
THE SOCIAL IMPACT OF THE POPE'S MESSAGES FOR THE WORLD DAY OF PEACE IN THE LIGHT OF TWITTER DATA ANALYSIS

Sławomir Bylina¹, Mariusz Pisarski² and Andrzej Adamski^{2*}

¹ *The John Paul II Catholic University of Lublin, Poland*

² *University of Information Technology and Management in Rzeszów, Poland*

(Received 14 July 2024, revised 18 January 2025)

Abstract

The article analyses the visibility of the papal message for the 2021 World Day of Peace (1st January) on the social media platform Twitter (now: X.com). The authors conclude that the papal message is lost in the flood of content related to the start of the New Year. From a communication point of view, it would therefore make sense to consider changing the date of the Catholic Church's World Day of Peace. The authors suggest merging this celebration with the International Day of Peace celebrated by the United Nations on 21st September. The article touches upon issues related to scientific disciplines such as communication and media studies, political science and religion and culture studies.

Keywords: Twitter, communication and media studies, press analysis, political science, World Day of Peace

1. Introduction

The aim of this article is to examine the dissemination of official information about the Pope's message of the Vatican on social media and the engagement it creates from the level of network visualisation and community detection. The authors question whether the papal message on such an important issue receives adequate coverage in the media discourse and, consequently, if it influences public opinion sufficiently. It is possible that the New Year celebrations dominate the media content during this period to such an extent that the message about the pursuit of peace goes unnoticed and is overlooked. The article is interdisciplinary in nature. Due to its subject matter, research focus, and employed research methods, it should be situated at the intersection of religious studies, communication and media studies, and political science.

After careful consideration, the authors of the article decided to analyse the 2021 address. This decision was influenced by several factors. First, on February 24, 2022, Russia attacked Ukraine. The Pope's stance on this conflict was perceived by many as ambiguous, leading to a series of unfavourable comments

* aadamski@wsiz.edu.pl

and potentially contributing to the informational noise surrounding the issue. Second, in 2023, Twitter was rebranded as "X.com." Additionally, the policy for sharing tweets for academic purposes changed, with access to the platform's content via API now requiring a subscription. Consequently, conducting comparative research in subsequent years became more challenging.

2. Background and literature review

Christian philosophy defines peace by drawing from the teachings of St. Augustine, who in his work *De civitate Dei* defines peace as the tranquility of order. He emphasizes that the fundamental condition for peace is order, which means harmony among people, starting from the family and extending to international relations. [1]. The encouragement to pursue a state of peace is also present in contemporary teachings of the Catholic Church. Tracing the origins of peace initiatives, one can look back to the 11th century when Pope Urban II proclaimed the so-called 'Peace of God' in 1095, aiming to halt the warring among rulers, even if only for a few days. Nonetheless, it must be objectively noted that in the 2000-year history of the Church as an earthly institution, embodied through the administrative structures and diplomatic entity of the Papal States, numerous wars have occurred, and popes have often been deeply involved in military affairs. Pope Julius II (pontificate: 1503–1513) personally engaged in military matters and led the Papal States' army, earning the nickname 'The Warrior Pope'. He frequently participated in battles and sieges [2, 3].

With the development of Catholic social teaching, calls for peace have become increasingly prominent in the statements of the popes. [4, 5]. The most well-known document in this regard is Pope John XXIII's encyclical 'Pacem in Terris' [Pacem in Terris, Encyclical of Pope John XXIII on Establishing Universal Peace in Truth, Justice, Charity, And Liberty, April 11, 1963, https://www.vatican.va/content/john-xxiii/en/encyclicals/documents/hf_j-xxiii_enc_11041963_pacem.html], where the Pope enumerated fundamental human rights.

An important place in the pursuit of peace is held by the annual Papal Messages for the World Day of Peace and the Easter Message 'Urbi et Orbi'. The observance of the World Day of Peace was initiated by Pope Paul VI in 1968. In his first message on this occasion, he wrote: "It is Our desire that from now on, every year, at the beginning of the calendar which measures and describes the paths of human life in time, this celebration will be repeated as a wish and a guarantee that peace, with its just and beneficent balance, will dominate the development of future history". [Message of His Holiness Pope Paul VI for the Observance of A Day of Peace, 1 January 1968, https://www.vatican.va/content/paul-vi/en/messages/peace/documents/hf_p-vi_mes_19671208_i-world-day-for-peace.html] The Pope's New Year 2021 homily to mark the 54th World Day of Peace was titled 'A Culture of Care as a Path to Peace' and published on the official Vatican website on the 1st of January [Pope Francis, A Culture of Care as a Path to Peace, http://www.vatican.va/content/francesco/en/messages/peace/documents/papa-francesco_20201208_messaggio-54giornatamondiale-pace2021

