VIRALITY WITHOUT ADHESION: HOW TIE STRENGTH SHAPES THE SPREAD OF CONSPIRACY THEORIES ON X

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This study investigates the role of social tie strength in the diffusion of political conspiracy theories on the social media platform X (formerly Twitter). By analysing 74 million interactions related to Polish politics between April 2021 and October 2022, the research aims to identify the relationship between tie strength and the spread of conspiracy narratives compared to other political content. The study also examined which social ties are activated during dissemination spikes of conspiracy theories. The findings based on Bayesian proportion tests reveal that weak ties, particularly retweets and quotations, are the primary conduits for spreading conspiracy content, whereas replies show a more diverse distribution. Conspiracy content is spread less through close-knit, frequently interacting accounts and more through casual or single-interaction accounts compared to non-conspiracy political content. During dissemination spikes, weak-tie retweets, fan account interactions, and one-time contributors drive the increase in conspiracy narratives, whereas moderate and strong ties show no significant changes. The results suggest that conspiracy theories are broadcast rather than debated on X, with limited engagement from strong and moderate ties. Furthermore, the presence of conspiracy narratives in political discourse, despite temporary surges, remained constant, suggesting that the diffusion process is limited. However, these findings highlight the challenges posed by the spread of conspiracy beliefs through weak social ties on social media platforms, potentially normalising fringe ideas.

Key words: conspiracy theories; platform X; politics; Poland; interactions.

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Introduction

According to the Eurobarometer Report (European Commission, Directorate-General for Research and Innovation, 2025), the proportion of Europeans who believe that 'Viruses have been produced in government laboratories to control our freedom' rose from 28% in 2021 to 35% in 2024. Similarly, the proportion of Europeans who think that 'The cure for cancer exists but is hidden from the public by commercial interests' increased from 26% to 34%. Although studies do not agree on whether the percentage of people who believe in conspiracy theories is increasing, it is undeniable that some conspiracy beliefs are shared by a significant portion of the population in various countries (Heft and Buehling, 2022; Uscinski et al., 2022). This can have far-reaching political implications. In democratic systems, where political power is tied to the electorate's decisions, the spread of conspiracy theories can significantly influence political decisions. For instance, a party whose electorate largely consists of climate change deniers may hesitate or deliberately delay implementing necessary environmental policies (Uscinski, 2020; Uscinski et al., 2017). Some leaders use conspiracy theories to set themselves apart from the rest and build a support base. Conspiracy beliefs also affect political activities. On the one hand, by fostering distrust in the political system, they decrease political engagement (Uscinski, 2020) and prosocial behaviours (van der Linden, 2015). On the other hand, they can mobilise people to dangerous actions, such as when a man who believed in the Pizzagate theory entered a pizzeria armed and fired several shots, fortunately injuring no one. He suspected that the pizzeria was connected to a paedophile ring and human trafficking (Metaxas and Finn, 2017). A far more dangerous event was the attack on the Capitol in January 2021. Fuelled by suspicions of fraud in the 2020 U.S. presidential election, it resulted in the death of five persons, and numerous injuries.

Before a conspiracy theory can become part of a person's belief system, it must first be communicated (DiFonzo, 2019). This communication is crucial in the process of adopting and altering beliefs (Centola, 2015; Rogers, 2003). In this study, we explore how conspiracy theories are disseminated on the Polish X (formerly Twitter) by employing the theory of weak and strong ties (Granovetter, 1973). The spread of conspiracy theories depends on social networks in which individuals are connected through various types of social ties. Strong ties, characterised by close, trust-based relationships, reinforce shared beliefs within close-knit groups, fostering a sense of belonging while heightening vulnerability to groupthink and

confirmation bias. Conversely, weak ties, which are more distant social connections, enable exposure to new information, expand individuals' perspectives, and serve as entry points for fringe ideas. Although Granovetter's 'strength of weak ties' theory suggests that weak ties promote societal trust by connecting individuals to diverse networks, they can also serve as conduits for misinformation, introducing conspiracy narratives to new audiences (Greve et al., 2022; Moffitt et al., 2021; Xu and Sasahara, 2022).

