735 (1.3%)	14,300 (2.1%)
Spoof	17,834 (31.2%)	150,351 (22.7%)

Table 3: “Not Safe” stickers categories on WhatsApp.

tent through the Safe Search detection from Google’s Vision API.¹⁰ This tool detects content within an image across five categories (adult, spoof, medical, violence, and racy) and returns the likelihood for each one of them. According to the API, Adult content encompasses elements such as nudity, pornographic images, cartoons, and activities of a sexual nature. The medical category accounts for the likelihood that the content is associated with medical imagery (e.g. wounds, surgeries, blood). Violence offers an estimation of the probability that the image portrays a violent action. Spoof is the likelihood that a modification was made to the image’s canonical version to make it appear funny or offensive. Content deemed racy may include (but is not limited to) skimpy clothing and strategically covered nudity, lewd, provocative poses, and extreme close-ups of sensitive body areas. In Table 3, we aggregated the results of Safe Search detection on our data collection of stickers, considering the likely and very likely labels for each category.

These findings underscore the urgent need for moderation and enforcement of content guidelines within WhatsApp’s sticker ecosystem. While stickers enhance user engagement and communication (Wang 2016), their misuse brings significant risks, including promoting hate speech, reinforcing harmful stereotypes, and creating unsafe environments within online communities. Our analysis suggests adopting strategies such as using automated tools to detect offensive, NSFW, or adult content and restrict potentially harmful stickers. Despite WhatsApp’s encrypted ecosystem, studies have proposed system architectures for moderate content on the platform (Kazmierczak, Thanapattheerakul, and Chan 2023) without violating the privacy of its users (Reis et al. 2020b). Since these stickers are primarily derived from existing images, the platform could offer alternatives to restrict the creation of content that violates community standards.

8 Conclusion & Discussion

The sticker is an emerging media format with massive popularity on instant message platforms. With digital communication more present in our daily lives than ever, users demand more effective ways to express feelings and specific concepts within virtual chats. In this context, stickers represent a welcome and rapidly adopted media type to extend the expressiveness of online conversation. Despite the widespread popularity of stickers, our understanding of their usage remains limited, primarily due to the closed and pri-

vate nature of messaging app architectures. The opaque nature of these platforms hinders the comprehensive analysis of stickers and their implications for online discourse.

In this work, we analyze 659,000 sticker messages from WhatsApp political public groups in Brazil, comprising a total of 57,031 unique stickers shared during four months of the 2022 presidential elections, offering interesting results on how stickers are employed in this specific domain. Our findings reveal some characteristics that suggest stickers are indeed a distinctive media format while also sharing similarities with others: stickers are less frequently sent compared to other media types, such as images within groups. However, a single sticker usually presents higher total shares, which means they exhibit a higher rate of recurrence within conversations, similar to an emoji. Moreover, stickers are rarely forwarded, suggesting that users often save and keep their collection of preferred stickers for future use instead of using the system’s forwarding tools. This behavior highlights the collectible nature of stickers, in which individuals accumulate a personalized repertoire of stickers to deploy on various occasions, like an emoji or a meme.

However, we also uncover instances where visually similar stickers convey entirely different meanings, emphasizing the importance of considering other aspects when grouping images by perceptual hashes. Particularly in political groups, where misinformation is a concerning issue, it is important to avoid merging distinct ideas within the same category, especially when minor alterations in images could propagate misleading narratives. Furthermore, we analyzed the political alignment of the stickers by building a network of co-occurrence in public groups. This network analysis resulted in two prominent communities of stickers, mirroring the polarized partisan landscape of our political WhatsApp dataset, and finding a strong association between stickers and political affiliations. Notably, we observe instances where political stickers are shared across ideologically opposing groups, often serving as tools for attacks and abuse on WhatsApp.

Moreover, our results reveal the urgent need for better moderation mechanisms to curb the dissemination of offensive stickers and safeguard users from encountering inappropriate content on WhatsApp. We identified a significant prevalence of potentially offensive sticker messages, including homophobia, hate symbols, racist stereotypes, and derogatory depictions of marginalized groups. We also observed that stickers are five times more likely to depict explicit (NSFW) content compared to images. Explicit content accounts for 2.3% of unique stickers and 5% of all sticker messages. Additionally, we identified a substantial volume of violent (0.7%), medical (2.1%), and racy (8.4%) stickers, which may be sensitive for certain audiences, especially in public groups. Given the visual immediacy of stickers, the unrestricted access to public groups, and the ease with which users can create and disseminate stickers from virtually any image, there are significant risks of offensive content spreading unchecked due to a lack of moderation. Stickers have transformed communication on messaging apps by offering users a nuanced way to express emotions and ideas. While they bring novelty to online chats, their impact on platform dynamics remains largely unexplored. Despite WhatsApp’s

¹⁰<https://cloud.google.com/vision>

private and encrypted nature, our research provides valuable insights into how stickers are used within public political groups, bringing more understanding and transparency to the platform, particularly about the substantial abuse of stickers with offensive content disseminated on WhatsApp, which requires actions to bring more safety to users.

As future work, we intend to expand the scope of this research by examining sticker usage across a broader range of contexts, beyond the political domain, to better understand how stickers are used in different types of online interactions. Additionally, as stickers represent a new form of media, a deeper investigation into their potential use for hate speech and online abuse is essential, especially within WhatsApp's public groups. Analyzing how stickers can be used to spread harmful content will provide crucial insights into their negative implications. This research will be important for informing the development of improved moderation strategies to mitigate such risks.