.html]. Around the publication date several Twitter posts were made by the official Vatican Twitter account, by Reuters news agency and numerous others news outlets, lay and Catholic. Several posts directing social media users to the text of the homily were also retweeted by Pontifex – the official Pope Francis Twitter account. These original inputs from major actors whose institutional and professional role is to either spread the Pope's New Year's homily or report about the fact of World Day of Peace and Pope's involvement in it, initiated dissemination of the message throughout the Twittersphere. During the process of dissemination, the original posts are retweeted, 'liked', mentioned and replied to. Such reaction propels a discussion further redirecting it either to its sources (Pope, Vatican, Church (in general), Reuters) or to their proposed topic of the 'culture of care', or to a theme of peace in current turbulent context marked by the second wave of the global covid-19 pandemic. As such, pope's message, in contrast to traditional, hierarchical distribution of information and announcements [6 - 8], is set on a trajectory controlled by specific rules of social media communication. Characterised by an emphasis on the activity of users, their status (measured by number of followers) and their ability to engage others (and number of likes, retweets and mentions a single post accumulates) these rules might lead to a situation when the original message is overshadowed by exchange of opinions and commentaries that follow it. In extreme cases this can result in an increased ratio level of noise over information, and phenomena such as 'hashtag hijacking' when an original post, most of the time by a prominent user, is being used to advertised unrelated content and to diverse the attention of the public toward the 'hijacker' in order to accommodate its self-serving goals. Hashtag hijacking is a relatively common occurrence on Twitter when a user of no major relevance wants to increase its ranking and visibility at the cost of a high ranked user. Although successful hijacking does occur rarely, along with other attention diverting strategies, it increases the amount of unreliable data on the Twittersphere.

In the case of Pope Francis' New Year address 'A Culture of Care as a Path to Peace' no significant noise generating strategies were detected by the data mining tools we have employed. The key distribution sources of the message remain central in the discursive field that was built around the event and reactions of social media to the event, its announcements and aftermath. As a result, clear picture of networks and communities of users disseminating and reflecting on Pope's message are revealed. Also, both word pools and emotive profiles of the accumulated linguistic big data remain stable and consistent.

However, our network analysis demonstrated visible divisions and a lack of connection between the major and minor actors, the lay and religious communities on the Twittersphere. Detected social networks do not converse with each other and, most of the time, the only bridge between them is formed by official news agencies. Such discursive compartmentalization stands in contrasts to the open, interreligious, universal message of peace that Pope Francis expressed in his homily. In our concluding remarks we suggest that the low rate of exchange across different groups, and the relatively low engagement in the discussion, can be prevented in the future either by tactical means, such as targeted social media information strategies or peace promoting activities on the ground, or by strategic,

administrative means, such as moving the World Day of Peace Day of Peace to a date other than the 1st of January in order to attract attention of a wider range of global communities.

3. Methodology of the study

The Twitter mining tool TAGS 6.0 was used to trace dissemination of Pope Francis' New Year's address 'A Culture of Care as a Path to Peace' across the Twittersphere. Using key words and hashtags to form queries such as: 'Pope AND Peace', 'Culture of Care', 'Peace AND world', 1672 Twitter posts published up to seven days before the 1st of January and 3 weeks after were gathered.

The data about Twitter activity was then exported to .csv format (coma separated values) that can be viewed as a spreadsheet table. A single tweet is recorded with more than 20 values. Most of them give general information about users – geographical location, web address of their Twitter page, number of followers, friends, number published tweets – and relations between users. Data specific to a single tweet presents information about engagement it creates number of likes (favourites), mentions, retweets and a data entry called 'in reply to' which positions a tweet as a reaction to an earlier, original post. The replies, mentions and retweets data displayed by TAGS is fundamental in tracking the information flow around Pope Francis' homily, and in measuring the engagement it creates. Maps of replies and mentions correspond to two main types of networks detected in any social media analysis: the chain network (who replies to whom) and the name network (who mentions whom). The chain network maps posting behaviour and represents the most vivid interactions. As such it is suitable for detecting engagement, whereas the name network is best at mapping more static net of affiliations between users [9]. A third overlay available in TAGS – retweets – helps in positioning conversations within a wider global context where the same subject is discussed by other, unrelated actors.