The strength of ties has implications for the social diffusion of beliefs (Centola, 2015). Weak ties are particularly crucial for gaining awareness of new ideas, playing a vital role in the knowledge stage of the diffusion process, in which individuals first encounter novel concepts (Rogers, 2003). While weak ties suffice for transmitting information (simple contagion), they fall short in altering beliefs, especially when such changes entail risks or costs. This is evident in the context of conspiracy theories, as these theories are often mocked, deemed pathological, and their proponents are labelled deviants (Uscinski, 2020). Under these circumstances, strong ties, marked by greater trust between individuals, prove more effective than weak ties. As Rogers (2003: 337) observed, 'Certainly, the influence potential of network ties with an individual's intimate friends is stronger than the opportunity for influence with an individual's weak ties'. This is crucial at the persuasion stage of the innovation decision process (Rogers, 2003), when individuals become more psychologically engaged with new ideas and seek social validation to confirm that their beliefs align with their environment. What is important is not multiple exposures but exposure to multiple sources, a phenomenon known as complex contagion (Centola and Macy, 2007)2007. It is noteworthy that adding new connections (creating weak ties) may not only be inefficient but also counter efficient. For instance, Bail (2018) discovered that exposing individuals to opposing political views did not moderate their beliefs but made them even more extreme. In complex contagions, it matters whether the source is trustworthy (Goldberg and Stein, 2018).

Conspiracy theories are typically examined from a psychological standpoint, focusing on cognitive, motivational, personality, and psychopathological factors (see Douglas et al., 2019; Enders et al., 2023; Goreis and Voracek, 2019; Pilch et al., 2023). However, to our knowledge, there has been limited focus on how these theories are disseminated. The first research question explores the crucial issue of how conspiracy theories spread through different types of social connections: *RQ1. What is the relationship between social tie strength and the diffusion patterns of political conspiracy narratives on X, and how does that relationship differ from that of*

other political content? By examining the strength of the social ties involved in this dissemination, we can discern whether conspiracy theories display unique spreading patterns compared to other content on the X platform. The second research question investigates the specific phenomenon of dissemination spikes observed in the rapid spread of conspiracy theories: *RQ2. Which social ties (considering their strength) are activated during dissemination spikes of conspiracy narratives?* By identifying which social ties are activated during these spikes, we can pinpoint the key structural sources of sudden increases in the volume of conspiracy narratives.

Defining Conspiracy Theories

Our research aims to understand how conspiracy theories (CTs) spread through social media, and for this reason, a distinction must be made. What one can observe in textual communications – such as X/Twitter or other social media – are different manifestations of CTs. Some of them can be expressions of support or purposeful dissemination, but others – even though they might use language typical of CTs – can criticise or ridicule them. Considering both phenomena as manifestations of potential CT transmission can lead to many false positives. That is why, following previous research, we decided to focus on statements indicating involvement in CTs, which we define as CT narratives. We distinguished four main criteria for identifying such communications (Matuszewski and Rams-Ługowski, 2025, 72):

1) Statements about belief in a conspiracy involving people in power or a secret group controlling the economy/politics/society, such as 5G, chemtrails, the Flat Earth theory, climate denialism, politicians being paid by foreign governments, COVID not existing.
2) Statements that imply the author shares beliefs produced by existing conspiracy theories.
3) Events being explained by conspiracies and sinister intentions, such as doctors being paid off to hide the truth about a fake pandemic for profit.
4) Questioning mainstream interpretations and providing alternative conspiracy explanations with a low probability.

If any of these criteria are met, but the case raises doubts, we consider four auxiliary criteria related to the form of argumentation.

1) Stating strong beliefs about important events that are contradictory, incoherent, or unverifiable.
2) Taking on the role of a victim of the mainstream narrative explaining important events.
3) Statements about important events pointing to evidence of resistance and self-sealing, such as believing that if NASA denies something, it is proof of a conspiracy.
4) Statements containing an extreme degree of suspicion, preventing belief in anything that does not fit the conspiracy theory.

The above approach is based on the research by Lewandowsky et al. (2015). Instead of challenging the substance of a given claim, we attempt to reconstruct the epistemic position behind a given argument.

Tie Strength and Misinformation

The role of weak and strong ties in the transmission of CTs remains largely unexplored. Therefore, while reviewing the current state of the art, we were forced to broaden our perspective to include different contemporary forms of misinformation, such as fake news. In our literature review, we identified three leading roles of tie strength that have been explored by researchers: the way it facilitates belief in each piece of information, how it encourages sharing of content on social media, and how it modifies susceptibility to changing one's mind.