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Ethics Checklist

1. For most authors...
 - (a) Would answering this research question advance science without violating social contracts, such as violating privacy norms, perpetuating unfair profiling, exacerbating the socio-economic divide, or implying disrespect to societies or cultures? **Yes!**

- (b) Do your main claims in the abstract and introduction accurately reflect the paper’s contributions and scope? **Yes, the claims in the abstract and introduction accurately reflect the paper’s contribution and scope.**
- (c) Do you clarify how the proposed methodological approach is appropriate for the claims made? **Yes, we state in the introduction and methodology why our approach is suitable for characterize stickers on WhatsApp and identify abuse in their usage.**
- (d) Do you clarify what are possible artifacts in the data used, given population-specific distributions? **No, because as described in Data Collection Section, we do not have access to representative samples from WhatsApp so we can not make any claims about the data used and its representativeness.**
- (e) Did you describe the limitations of your work? **Yes, the limitations of our work are mainly related to data collection in a dedicated subsection.**
- (f) Did you discuss any potential negative societal impacts of your work? **No, because we do not foresee any potential negative societal impact from this work.**
- (g) Did you discuss any potential misuse of your work? **No, because we do not foresee any potential misuse of this work. Our research aims to raise awareness and inform the public and messaging platform operators about the existence of abusive behavior using stickers on WhatsApp.**
- (h) Did you describe steps taken to prevent or mitigate potential negative outcomes of the research, such as data and model documentation, data anonymization, responsible release, access control, and the reproducibility of findings? **Yes, we describe measures we take to prevent or mitigate potential negative outcomes of our research in Ethics Sections, which includes a discussion about how we dealt with sensitive information.**
- (i) Have you read the ethics review guidelines and ensured that your paper conforms to them? **Yes, we have read the ethics review guidelines and ensured that our paper conforms to them.**
2. Additionally, if your study involves hypotheses testing...
- (a) Did you clearly state the assumptions underlying all theoretical results? **NA**
- (b) Have you provided justifications for all theoretical results? **NA**
- (c) Did you discuss competing hypotheses or theories that might challenge or complement your theoretical results? **NA**
- (d) Have you considered alternative mechanisms or explanations that might account for the same outcomes observed in your study? **NA**
- (e) Did you address potential biases or limitations in your theoretical framework? **NA**
- (f) Have you related your theoretical results to the existing literature in social science? **NA**
- (g) Did you discuss the implications of your theoretical results for policy, practice, or further research in the social science domain? **NA**
3. Additionally, if you are including theoretical proofs...
- (a) Did you state the full set of assumptions of all theoretical results? **NA**
- (b) Did you include complete proofs of all theoretical results? **NA**
4. Additionally, if you ran machine learning experiments...
- (a) Did you include the code, data, and instructions needed to reproduce the main experimental results (either in the supplemental material or as a URL)? **NA**
- (b) Did you specify all the training details (e.g., data splits, hyperparameters, how they were chosen)? **NA**
- (c) Did you report error bars (e.g., with respect to the random seed after running experiments multiple times)? **NA**
- (d) Did you include the total amount of compute and the type of resources used (e.g., type of GPUs, internal cluster, or cloud provider)? **NA**
- (e) Do you justify how the proposed evaluation is sufficient and appropriate to the claims made? **NA**
- (f) Do you discuss what is “the cost“ of misclassification and fault (in)tolerance? **NA**
5. Additionally, if you are using existing assets (e.g., code, data, models) or curating/releasing new assets, **without compromising anonymity...**
- (a) If your work uses existing assets, did you cite the creators? **NA**
- (b) Did you mention the license of the assets? **NA**
- (c) Did you include any new assets in the supplemental material or as a URL? **NA**
- (d) Did you discuss whether and how consent was obtained from people whose data you’re using/curating? **NA**
- (e) Did you discuss whether the data you are using/curating contains personally identifiable information or offensive content? **NA**
- (f) If you are curating or releasing new datasets, did you discuss how you intend to make your datasets FAIR? **NA**
- (g) If you are curating or releasing new datasets, did you create a Datasheet for the Dataset ? **NA**
6. Additionally, if you used crowdsourcing or conducted research with human subjects, **without compromising anonymity...**
- (a) Did you include the full text of instructions given to participants and screenshots? **NA**
- (b) Did you describe any potential participant risks, with mentions of Institutional Review Board (IRB) approvals? **NA**
- (c) Did you include the estimated hourly wage paid to participants and the total amount spent on participant compensation? **NA**
- (d) Did you discuss how data is stored, shared, and de-identified? **NA**

Ethics Statement

Unlike other qualitative approaches, this study does not involve direct experiments with human subjects. However, the messages may contain sensitive content and require consideration of privacy and ethical guidelines. We collected only messages from public groups on WhatsApp, focusing on stickers. All sensitive information (i.e., usernames, phone numbers, and text) was anonymized. We conducted a large-scale analysis of stickers used in political WhatsApp groups, presenting results only in aggregate form. Moreover, we select groups based on a set of keywords with a balanced number of terms for different political alignments in Brazil to ensure diversity of groups and avoid methodological bias. Despite these precautions, the number of right-leaning groups on WhatsApp in Brazil is more prevalent, impacting our data. However, we believe that our methodology accurately reflects the asymmetrical political landscape on WhatsApp.