Social Cohesion During the Stay-at-Home Phase of the First Wave of the COVID-19 Pandemic on Polish-Speaking Twitter

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Abstract. Catastrophic and urgent events, such as the COVID-19 pandemic, are known not only to polarize societies and induce selfish, individualistic behavior, but might also motivate altruistic behavior. We have analyzed COVID-19 perception using data collected from the Polish-language Internet from 15.01-30.06.2020, equaling 930,319 tweets. Deploying methods of computational social science and digital epidemiology, we aim to understand mechanisms of social consolidation and depolarization (measured by network modularity and sentiment) during the so-called "stay-at-home phase" of the COVID-19 pandemic. Mauss' theory of interaction or exchange of gifts, the theory of social capital, as well as Kaniasty's theory of mobilization and deterioration serve as a background for reflection on the Polish example during the first epidemic wave. Our study highlights the potential of social support and caretaking to reduce affective and behavioral polarization in social media

Keywords: COVID-19 · Risk perception · Polarization · Twitter · Social media · Social network analysis · Sentiment · Internet research

1 Introduction

Theoretical Background. Social interactions have a fundamental impact on the dynamics of infectious diseases (such as COVID-19), challenging public health

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mitigation strategies and possibly the political consensus. COVID-19 posed a paradox of social interaction. On the one hand, it polarized and disrupted social networks [18,34], which resulted in the formation of filter bubbles. On the other hand, it provides a stage for mutual help and support [25,26].

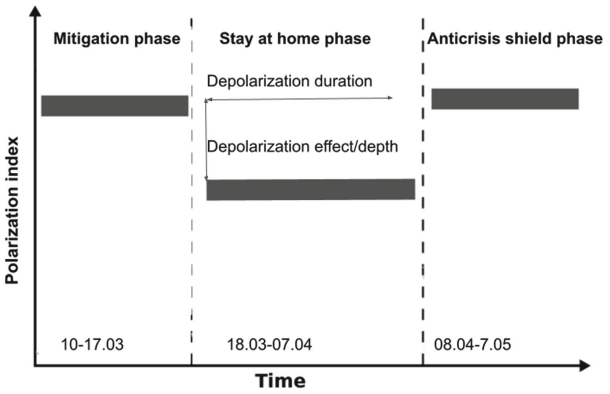

Fig. 1. Theoretical model of mobilization and deterioration during the first wave of COVID-19 in 2020.

Social media gives a voice to user concerns regarding COVID-19, society, and political systems in an interactive way. Perceived social support and a sense of society (Gemeinschaft vs. Gesellschaft [41]) are known to be mediated by social media [31]. The COVID-19 pandemic found Poland and other post-communistic countries totally unprepared in March 2020, while richer Western European countries limited the sharing of resources they possessed and controlled supply chains, disconnecting weaker EU members [10]. The new reality of the crisis has not been seen in Poland since 1981's martial state [23]. The COVID-19-related state of emergency was declared due to the necessity of supporting hospitals with food delivery, homemade personal protective equipment, etc. due to a shortage of resources and limitations in dealing with patients and the elderly. Mauss's theory of help-giving defines the concept of gifts to benefit other people. Pro-social interactions depend on "social embedding" [28], which has its own projection in virtual reality (e.g., social media). Interactions between goal-oriented actors could create a focus on the social environment [37] and build positive and negative attitudes towards help-giving.

Most studies on self-organized and collective movements on social media during the pandemic revealed its negative impact on the society [34], but this need not always be the case. These mechanisms provide emotional or material support, which could not appear in non-crisis situations due to the social distance/anti-homophily rule. In non-crisis times, people are unlikely to befriend people who are too different - above some similarity threshold-from each other, because building and maintaining social interactions is costly [30]. Social capital from these interactions [8] can lead to action (such as social support and cohesion [33]). Thus, help-giving principles and social consolidation [6] could be independent from political

orientation and be projected, even induced, by social media, thereby moving society to a new equilibrium. We investigate the emergence of altruistic behavior characterized by higher-than-usual levels of social interactions (e.g., in social media) between conflicting (polarized) communities. Thus, in such a scenario, we should expect more inter-community links, which could lead to a suboptimal state from an evolutionary perspective [30]. Social embeddedness at the country level was significantly negatively associated with controlled COVID-19 R_t [22] during the first wave of infections. This implies that better-connected/-networked societies were more efficient in coping with the spread of the disease.