The first research issue is the impact of tie strength on people's tendency to believe certain information. In their survey of social media users in Nigeria, Apuke and Omar (2020) found that tie strength was the strongest predictor of believing fake news related to COVID-19. In addition, the authors observed that the effect of tie strength was moderated by respondents being informed about fake news, which reduced their tendency to believe in misinformation. In their theoretical analysis, Spatan and Rich (2025) argue that tie strength is a key factor in the assimilation of misinformation, which is often overlooked in analyses focused on the epistemic quality of a given source. According to the authors, the core of this phenomenon is that strong ties serve as customary and normative points of reference. The problem emerges when people assume that if a source aligns with their values, it must also align with the truth. In other words, one can assume that if a given source allows us to better navigate the normative sphere, the same will be

true for the factual one. Moreover, if an issue is related to our identity, strong ties are usually the leading sources of information.

The role of tie strength appears to be slightly different in the study by Rossini and Kalogeropoulos (2025). Based on two surveys among Brazilian users of WhatsApp groups, they found that the more intense the communication on political topics in each group, the easier it is for users to believe the disinformation to which they are exposed. Moreover, the authors recognise that the greatest threat exists in groups characterised by weak ties – or, as they write, 'no ties' – as this is where disinformation appears most frequently. This is consistent with the general state of the literature, as shown by Spatan and Rich (2025) where weak ties, despite their transience, have a broad reach and are capable of virally transmitting less complex (mis)information. Another social platform, Facebook, was studied by Di Domenico et al. (2021) in a simulation experiment. The authors identified tie strength as merely a moderator of the primacy effect, namely that source-primacy increases suspicion if the information comes from a weak tie. Pareek and Gonclaves (2024), on the other hand, conducted an experiment in which participants were exposed to news headlines accompanied by simulated commentary from people with different tie strengths and political views relative to the participants. Statistical analysis of the results showed that regardless of the tie strength between a person exposed to headlines and the person commenting on them, it was shared political views that caused those headlines to be questioned. Nevertheless, based on open-ended questions asked to the participants after the experiment, the authors observed a general tendency to trust strong ties, while weak ties reinforced some people's opposing beliefs due to a lack of trust.

The second area of research we identified is the role of tie strength in the retransmission of misinformation on social media. Once again, Apuke and Omar (2020) consider strong ties with the source of information to be the most important predictor of sharing fake news. Rossini and Kalogeropoulos (2025) observed that respondents who were in groups consisting of strangers ('no ties') were more likely to share fake news than those who were in groups with stronger ties. Di Domenico et al. (2021) did not find a direct effect of tie strength but rather identified it as a moderating factor of the primacy effect: respondents were less likely to share fake news if it came from a weak tie source characterised by source-primacy. Meanwhile, Pareek and Gonclaves (2024) found no statistically significant relationship between tie strength and the propensity to share disinformation.

The last issue we distinguished is the role of tie strength in susceptibility to changing views. This is an important problem because it concerns not only the processes of acquiring views related to CT or disinformation in general but also the prospects of convincing them to adopt fact-based views. Suthaharan and Corlett (2023) conducted an experiment among individuals exhibiting paranoid personality traits and examined the role of social ties in the persistence of one's own views. The experiment showed that paranoid individuals reported significantly larger social networks than the rest of the participants, which made them feel more confident about their beliefs. Spatan and Rich (2025) came to a similar conclusion, writing that even if a person has reliable sources of information, their epistemic perspective will be very unstable if the views obtained from such sources do not agree with their strong-tie environment. Therefore, in their practical conclusions, the authors note that the authority of science alone is not enough and that actions addressing disinformation should target not 'special people' (i.e., influencers), but key nodes for a given tightly knit community. Although Rossini and Kalogeropoulos (2025) did not study the variability of views, they noted that in WhatsApp groups characterised by weak ties and in the case of intense political discussions, there is a greater likelihood of encountering both disinformation and its correction. These are therefore dynamic environments in terms of changing views, both for better and for worse. In contrast, Pareek and Gonclaves (2024) did not find a statistical effect of tie strength on the propensity to change views. At this level of analysis, only political agreement with the person criticising a given message proved to be a significant factor in changing one's views, and in the case of open-ended questions, respondents prioritised the epistemic authority of a given person over their tie strength.

