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The Double Network Model of the Spread of Representations

News and Fake News on Facebook Social Network Site

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Keywords

double network model, representation (mental representation, public representation), network (mental network, representation network), Facebook, news, fake news, brain

Abstract

How does culture spread through representations? – This is the main question of my paper that I attempt to address in a comprehensive manner while also making efforts to create a scientifically descriptive model for this process. Investigating the network characteristics of news and fake news spreading on Facebook social network site (SNS), the section dedicated to analysis looks into a particular case of the general model to be introduced in the theoretical part and created based on literature, while it is also demonstrated how data stored in digital footprints make the spread of representations transparent, thereby allowing for their reconstruction and research.

Taking a more general and simplified approach on culture, it can be understood as the various levels of prevalence of human actions, patterns of behaviour/forms of attitude, and systems of knowledge and beliefs. My focus is on how all of this is represented in the mind of the individual and how it becomes a social-level phenomenon. Accordingly, I consider two main types of representations, in the context of which I examine the dynamics of change of *mental representations* stored in the human brain and mind as well as of *public representations* (e.g. books, articles, statues, lectures, etc.) accessible to anyone.

The initially formulated question already comprises the basic tenet that culture *spreads* in time and space among humans. To make this scientifically comprehensible, culture is understood here as the spread of *representation*s that takes place in various *network*s. Applying an anthropological approach and sensitivity, my work is a pathfinding study that is informed with the spirituality of the new science of networks and wherein its methodological toolkit is put to use. The present paper takes an interdisciplinary as well as a multidisciplinary approach. While trying to get a better understanding of culture, relevant consideration is taken of the results of brain research, the toolbox of network theory and research, and insights provided by social psychology, communication science, and behavioural economics.

Based on relevant literature, my ambition is to develop a theory that has the potential to model and provide a general description of how representations spread, with specific focus on

the characteristic features of the environment created by the new communication devices and platforms. Starting out from the premise that the latter, besides the rising number of representations, have also led to qualitative changes affecting culture, the spreading of news and fake news as public representations on Facebook is investigated. In terms of spreading, the question of *how* takes priority in my analysis over the question of *what*. My premise is that content believed to be true but that is actually misleading, false, and untrue is integrated into people's mind as a *belief*, thus becoming part of everyday life.

My thesis is organized into five chapters. Following the introductory section, Chapter 2 presents a review of the literature with relevance to the line of thought developed in my paper, serving as a basis for expanding on my own model of the spread of representations in Chapter 3. Analysis is included in Chapter 4, where a particular case of the theory under discussion is demonstrated in practice: the spreading of news and fake news on Facebook is placed under scrutiny. The closing chapter summarizes the conclusions.

The literature review is divided into seven subchapters: the first five assisted in developing the *double network model* also featured in the title of my thesis, while the last two provided guidelines for the case study. By presenting the neural network of the plastic human brain (Subchapter 2.1), I aim to provide a better understanding of the neural-level organization of mental representations (Subchapter 2.2). The system of knowledge and beliefs (2.3) forms the network of mental representations, and if any information is communicated therefrom (2.4), it will start spreading across human networks (2.5). The causation and the cumulative effect of these phases establish the model for the spread of representations to be presented in Chapter 3. The subchapter on Facebook (2.6) together with the one discussing the fake news (2.7) provide the theoretical basis for the case study included in Chapter 4. I consider that the analysis confirms the raison d'être of the double network model described in the theoretical introduction while making it comprehensible and verifiable at the same time.

In the framework of my thesis, I created the double network model of culture spreading by way of representations, which can account for the dynamic process taking place at the level of both the individual and the society. The model developed in the context of my doctoral dissertation relies on as well as gives further considerations to Dan Sperber's ideas on epidemiology of representations (Sperber 2001).

In my view, culture can be described as the spread of representations defined by the structure of two nested, interacting networks connected by individuals functioning as agents with an active and mediating role played in connecting these networks. Therefore, in relation to the individual, we can speak about an internal, *mental network* and an external, *social network*, which are in interaction.

There are two distinct types of representations spreading in the two networks: *mental representation* shapes the mental network, while *public representation* produces its effect within the social network. In fact, cultural diffusion takes place through the repeated transformation of the mental and public representations from one form to the other. Accordingly, the communication of mental representations causes physical changes in the environment (in the form of sound waves, images, or other signs), thereby creating public representations, whereas when another individual perceives and experiences this sequence of signs public representations will be again transformed into mental representations.

This model locates in the *brain* both the source and the driver of culture, whose *plastic structure*[1] has a profound effect on mental representations and as a command and control centre plays a decisive role in the creation of cultural symbols and artefacts (speech, written word, video recording, etc.) understood as public representations and thereby in cultural diffusion. Recent results of brain research focusing on the network component may bring us closer to gaining more insight of the human mind, behaviour, and culture, while the increasingly accurate scientific description of the coherent and complex connectome – which is the comprehensive neural network of a living being – enables the development of much more realistic models and theories in the social sciences.