The aim of this study was to use social media (Twitter) data to explore polarization dynamics revealed by intercommunity links and sentiment analysis. Thus, using network modularity and sentiment to assess polarization dynamics could provide an overview of this ongoing phenomenon in society.

2 Data, Methods and Research Questions

Twitter has relatively low popularity in Eastern Europe ($\sim$1.5 million active users out of $\sim$6 million registered accounts or less than 5% of the literate population in Poland [14]) and is mainly used by expats, journalists, and politicians. Consequently, it reflects the opinion of key influencers of national politics. During the lockdown, as in many other social media, the number of users significantly increased [40]. Moreover, professional news (traditional media) was ahead of the commentating reaction on Twitter in Poland [21]. This implies that Twitter is not a primary knowledge hub about COVID-19. For example, only 8% of respondents mentioned Twitter as a source of information, many times less than TV or nationwide Internet portals [49]. Despite many initial observations, mainly in the USA [38] the pandemic did not drive the polarization significantly deeper or weaker in the behavioral dimension [3,9]. Other studies on Twitter did not confirm that polarization decreased over time during the first waves of the pandemic [35,42]. In our study, based on the analysis of Polish Twitter data, we claim that we could observe and quantify the polarization. Our main hypothesis is that communities divided according to political beliefs (partisan), became less segregated during the mobilization phase, and returned to the previous level of polarization during the deterioration phase (Fig. 1). Thus, the main goal of our study is to indicate the depth and duration of depolarization on Twitter using the affective (emotional load) and behavioral (structure of the social connections) metrics.

The social network of Twitter users may be represented as a graph $G = (N, E)$ with a set of n nodes $N = \{1, ..., n\}$ and a set of m links (edges) $E \subset N \times N$, $|N| = n$ and $|E| = m$ with $|\cdot|$ denoting cardinality. We represent a Twitter user as a node, and we connect the nodes with a link if there is an interaction between the nodes. We considered three interactions: retweeting, replying, and quoting. Each interaction results in a different network; thus, we consider three networks corresponding to specific interactions.

We used network modularity [29] as an index of polarization, which has been widely used in measuring polarization [11,13]. Modularity is computed

for the network and partitions of its nodes into communities. Modularity has a value in the range $[-1/2; 1]$ characterizing the partition. The maximization of modularity leads to the best separation of the network into communities; there are multiple algorithms for modularity maximization. In the current paper, we used the unsupervised weighted Louvain algorithm [7] and considered the networks as undirected.

The data collection includes tweets with the #Koronawirus hashtag posted from 15.01.2020 to 30.06.2020. We constructed networks based on the interactions that occurred within each week. We used word count-based sentiment analysis, with the Nencki affective word list [36,45] for the Polish language. We computed the proportion of the words (content of Tweets for weekly aggregated data) having connotation for selected emotions (with focus on optimism/happiness in our study). The baseline to understand the process is the pre-pandemic polarization and partisan level in Poland, which is reflected in social media [4,20,27].

3 Results

A starting point of our analysis was to reveal the partisan structure of our pandemic-related data sample. Previous studies on the Polish-language Twitter showed similar clusters emerging among partisans with sharp community divisions in general [27] almost the same as in the COVID-19 discourse (Fig. 2). After

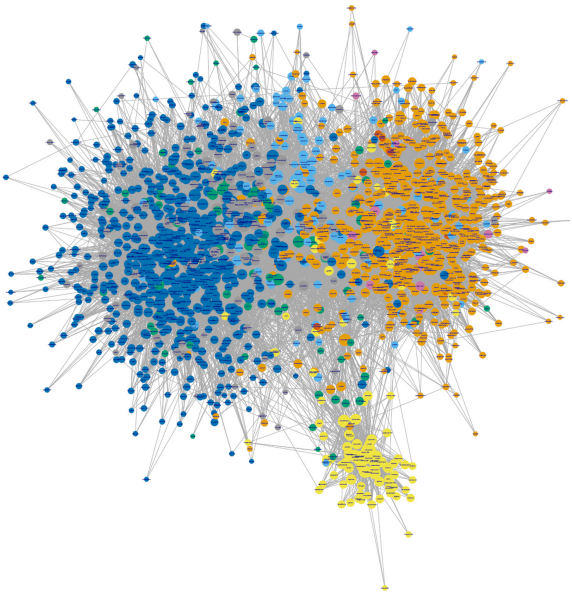

Fig. 2. A network of retweets with the #Koronawirus hashtag in the Polish language during 15.01-30.06.2020 (1,500 most central nodes by weighted degree centrality, color codes correspond to different communities). Blue—the ruling coalition, Orange—the mainstream opposition, Light blue—far right, Yellow—a Protestant minority. (Color figure online)