Notably, none of the empirical studies cited above were conducted in the natural environment of interpersonal communication or on a specific social media network. These were either experiments or surveys. Moreover, in each case, tie strength was determined based on the respondents' reports, and there was no attempt to determine it more objectively. At the same time, tie strength was operationalised in different ways: as a quantitative variable resulting from a network analysis (Suthaharan and Corlett, 2023), a variable on a scale obtained from survey questions (Apuke and Omar, 2020; Pareek and Goncalves, 2024), the reported intensity of interaction with a given group on social media (Rossini and Kalogeropoulos, 2025), or as a binary variable determined through an interview (Di Domenico et al., 2021; Rossini and Kalogeropoulos, 2025). In this situation, we identify a significant research gap, which is addressed by our study based on

the objectified criteria of tie strength and data obtained from within a social media platform, namely, X.

In general, we can see the dual role of tie strength in the adoption, correction, and transmission of misinformation. The latter is more easily acquired when arriving through strong ties, but at the same time, they are most often encountered through weak ties. Similarly, efforts to counter misinformation should be carried out with a particular emphasis on strong ties, as this type of relationship most strongly influences changes in beliefs. Finally, when it comes to the transmission of misinformation, weak ties remain the most far-reaching interactions, capable of crossing different environments and providing simple confirmation of one's beliefs. Simultaneously, strong ties seem to play the most important role in assessing the truthfulness of a given piece or source of information. Even when tie strength is not a direct factor in such assessments, it is an important moderator of other epistemic factors, such as the primacy effect.

Methods

This study uses data collected on the Polish X between April 2021 and October 2022 via the Twitter REST API and the academictwitteR R package (Barrie and Ho, 2021). They consist of all tweets, retweets, replies, and quotations that contain the names and Twitter handles of the major Polish political parties (included in surveys), party leaders, members of the Polish Parliament (both chambers), Polish members of the European Parliament, the President of Poland, or mayors of 18 major cities (capitals of voivodeships – the highest-level administrative division, similar to a province in other countries). The dataset consisted of 1,461,964 unique accounts that formed 19,448,679 pairs and interacted 73,592,452 times. Each account was considered a node connected to another node by one of three types of directed edges: quotes, retweets, and replies.

A crucial part of this study was the detection of conspiracy narratives in textual data. Based on the algorithm described in Matuszewski and Rams-Ługowski (2025), we defined a list of keywords (unigrams, that is, single words, and skip-grams, that is, two words that may occur in close proximity to each other, for instance, *schwab* and *reset* in the sentence 'this is the beginning of the globalist reset planned by Klaus Schwab'). We then employed word embedding to identify

semantically similar words based on a cosine similarity above 0.7, supplemented by expert evaluation (excluding words clearly unrelated to conspiracy theories). This process was repeated three times, each iteration expanding the list from the previous step. Subsequently, we randomly sampled at least 10 tweets per keyword and manually verified whether they contained any conspiracy narratives. Some keywords appeared together, resulting in a sample size smaller than the simple multiplication of the number of keywords by ten. Ultimately, we manually verified 3,804 tweets. The Cohen's Kappa for the two annotators was 0.86, indicating a very high level of inter-coder agreement. Hand coding was used to calculate the probability of a tweet containing conspiracy narratives if it included one or more keywords. Based on the analysis of these probabilities using Bayesian proportion tests, we classified all keywords with a lower 95% Credible Interval for a probability above 0.5 as indicators of conspiracy narratives (N = 146). The classification metrics were as follows: F1-score = 0.88, precision = 0.79, and recall = 0.99.

Social ties, defined as unique pairs of accounts, were assessed based on the interaction duration, interaction asymmetry, and average weekly interaction frequency. We used empirical distributions for the duration and frequency of retweets, quotations, and replies. Relationship length was categorised as either short- or long-term, and frequency as infrequent or frequent, using the 90th percentile of interaction duration in weeks or the mean weekly number of interactions. However, specific rules were added for categorisation: social ties that interacted only once during the observation period were labelled as one-timers. For asymmetry, we used another approach because its scale ranges from 0 to 1 and is interpretable. Social ties with a score of 0.5 or below were deemed symmetric, those with scores between 0.5 and 0.8 (inclusive) were considered asymmetric, and scores above 0.8 were classified as unidirectional to distinguish this from asymmetry, where both accounts are engaged but disproportionately. Based on these criteria, social ties were divided into five levels: strong tie, moderate tie, weak tie, weak tie (fan), and weak tie (one-timer) (see Table 1 for details).

Table 1: Operationalisation of social ties is based on asymmetry, duration, and frequency of interactions between X accounts.