TAGS Explorer, the visualisation tool, is not supplied with filter algorithms. TAGS visualisations are overpopulated and users with 'long edges' (a distant connection bordering on irrelevant) between them are shown in close proximity. This does not help in detecting community cluster and brings forward a social media noise over detecting discussions, debates of dissemination patterns. Due to such limitation, the use of the tool ends at collecting the data, storing links, and delivering preliminary rankings. The rankings are based on centrality measures such as in-degree and out-degree (number of inbound and outbound connections to a tweet or a user) that help structure the data: top tweeters, top hashtags, top conversationalists.

The second software, Netlytic.org, introduces more advanced and user-friendly network visualisation and cluster detection tools. Netlytic detects and colour codes groups of related nodes representing clusters of stakeholders that dominate discussion under an observation. The main parameter the governs Netlytic's representation of networks is degree centrality. It detects the number of connections to other network participants featured by individual accounts. In-degree relates to mentions and replies, out-degree a number of times the user

is engaging with the encountered content. This way Netlytic delivers a visual ranking of Twitter users in relation to degree centrality and can refine the results brought by TAGS. Netlytic is also able to show influential actors in a network structure in the context of their online and offline communities, e.g [10]. Most importantly, Netlytic allows for clear distinction between the name network and the chain network. These two views on the same data, the first one based on mentions, the second on replies, can highlight two key types of interactions: sharing the news and debating the news. The name network presents those who share the Pope's homily, the chain network those who engage in active conversations and debates about it. We shall see in the findings part of the article that these two perspectives reveal different communities and different phenomena.

Lastly, digital humanities tool Gephi is used to further refine the results. In addition to degree centrality parameter employed by Netlytic, Gephi offers several other network tools such as betweenness centrality and modularity. Betweenness reveals important connecting nodes within a cluster by detecting shortest paths between nodes, whereas modularity detects strength of the paths (bonds) and decides a cluster into modules [Martin Grandjean (2015), GEPHI – Introduction to network analysis and visualization, <http://www.martingrandjean.ch/gephi-introduction>]. A range of filtering tools in Gephi makes it useful for presenting the quality of ties between community members and highlight the key actors.

4. Network and community detection: results

In the data that TAGS import from Twitter, Pope Francis' and other Vatican related Twitter accounts are confirmed to be central to the celebrations of the World Day of Peace Day of Peace. They rank in the top 3 results on the lists of top tweeters, top hashtags and top conversationalists. Hashtags #popefrancis, #peace, #worlddayofpeace as well as account names of ponti-fex, CatholicBishops, VaticanNews, ChurchTimes, paxchristiEW, cnews representing religious community accounts and Catholic news agencies score highly in the mentions overlay of TAGS – representing the name network – and the on the retweet and reply overlays which represent the chain network (Figure 1.).

However, the raw data in TAGS displays a fair number of irregularities and randomness. Both on the replies and on the mentions overlay of TAGS this perceived contingency is exemplified by a high ranking of accounts completely unrelated neither to Vatican nor to World Day of Peace such as Pope_Cee - a black activist user; JohnPatrickHil2 - a self-styled scientist and photographer; Alexandra0306, a numerologist; MarlinTheLoft - an artisan shop. In effect, these high scoring accounts are represented as key players and as centre hubs for discussions and communities that form around them. The picture gets much clearer after looking at the 'retweets' overlay which represents the data outside of community detection algorithms of name networks and chain networks (Figure 2.).