community detection, the vertices were colored the same color if they belonged to the same community. Out of 76,822 Twitter users engaged in coronavirus discourse, there is a clear polarization between major communities: ruling party, mainstream opposition, and minor but clear communities of the far-right party and Protestant movement. See Fig. 2. Notably, before SARS-CoV-2's introduction to Poland, there was no far-right community [20] that came onto the scene when the topic became popular and gained political power. The role of central nodes, such as celebrities, politicians, and scientists [24] could be important in building the discourse on Twitter. In this study, we focus on the "stay-at-home" phase; however, it is important to draw an epidemiological and infodemiological background before and after the investigated period. Based on the qualitative and quantitative analysis of multiple media sources in Poland from 10.03-07.05.2020 (which we define as the first wave of the epidemic), we can distinguish the following phases [15,21].

1. Mitigation phase (10-17.03.2020). Declaration of the main restrictions.
2. "Stay at home" phase (18.03-07.04.2020). Social consolidation.
3. Anti-crisis shield phase (08.04-7.05.2020). Anti-crisis shield declaration.

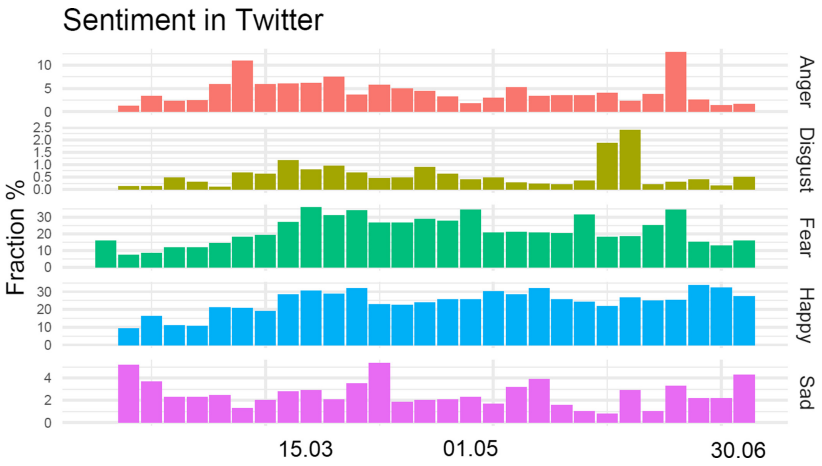

Fig. 3. Sentiment dynamics on Twitter week by week. The depolarization phase corresponds to 18.03−07.04.2020.

In the middle of the "stay-at-home phase," we observe a temporary minimum of network modularity, which implies temporary depolarization and mobilization (Fig. 4) in supporting each other (which is also seen in optimism in the sentiment analysis) over political divisions (Fig. 3). However, it lasted very shortly (just a few weeks) and the system relaxed back to reach the peak of polarization around the summer presidential campaign.

The main hashtags of the consolidating phenomenon were #widzialnareka (visible hand), #pomoc (help), #solidarność (solidarity), #WspierajSeniora (support senior), #PomocZakupowa (shopping help), #covidowesos (COVID SOS), #szyje maseczki (sewn masks), and #brawadlaWas (applause for you). The end of social consolidation happened when the presidential election campaign started around 10.04.2020, which was the 10-year anniversary of the Smoleńsk crash, the main polarizing event in the history of an independent Poland [17].