Asymmetry	Duration	Frequency	Description	Social tie
<= 0.5	> 90th percentile	> 90th percentile	symmetric long-term frequent	strong tie
<= 0.5	> 90th percentile	<= 90th percentile	symmetric long-term infrequent	strong tie
<= 0.5	<= 90th percentile	> 90th percentile	symmetric short-term frequent	strong tie
<= 0.5	<= 90th percentile	<= 90th percentile	symmetric short-term infrequent	moderate tie
(0.5, 0.8>	> 90th percentile	> 90th percentile	asymmetric long-term frequent	moderate tie
(0.5, 0.8>	> 90th percentile	<= 90th percentile	asymmetric long-term infrequent	moderate tie
(0.5, 0.8>	<= 90th percentile	> 90th percentile	asymmetric short-term frequent	moderate tie
(0.5, 0.8>	<= 90th percentile	<= 90th percentile	asymmetric short-term infrequent	moderate tie
> 0.8	> 90th percentile	> 90th percentile	unidirectional long-term frequent	weak tie (fan)
> 0.8	> 90th percentile	<= 90th percentile	unidirectional long-term infrequent	weak tie
> 0.8	<= 90th percentile	> 90th percentile	unidirectional short-term frequent	weak tie
> 0.8	<= 90th percentile	<= 90th percentile	unidirectional short-term infrequent	weak tie
---	---	1 time	unidirectional short-term one-timer	weak tie (one-time contributor)

Our research questions focused on the differences in proportions. To address these issues, we utilised Bayesian proportion tests with the brms package in R, which shows differences in proportions and the degree of certainty in the results. The second question also involved identifying instances where conspiracy content appears disproportionately more frequently, which we refer to as spikes. To detect these periods, we applied a changepoint detection algorithm to the weekly proportion of conspiracy narratives in all tweets over time. This method allowed us to identify an unspecified number of change points in both the mean and variance of time series. We used a relatively conservative Bayesian Information Criterion (BIC) penalty to fine-tune the number of change points and set a minimum segment duration of two weeks to reduce the likelihood of capturing random fluctuations or short-term noise.

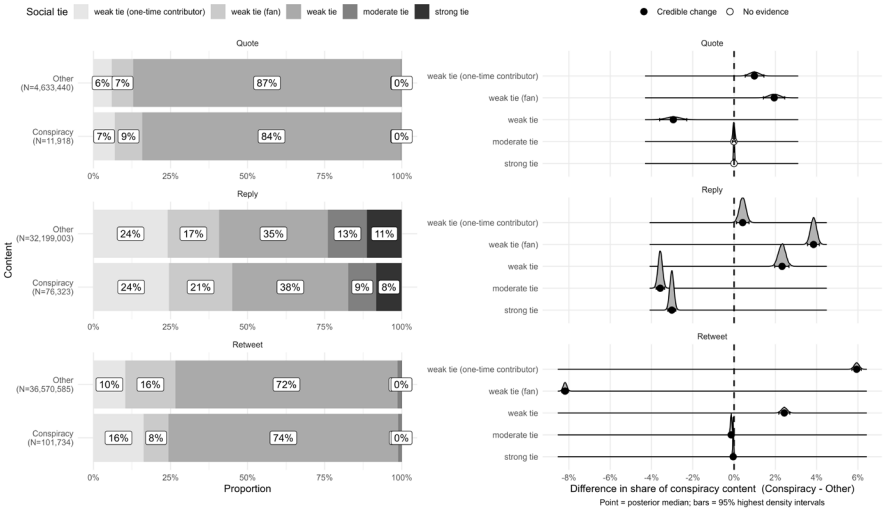
Results

Through which conspiracy ties do conspiracy theories spread?

Our first major finding is that the mode of contact – retweet, quote, or reply – shapes which social-tie strengths transmit conspiracy theories. Both quotations and retweets are spread predominantly via 'plain weak ties' (short- or long-term but infrequent connections), accounting for 84% of quotation transmissions and 74% of retweets. A total of 9% of quotations containing conspiracy narratives were transmitted by fans and 7% by one-time contributors. In the case of retweets, these proportions are slightly different. While the majority (74%) of conspiracy narratives are transmitted by plain weak ties, 16% are transmitted by one-time contributors and 8% by fans. By contrast, replies show a markedly different profile: only 38% of conspiracy replies come via weak ties, while replies among one-time contributors (24%) and fans (21%) rise sharply, and moderate and strong ties jointly account for 17% of transmissions. This picture is completed by the fact that most conspiracy narratives are transmitted by retweets (N = 101,734; 53.55%), followed by replies (N = 76,323; 40.18%) and quotations (N = 11,918; 6.27%), which makes weak tie retweets responsible for the dissemination of 36.4% of all political conspiracy content in the sample.