It is my understanding that *mental representation* is the brain activation pattern of any given moment in an individual's life, experienced by them as a flow of thoughts and emotions as well as the changes thereof, including perceptual, cognitive, and motor neural phenomena alike. This is influenced by environmental and internal stimuli on the one hand and by the individual's previous experiences and personal life story on the other. Mental representations as functional

[1] The key moment in the line of reasoning presented in my thesis is the realization of brain research that the brain is plastic, flexible, which characteristic is called *neuroplasticity*. 'They showed that the brain changed its very structure with each different activity it performed, perfecting its circuits so it was better suited to the task at hand' (Doidge 2017: 11).

brain conditions may cause changes in the brain structure, whereby they can be stored and thus perceived as memory traces. According to Hebb's rule: in the brain, neurons that are activated together connect with one another. By analogy, my understanding is that mental representations are also interconnected, this way forming a network, which is referred to in my thesis under the name *mental representation network*, or, for ease of reference (without any change in meaning), *mental network*. Hence, mental network means the complete brain neural network shaped as a result of previous mental representations. In this sense, *memory* is the transformation of the impressions of previous mental representations stored in the connectome into actual mental representations.

Public representations spread among individuals in the social network and allow for the organization of joint actions and the internalization of common cultural knowledge. In the interpretation of social phenomena, scientific discourse usually derives its findings – depending on the scientific tradition – from the individual or perhaps the society or their interaction. In the light of these results and observations, I propose the introduction of a new approach that could provide a supplementary and clarifying description on the spread of representations. The emergence of new media gives reasonable grounds for complementing the difficult-to-comprehend social network with the *representation star network*[2] and the *representation network* developing therefrom.

By *representation star network*, I understand a set of individuals internalizing a specific public representation, who, by encountering this public representation, form a mental representation thereof. At the centre of the representation star network, we can find public representations to which those persons are connected that have come into contact with, i.e.: either read a book or saw a film or listened to a presentation or read a Facebook post, etc. I do not call the set of individuals (within the meaning used here) a group or a community because, on the one hand, this is not about interpersonal relationships, and in the majority of the cases – especially with social networking websites that are the focus of my empirical research – the only thing these individuals have in common is that they have all encountered the same public representation or an identical copy of the same public representation, on the other hand.

[2] Star network is the topology of networks where nodes are connected to a single central hub; it is also called star graph (Barabási 2016 [2003]: 117–118; Csermely 2015: 29; Kürtösi 2005: 671; Mérei 2006: 64).

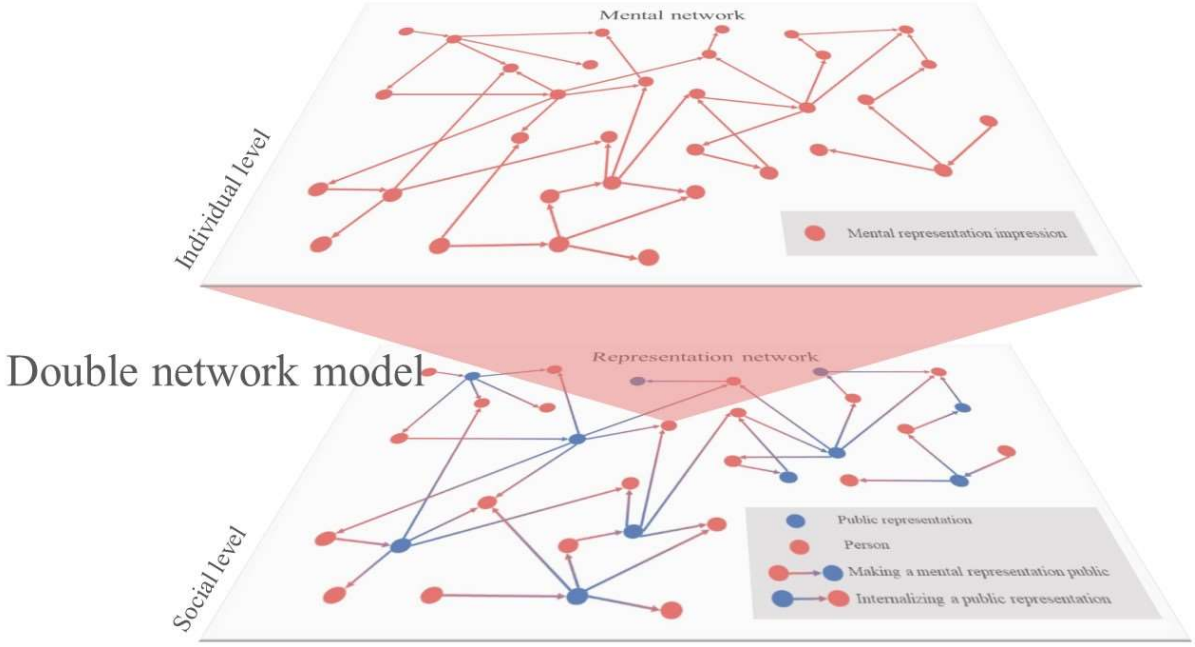
By overlapping several representation star networks, we can obtain the *representation network*, wherein a coherent network is created due to people coming into contact with multiple public representations, thereby connecting the otherwise independent representation star networks. Consequently, a complex *bipartite network*,[3] is created, where one set of nodes is formed by the public representations, while the other one is made up of the individuals that come into contact with these public representations. (Accordingly, there is no connection whatsoever either between individuals or between representations, only between individuals *and* representations.)