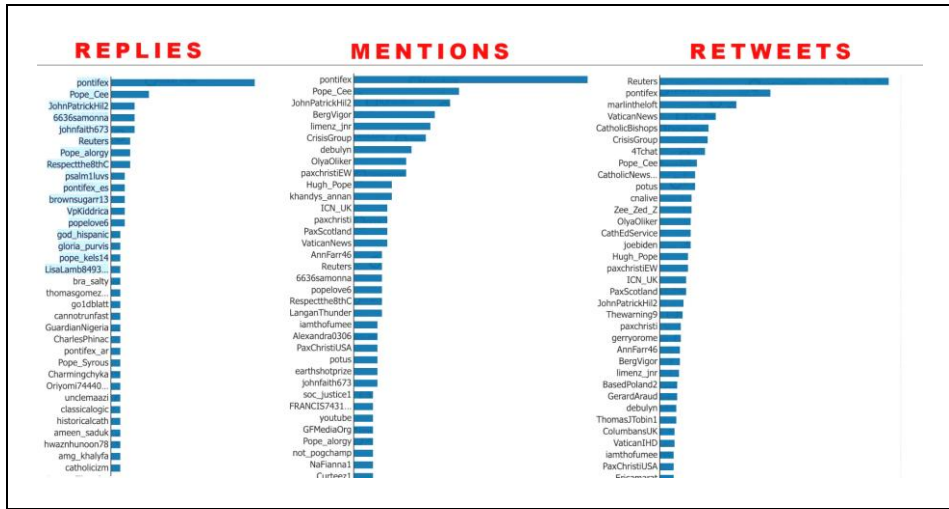


Figure 1. Top Conversationalist pane in the replies, mentions and retweets views on the Twitter conversation following Pope Francis' World Day of Peace homily on the 1st of January 2020. (Source: own study)

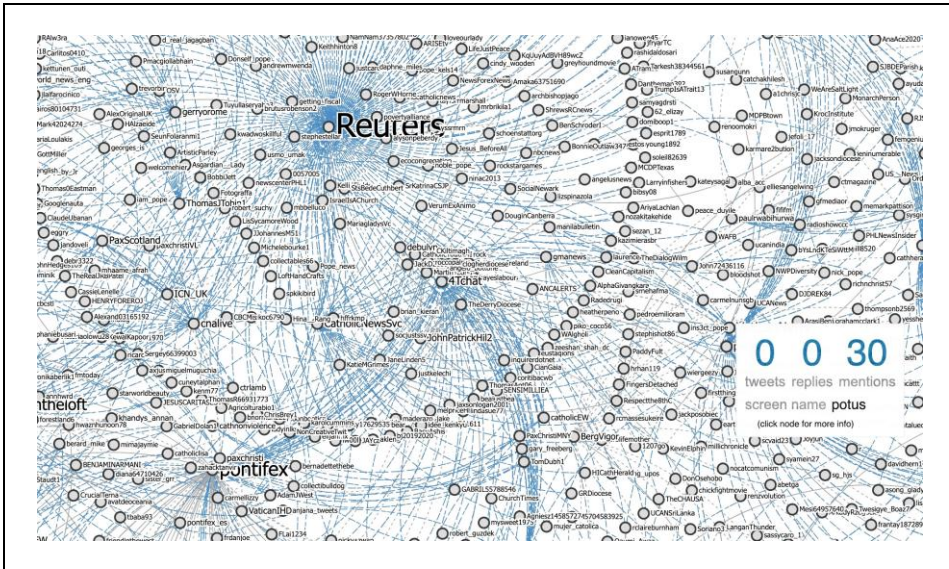


Figure 2. TAGS retweet overlay of the network visualisation of Twitter conversations about peace, pope and the World Day of Peace. (Source: own study)

It turns out that in the context of a general global discussion in which either the words “peace”, “Pope Francis”, “Church” are mentioned, there are indeed clusters of users unrelated to neither although connected by similar semantic pools their messages draw from. Pope_Cee is mentioned in an often retweeted post with a catchy and potentially contagious slogan ‘peace is overrated’; Alexandra0306 advocates for finding hidden messages in numbers present in the Pope’s homily; JohnPatrickHil2 addresses his posts about a historical meteorite that resulted in biblical flood to all world powers, from the USA president to the Pope; a new

handicraft line coming from the artisan shop is followed by a frequently retweeted post with a quote from Pope Francis. In other words, by presenting and visualising unfiltered data TAGS is able to act as a “pulse” of social media. Within this broad horizon, the Pope’s message constitutes just one focus of Twittersphere’s attention among others, an important one, but not overly dominant. Official news agencies, such as Reuters, serve as an important dissemination conduit for Pope’s message. However, the broader perspective given by the retweet overlay presents a confusing overlap of communities and tweet sources that hinder rather than reveal the homily’s dissemination among the public realm.