Next, we detected statistically significant differences in tie strength distributions when comparing conspiracy-laden versus non-conspiracy content. For quotations, conspiracy narratives are slightly more often spread by one-time contributors and fans (up 2 and 1 percentage points, respectively), balanced by a small decline in weak-tie transmission. Retweets of conspiracy content show a larger shift: they are more often shared by one-time contributors (16% vs. 10%) and weak ties (74% vs. 72%), but less often by fan accounts (8% vs. 16%). The pattern holds that strong and moderate ties remain negligible. Among replies, the share of conspiracy content decreases by 3 percentage points for strong ties and by 4 percentage points for moderate ties and increases by 4 percentage points for fans and by 3 percentage points for weak ties. Thus, conspiracy theories diffuse less through close-knit, frequent interlocutors and more through casual or single-interaction accounts.

Figure 1: Proportion of political content produced on the X platform through different types of social ties



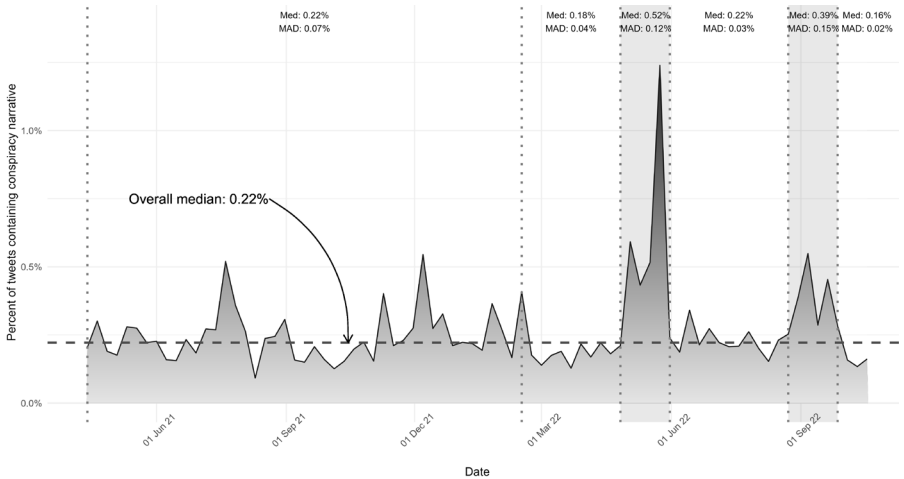
Notes: The left panel shows the percentage share of each type of social tie in the production of content, distinguishing between conspiracy-related and other political narratives. The right panel displays the posterior differences in the predicted proportions (Conspiracy – Other) for each contact type and level of social ties, estimated using a Bayesian model. The points represent posterior medians, and the horizontal bars indicate the 95% highest density intervals. The filled points denote credible differences.

What kind of social ties are engaged in the dissemination of conspiracy narratives during conspiracy dissemination spikes?

The changepoint detection algorithm detected two significant spikes in the number of disseminated conspiracy narratives: April 26–May 31, 2022, and August 23–September 27, 2022 (Figure 2). The first interval coincided with Prime Minister Morawiecki's visit to Chancellor Scholz in Berlin (26 April 2022), Gazprom's suspension of gas deliveries to Poland (27 April 2022), the transition

from a state of epidemic to a state of epidemic threat in Poland (16 May 2022), and Prime Minister Morawiecki and President Duda's attendance at the WEF summit in Davos (22–26 May 2022). The second spike followed events including the assassination of Darya Dugina (20 August 2022), Ukrainian Independence Day (24 August 2022), along with subsequent solidarity demonstrations in Poland, new visa and entry restrictions for Russian citizens, and the inauguration of the Baltic Pipe gas pipeline (27 September 2022).