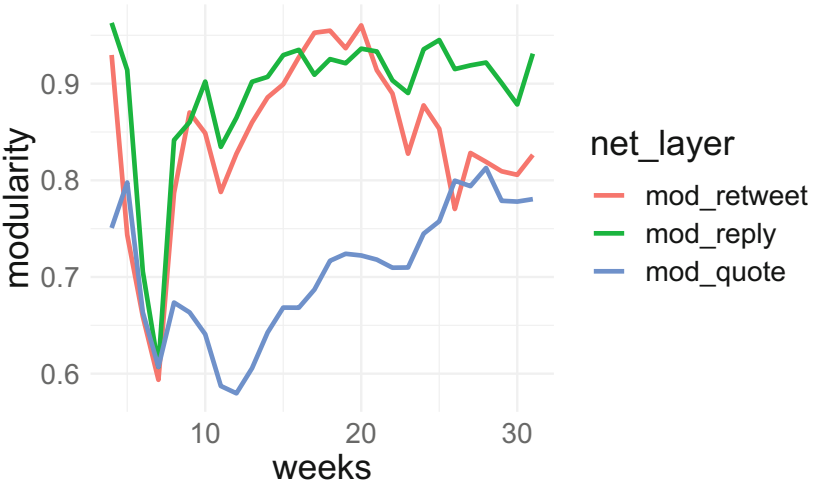

Fig. 4. Attempt to indicate the depolarization phase 18.03-07.04.2020. The modularity of the full networks and their weekly dynamics for types of communication (retweeting, reply, quotation).

4 Discussion

In critical moments of the pandemic, the social media were already incorporated into emergency planning and crisis management for monitoring as well as for crowd-sourcing and collaborative development [2] mainly for local communities. It provided opportunities for commenting and engagement by active users (76,822 unique users in the Polish COVID-19 context).

The unexpected scale of the pandemic and the loss of information control by the government have destroyed the existing "institutionalized society" in social media (with high polarization) and created a "communal society". However, in the COVID-19 era, social media has gained a bad reputation due to the spread of mis-/dis-information [44], creation of filter bubbles/echo chambers [5], etc. Most current research on communication through social networks during crises concentrates on the speed of spread [12] and the quality of information [43];

however, the most influential element—inter-community links—was not investigated to such an extent. A special role of social media as the moderator could be deployed to maintain social capital during the COVID-19 pandemic.

We showed that in the mobilization phase ("stay at home"), people demonstrated an altruistic attitude (experiencing positive emotions such as optimism (Fig. 3)) on Twitter. They could potentially take actions benefiting others in the physical world and the virtual reality of social media. We also discovered that sharing activities (for instance, retweeting) crosscut partisan lines (Fig. 4). Thus, we confirmed the short-term depolarization during the "stay-at-home phase" (Fig. 4, 3) in late March/early April. However, this phase of relative optimism and high interlinkage between all users was unstable. The system soon returned to its polarized equilibrium. Studies on inter-connected partisan communities formed in crisis situations in the pre-social media era have reported that interconnectivity (depolarization) was also unstable. For instance, in 1997 during the flood of the century in the Polish city of Wroclaw, a support society was also formed for a short time [39].

Limitations. We are aware that operationalization of polarization to network modularity and sentiment is a simplification, and we miss many aspects of this phenomenon. Historically in Poland, solidarity movements that gathered people of different statuses, religions, and political orientations in the 1980s (form of social capital [1,16]) played a role in the democratisation of this post-communistic country, so the level of mobilisation observed in Polish social media during COVID-19 does not need to be observed in other countries to such an extent. Some civil initiatives via social media such as participatory epidemiology of COVID-19 vaccines have been only carried out in post-communistic societies only [16,19]. Moreover, the retrospective character of this study and the use of the biased medium of Twitter does not allow causative reasoning without further qualitative reflection [32].

5 Conclusion

In conclusion, social media provides new opportunities for fostering the dynamics of supportive actions [37] allowing the mobilisation of people in crises such as COVID-19. Massive, apolitical actions supporting the healthcare system or people with special needs are creating social cohesion. Social media platforms (particularly Twitter) are known for polarizing (by default) the communication ecosystem, because users see content filtered by this technological giant according to their preferences mostly from the other users they like, follow, and retweeted previously [47,48]. However, top-down policies and procedures on social networks are likely to fail [46], so the advocacy of bottom-up (civil initiatives of average users) could be critical in future resilience policy planning, aiming for depolarization. Thus, the catastrophic weather anomalies in Europe in 2021 could also lead to forming supportive Internet communities in societies.

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