A further filtering, processing and refining of the data offered by Netlytic reveals patterns and regularities not visible in TAGS. Firstly, by clearly distinguishing between the name network and chain network, Netlytic highlights a major disparity in the size of two networks. The network based on mentions of the Pope’s homily consists of 1298 names (accounts) and 1205 ties between these names. It represents general group of users who mentioned the Pope, peace or both after Pope Francis’ homily. However, the chain network, build on the number of direct replies (not retweets) is six times smaller and contains 211 ties made by 98 posters. Community detection algorithms bring forward the detected communities as autonomous entities of visually separated, distinctly coloured clusters. Out of 211 ties by 98 users, only a small part, the central one, belongs to accounts affiliated with Pope and the Church. The majority of groups which are pushed by the visualisation algorithm further to the edge of the perimeter talks about peace, quotes the Pope, or comments on the homily without directly addressing the Pope (for example, by including the “@pontifext” mark in their tweets). However, it does not mean that Twittersphere is not responding to an informational commotion caused by the 54th World Day of Peace, but rather that its response comes from within communities who are either distant or who want to distance themselves from the intended universality of the Pope’s message. For example, a user Soc_Justice1 – positioned at the centre of one of such community clusters – wrote:

“@littlecindy71 @cjkwarrior @brandongonez @CP24 oh no, NEW YEAR is by the Christian calendar of POPE GREGORY called Gregorian calendar 🤪 Chinese, Vietnamese, Korean, Hebrew, Hindu, Persian etc etc have a different new year. Thanks but January 1 is not my new year”

Netlytics’ name network visualisation suggests that such separation can be related to the affiliation of users with either lay communities or religious communities outside of the Catholic faith or Christianity in general.

Figure 3. makes it clear that the Pope’s account, the accounts of Vatican news, Catholic Bishops in Scotland, PAX Christina, Catholic News Agency as well as other sources form a large grouping of communities on the right side of the names map form a closely connected social network. Reuters Agency is positioned in the centre of the map as a major source of dissemination of Vatican’s announcements. However, there is only one single thread that connects Reuters with Vatican news, and with the lay world that is Reuters’ main news target.

Interestingly the connecting node is a Berlin based account #HauptstadtStudio aka Demic, highly active, with 127,000 tweets, yet not much popular, with only 205 followers, who retweeted VaticanNews tweet about Pope St Paul VI's inauguration of the 1st World Day of Peace in 1968. This is illustrated by the zoomed out view of the same map (Figure 4.), with the Pope marked in red in the center, and Reuters in yellow.

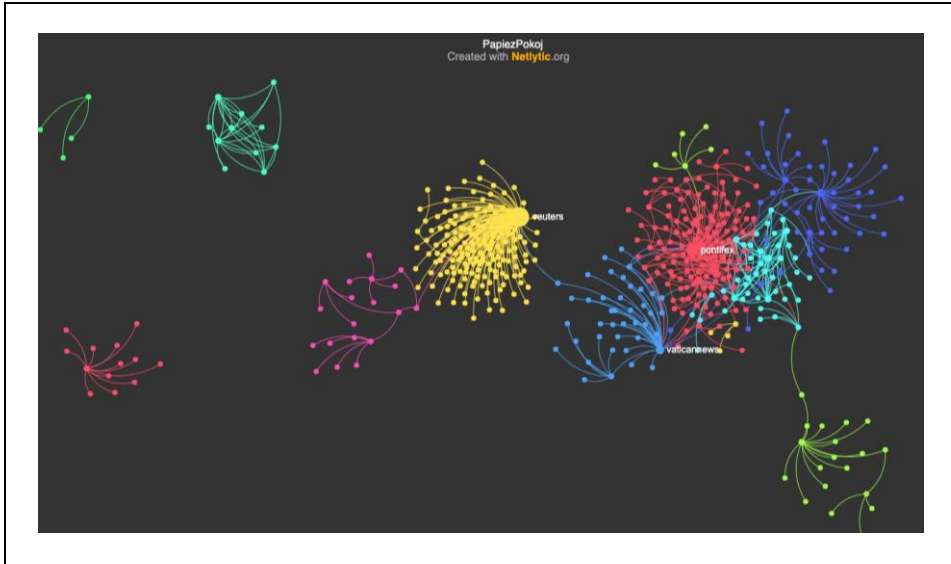


Figure 3. TAGS retweet overlay of the network visualization of Twitter conversations about peace, pope and the World Day of Peace. (Source: own study)