Figure 2: Proportion of conspiracy narratives among all political tweets, over time



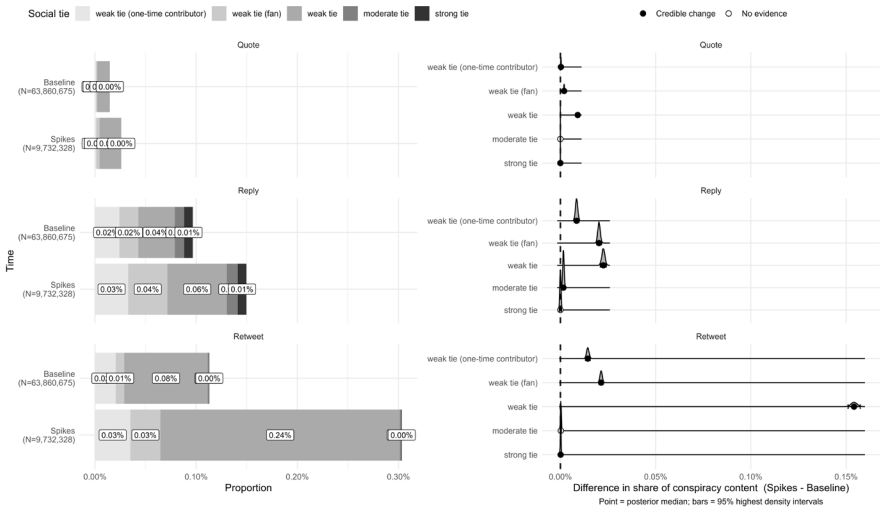
Notes: The grey-shaded areas indicate spike periods identified through changepoint detection. The vertical dotted lines mark the boundaries of the time segments detected by the changepoint algorithm. Summary statistics (Med = median; MAD = median absolute deviation) are provided for each segment.

To illustrate the problem in question, we used the proportion of conspiracy narratives among all publications on X and differentiated between quotations, retweets, and replies (see Figure 3).

During the two dissemination 'spikes' detected via changepoint analysis, conspiracy content among all political posts rose by 0.255 percentage points (pp) over the baseline. Weak-tie retweets drove 60.5% of that increase, rising from 0.08% to 0.24% of political content. In other words, weak ties during spikes disseminated 200% more retweets than they did in the baseline period. The remaining inflows during the spikes were much smaller. They came from replies

between weak ties (+0.026 pp), fan account replies (+0.0203 pp), one-time contributors' retweets (+0.0144 pp), fan account retweets (+0.014 pp), weak ties' quotations (+0.009 pp), and one-time contributors' replies (+0.009 pp). The size of all other inflows was less than 1.68% of the spike. The coefficients for them were above 0 within 95% credible intervals, but their statistical effect was nearly unnoticeable. Notably, moderate and strong ties showed no significant changes. These findings underscore that ephemeral, infrequent contacts – and accounts participating only once – are chiefly responsible for sudden increases in the volume of conspiracy narratives. A noticeable share of conspiracy content is disseminated by accounts that join discussions just to make a conspiracy-related statement and are never or almost never replied to. The other visible pattern is accounts that persistently retweet conspiracy content of selected accounts. The next pattern is that during spikes, there was an increase in accounts that retweeted conspiracy content or replied to accounts with conspiracy content just once and never tried to maintain the relationship. Such actions may be coordinated and/or paid activities aimed at quickly increasing the visibility of certain tweets. In summary, the disproportionate increase in conspiracy content on the X platform is associated with weak ties (including fan accounts and one-time contributors). These spikes are not associated with more profound discussions among moderate or strong ties. Accounts that formed moderate or strong ties produced a statistically equal share of conspiracy content during spikes and beyond.

Figure 3: Proportion of conspiracy-related content among political posts produced on X through different types of social ties, compared between periods of intensified conspiracy activity (spikes) and baseline periods.



Notes: The left panel shows the percentage share of each social tie type in the production of conspiracy content during both periods. The right panel presents the posterior differences in predicted proportions (Spikes – Baseline) for each contact type and level of social ties, estimated using a Bayesian model. The points represent posterior medians, and the horizontal bars indicate the 95% highest density intervals. The filled points denote credible differences.

Discussion

Our work expands the conspiracy theory literature by offering insights into the diffusion patterns of conspiracy theories, especially how the tie strength between X accounts is related to the transmission of political conspiracy narratives. On a conceptual and operational basis, we distinguished three different types of weak ties – fans, one-time contributors, and 'plain weak ties' – which was a significant improvement that allowed for detailed analyses of diffusion patterns.