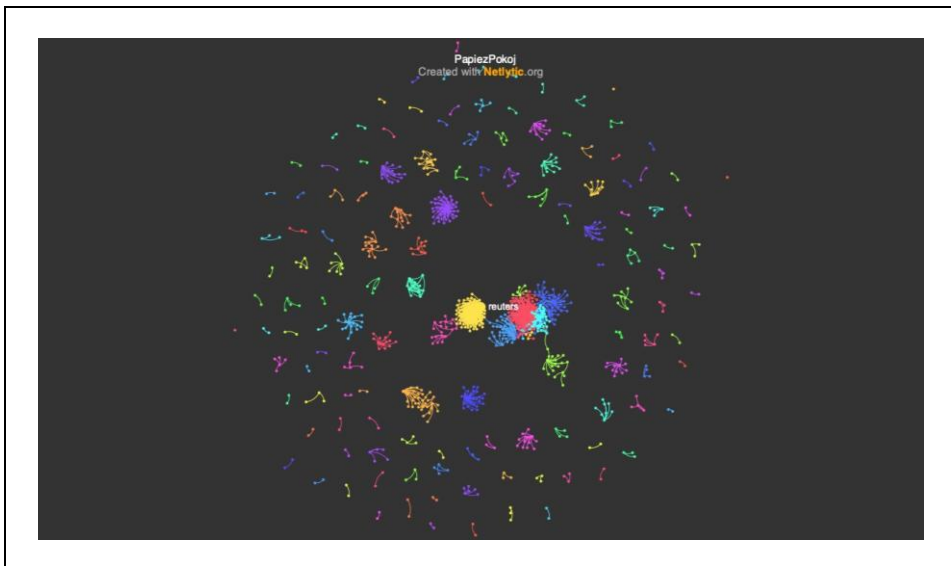


Figure 4. Netlytic' DrL layout of the name network: a larges view on the whole of the data. (Source: own study)

The large view of all existing clusters reveals that news sharing interactions originated by a set of Church and Reuters tweets are surrounded by communities of who mention peace or the Pope in their messages but are not in direct proximity to the particular event Church and Reuters relate to. Pope_Cee's presence (an account of black activist) – is detected as not relevant to Church communities, religious or even any lay commentators, and pushed away from the source of the homily and discussions it generates to the margins, inhabited by small autonomous groups of users who discuss topics around peace in general, not in connection with news coming from Vatican, Reuters and other news agencies.

Finally, Gephi was capable of refining the gathered data by identifying key actors within the large cluster of Catholic sources. Betweenness centrality algorithms, which measure the volume of traffic passing through a node or the amount of network flow that a given node “controls” [11, p. 30], were able to detect major actors in the process of dissemination of Pope Francis's homily. In other words, vocal promoters of the Pope's message are revealed. These actors, among others, are: CatholicBishops (a Twitter account of Irish bishops who posted several tweets about the homily), Pax Scotland, Pax Christi England & Wales, and other Catholic organisations. Individual accounts, such as that of Marek Misak, the Policy Adviser for EU External Relations, are also prominent on the map (Figure 5.).

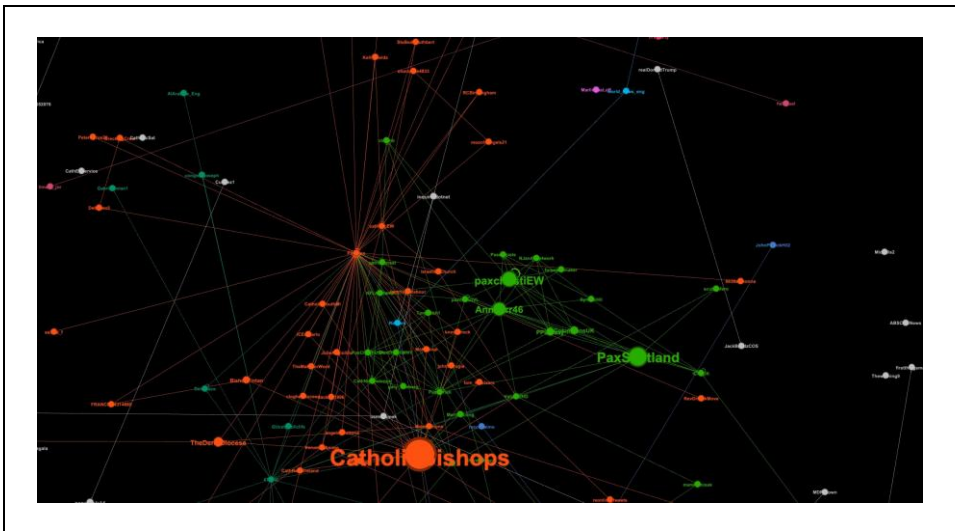


Figure 5. Netlytic' DrL layout of the name network: a larges view on the whole of the data. (Source: own study)

After application of topology filters on top of betweenness centrality algorithms, Reuters central position on the map is replaced by the Pope. His message is the subject of mentions, retweets and discussions by active, vocal users (in case of Catholic Bishops) with either a high network ranking (number of followers) or a high degree of betweenness (Marek Misak as a person active in EU institutions and thus connected to other, non-Catholic sources).

5. Network and community detection: Discussion

Presented results of the network visualisation and community detection tools demonstrate that no single tool can reflect a complex system of dissemination of information within the networked environment. Messages coming from the Vatican at the very moment of their entrance into the realm of digital discourse are subjected to its parametric, egalitarian, non-discriminative rules. Hierarchical travel of information from top to bottom gives way to a distributed dispersed matrix of blinking signals.

Initial processing of the raw data delivered by TAGS reflects traditional hierarchies in the form of ranking lists, but these generated hierarchies are far from traditional notion of hierarchy: a young black rapper named Pope, with as little as few hundreds' followers, whose death initiated a wave of condolences from his Twitter friends with the words 'rest in peace' can be second in the Twittersphere ranking of engagement to the Pope himself.

For this reason, data processing based on proved algorithms and paradigms of network studies was necessary. Chain network visualisations of the Pope's 'A Culture of Care as a Path to Peace' homily demonstrated that it is easier to retweet or mention original announcements about the homily than to directly engage with it in a public space, especially if the message comes from a respected public institution or a state, and when the message itself does not carry much potential for controversies. The name network, or the mentions map, proved that discussion about peace in general takes place around the globe every day and is able to engage many global communities, from private groups to larger institutions (Figure 5.). Pope Francis' message, although situated at the discursive centre of the global discussion on peace at the time of the homily's announcement, might be perceived as not as universal as it traditionally aspires to be, especially by those members of the Twittersphere who question the Enlightenment values of the West or Christianity's role in history (such as the Soc_Justice1).

Our findings confirm a general rule of a power law on social media networks [12, 13] that few users can be responsible for the majority of attention and that the benefit of exposition goes to more vocal actors who can quickly turn into power users [Zizi Papacharissi, Sharon Meraz, S. The rhythms of occupy: Broadcasting and listening practices on #ows. The Annual Convention of the Association of Internet Researchers 13, Salford, UK, October 17–21, 2012; <https://www.slideshare.net/zizipapacharissi/the-rhythms-of-occupy-broadcasting-and-listening-practices-on-ows>]. At the same time, we have found that the more advanced is the tool for network research, the more it is able to reflect authentic bonds and consistent strong connections between individuals and institutions who want to spread the word about the 'culture of care'. The algorithms detecting the strength of these bonds reveal real life, offline communities behind the Twitter activity. Noise of the network is giving place to a concise, focused transmission of values, ideas and aspirations.

6. Conclusions

The media are both a mirror of public opinion and a tool for influencing it. Analysing media content in conjunction with theories like agenda setting allows for a better understanding of the mechanisms that influence public opinion: not only what people think, but also what they think about, and which topics are practically non-existent in their awareness. The authors' study of the reach and presence of content related to the Catholic Church's World Day of Peace on Twitter unequivocally indicate that this topic is largely ignored and barely penetrates public consciousness. This is due to several factors, with the timing being particularly significant. Pope Paul VI chose January 1st based on religious and devotional motivations. Although the Pope himself acknowledged the possible difficulties arising from the location of the World Day of Peace in the liturgical calendar, he wrote that “such an observance must not change the liturgical calendar, which reserves New Year's Day for veneration of the divine motherhood of Mary and the most holy Name of Jesus” [Message of his Holiness Pope Paul VI for the Observance of a Day of Peace, 1 January 1968. https://www.vatican.va/content/paul-vi/en/messages/peace/documents/hf_p-vi_mes_19671208_i-world-day-for-peace.html (22.11.2024)]. However, from a purely marketing standpoint, the beginning of the calendar year is not advantageous. The important issue of concern for peace and education for peace is literally and figuratively drowned out by New Year's fireworks. Therefore, it would be worth considering moving the observance of the World Day of Peace to another, more suitable date that would allow the Pope's message of peace to reach the public more effectively.