We present four key findings. First, conspiracy narratives are spread through weak ties, but the mode of contact changes the transmission patterns. Quotations and retweets predominantly spread via 'plain weak ties' (84% and 74%, respectively), while replies reveal a more diverse distribution, with 'plain weak ties' accounting for only 38%. This means that conspiracy narratives are rarely discussed. Usually, they are simply passed on. This suggests that while conspiracy theories might spread on platforms like X, their discussion and development occur elsewhere.

Second, there are notable differences in the distribution of tie strengths between conspiracy and non-conspiracy content. For quotations and retweets, shifts were observed among weak tie categories, which accounted for nearly all transmissions. However, when it comes to replies, conspiracy content experiences a decline among strong and moderate ties, while there is an increase among fans and weak ties. This indicates that conspiracy content is less frequently discussed than other political content, and that strong and moderate ties do not disseminate conspiracy content as readily as they do other political topics. This may imply that sharing conspiracy content is perceived as a riskier or more costly behaviour (Centola and Macy, 2007) compared to discussing political topics free of conspiracy theories.

Third, a time series analysis showed that weak-tie retweets accounted for 60.5% of the increase during spikes in conspiracy dissemination. Smaller contributions were from replies between weak ties, fan account retweets and replies, one-time contributors' retweets, and weak ties' quotations. Moderate and strong ties showed no significant changes. This means that ephemeral, infrequent contacts, one-time contributors, and accounts that persistently retweet a conspiracy from one source were primarily responsible for the sudden increases.

Fourth, the spikes were not associated with deeper discussions among moderate or strong ties. Furthermore, conspiracy content did not "stick", in the sense that its share in political discussions permanently grew after surges. There were sudden spikes, but then the levels of conspiracy content returned to the baseline.

Our research corroborates existing studies indicating that weak social ties serve as primary channels for the dissemination of conspiracy content (Rossini and Kalogeropoulos, 2025). As theorised by Granovetter (1973), weak ties link the distant parts of a network. However, as suggested by Macy and Centola (2007) this may not be enough to change the behaviour of X users and make them discuss conspiracy theories more often. This corresponds with the analysis by

Spatan and Rich (2025), who emphasised the pivotal importance of the reliability of strong ties in the process of adopting conspiracy beliefs. However, it is important to consider further implications. Dow et al. (2021) hypothesised that conspiracy beliefs, when reinforced and spread within online communities, blur the distinction between fringe and mainstream beliefs, fostering the perception that such beliefs are more widespread than they actually are, thereby normalising them. Although we did not examine these perceptions, our analyses indicate no evidence of the adoption of these ideas online, as measured by an increase in the volume of such content. Over the 15 months of observations, and in line with other studies (Uscinski et al., 2022), we did not observe any systematic growth in conspiracy theories.

Next, we highlight the limited role of strong and moderate ties. Our analyses revealed that conspiracy theories were usually broadcast but not debated. On X, accounts discussed them significantly less often than the usual political content. This suggests that X is not a platform where conspiracy theorists engage in deep conversation. Moreover, the observed patterns suggest bot/farm activity or opportunistic one-off users. Such amplification by bots may lead to increased visibility and dissemination of conspiracy theories (Greve et al., 2022; Moffitt et al., 2021; Xu and Sasahara, 2022).

Our findings are constrained by the observational nature of the study, which prevents us from interpreting them as causal mechanisms. Additionally, our operationalisation of tie strength, which uses interaction frequency as a proxy, constrains the interpretation of the results. X is the sole sphere where individuals can interact, and our operationalisation does not account for other spheres. In other words, the strength of the ties is confined to interactions on X alone. For instance, two accounts might have interacted only once on X, but they could be colleagues who communicate daily offline. Another limitation arises from the time span of the data. Although we collected tweets over 15 months, this period may not be sufficient to capture long-term changes. Furthermore, while X is a significant platform for political communication, there are others, such as Facebook, Instagram, and TikTok, each with distinct demographics and specific mechanisms for discussion, sharing and feedback. Future research could incorporate other platforms and countries and conduct longitudinal studies on the persistence of conspiracy networks.

The spread of conspiracy beliefs poses significant challenges to democratic societies, as evidenced by their impact on political decision-making, civic engagement,

and social cohesion. This study's findings underscore the critical role of weak social ties in disseminating conspiracy narratives on social media platforms such as X. Although X accounts significantly less frequently discuss such content than other political accounts, their constant presence in the public sphere may normalise such narratives. These trends are particularly troubling given the current political polarisation and array of global challenges, including climate change and global conflict, which require well-informed citizens and politicians who are neither swayed by nor captive to fringe ideas.

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