What date, then, would be more appropriate and provide an opportunity for a more significant impact? The authors of the article propose September 21 as the World Day of Peace, with September 1 as the date for the Pope to announce the Message for this day. This proposal is justified as follows:

September 1 marks the commemoration of the outbreak of World War II in 1939. The attack by Nazi Germany on Poland initiated a global armed conflict. World War II was the largest military conflict of the 20th century, causing colossal losses and resulting in permanent changes to the world political map. The annual commemoration of this day serves as a warning to humanity against the pursuit of war. Additionally, in the Catholic Church in Poland, September 1 is the liturgical feast of Our Lady, Queen of Peace.

On the other hand, the World Day of Peace could be observed by the Church on September 21. This date coincides with the International Day of Peace established by the United Nations General Assembly in resolution 36/67 on September 7, 2001. It is also the International Day of Prayer for Peace, celebrated at the initiative of the World Council of Churches.

It seems that the Catholic Church joining these observances would be a significant gesture of engagement and a desire to unite the efforts of the secular community and religious institutions. Although history provides examples of the problematic outcomes of alliances between the throne and the altar, in this situation such danger is unfounded. This action by the Church aligns with the spirit

of the Second Vatican Council, specifically the Pastoral Constitution on the Church 'Gaudium et Spes', No. 76: "The political community and the Church are independent and autonomous from each other in their own fields. However, both communities, even if by different titles, serve the personal and social vocation of the same human beings. They will carry out this service with greater efficacy for the good of all insofar as both institutions develop better cooperation according to the circumstances of place and time. (...) For the temporal sphere is ordered to the human person, and it derives its value from conforming to the ultimate ends of man."

Furthermore, such a change provides an opportunity to raise media awareness of the very idea of Peace Day celebrations. The combined efforts and voices of all Churches and the United Nations increase the likelihood that this message will be more widely heard and commented on worldwide. This could lead to a more pronounced presence of the theme of peace and education for peace in the media agenda and public opinion.

References

- [1] St. Augustine of Hippo, *De civitate Dei*, XIX, Patrologia Latina, vol. MPL041.
- [2] Christine Shaw, *Julius II: The Warrior Pope*, Blackwell, Oxford, 1993, 360, ISBN 9780631167389
- [3] M. Creighton, *The Wars of Julius II*, 116-136, in *A History of the Papacy during the Period of the Reformation*, M. Creighton, Cambridge University Press, Cambridge, 2011, 332, ISBN 9781108041096
- [4] A. O'Mahony, International Journal for the Study of the Christian Church, **9(3)** (2009) 177-194, doi: <https://doi.org/10.1080/14742250903201320>
- [5] J. Kondziela, *Pokój w nauce Kościoła, Pius XII – Jan Paweł II*, KUL. Pub., Lublin 1992, 103, ISBN 9788322802878
- [6] P.K. Goel, Journal of the American Statistical Association, **78(382)** (1983) 408–410, doi: 10.1080/01621459.1983.10477985
- [7] J.N. Rouder, J. Lu, P. Speckman, D.C. Sun and Y. Jiang, Psychonomic Bulletin & Re-view **12(2005)** 195–223, doi: 10.3758/BF03257252
- [8] J.M. Liberti and A.R. Mian, The Review of Financial Studies, **22(10)** (2009) 4057–4090, doi:10.1093/rfs/hhn118
- [9] A. Gruzd, P. Mai and A. Kampen, *A How-to for Using Netlytic to Collect and Analyze Social Media Data: A Case Study of the Use of Twitter During the 2014 Euromaidan Revolution in Ukraine*, 513-529, in: *The SAGE Hand-book of Social Media Research Methods*, L. Sloan, A. Quan-Haase and D. Angus (eds.), Sage Publications Ltd, Los Angeles, 2016, 768, ISBN 9781473916326
- [10] E. Dubois and D. Gaffney, American Behavioral Scientist, **58(10)** (2014) 1260-1277, doi: 10.1177/0002764214527088
- [11] S.P. Borgatti, Social Networks, **27(1)** (2005) 55–71, doi: 10.1016/j.socnet.2004.11.008
- [12] L.A. Adamic and B.A. Huberman, Science, **287(5461)** (2000), 2115, doi: 10.1126/science.287.5461.2115a
- [13] R. Perline, Statistical Science, **20(1)** (2005) 68–88, doi: 10.1214/088342304000000215