The distinction between social and representation network is driven by the recognition that during mediated communication people come into contact with public representations, while the creator thereof is not present when and where a specific mental representation comes into existence, which is triggered in the perceiving subject by the given public representation. In the case of content, news, and fake news spreading in the news feeds of social networking websites, the individual receiving the public representation is often so far in space (and perhaps time) from the creator thereof that their person or the image/idea constructed of them becomes insignificant in the process of interpreting the internalized representation.

The *double network model* of culture understood as the spread of representations claims that the extent of the spread of representations is defined, in addition to the content of representations, by the structure of the *mental networks* and *representation networks* involved in the process of spreading. Penetration rate is significantly dependent on the population size that public representations reach as well as on the form in which these representations come into contact with the individuals concerned. Hence, the representation network partly hinges on interpersonal relationships, but it often goes well beyond them with the involvement of technical means. At the same time, whether or not a person passes on a representation is a question of how that particular representation fits into their mental network: do they have any previous experience, prior knowledge of it and, if so, then how does that relate to the new representation? In line with this reasoning, the *double network model* is understood as two nested networks (*Figure 1*). In the social dimension, individuals and public representations make up the nodes of

[3] The nodes of the bipartite network can be divided into two separate sets, and all edges in the network interconnect the nodes found in these two sets (Barabási 2016: 70). In a representation network, one of the sets includes the individuals and the other one the public representations.

the network, where the relations system established between them stands for the edges of the network. At the individual level, an internal, mental network opens up, which has influence on whether or not a person becomes the distributor of a given representation.



Source: author's compilation

Figure 1. *The double network model understood as two nested networks*

A third type of network is also featured prominently in the spread of representations, having a key responsibility in their distribution. These are the so-termed artificial neural networks, which, forming a family together with deep learning algorithms built on machine learning[4] and with other forms of artificial intelligence, select in the digital ecosystem what public representations users can encounter. Online advertisements appear to users with consideration to their digital footprints; when browsing the Internet, algorithms decide what to display and in what order, just as the news feeds of social network sites are customized by an algorithm based on users' previous activities and online relationship networks.

[4] Machine learning consists in computers and algorithms learning from data and recognizing patterns without being specifically programmed to do this (Szűts–Yoo 2016: 13).

The case study (Chapter 4) presents the particular case of the spread of representations that can be reconstructed from the digital database of the news and fake news spreading on Facebook social network site.

In the course of my analysis, I examine the data obtained from the Facebook pages of the top 5 Hungarian-language news portals[5] with the largest base of followers as well as the data of the top 5 Hungarian-language Facebook pages with the largest base of followers and ranked among the so-called iffy pages[6] (i.e. with doubtful reliability), often spreading misinformation and fake news (data obtained in the period of April–May 2017). Therefore, the 'interview subjects' questioned from an anthropological and ethnographic perspective will in fact serve as data sources helping my case study. It is not the persons but the digital footprints left behind on Facebook social networking website that I interrogate, observe, and analyse.

Network analysis methods are applied in analysing the bipartite *representation network* created as a result of the interaction between the posts as public representations shared on these Facebook pages and the persons (Facebook profiles) reacting (liking, commenting) to them. I look into the structure of these networks, the overlaps between the networks, and the common, active readership of the Facebook pages under analysis.

As the mental network is an inaccessible 'black box', it is only through the public representations exerting effect on the mental network that we can gain actual knowledge of it, and we can infer its structure from the individuals' actions as well as the public representations created by them. In my case study, I make an attempt to process a person's digital footprints, the network of keywords extracted from the articles liked and commented by this person in order to reconstruct part of my research subject's *mental network* – which, however, given the limited nature of the data used, cannot answer the question 'What is in his/her head?' but can instead reveal the topics that this person is interested in and that s/he will further distribute.

Daniel Miller recalls how Trinidadians often refer to Facebook by the names *Fasbook* or *Macobook*: 'In Trinidadian dialect, to be *fas* is to try and get to know another person rather too quickly, as compared to the accepted etiquette. To be *maco* is to be nosy, constantly prying into other people's private business' (Miller 2018: 163). Labelling Facebook as seen above, Trinidadians managed to capture two of its major features: promptness and 'loudness'.

[5] www.24.hu, www.hvg.hu, www.index.hu, www.origo.hu, www.444.hu.

[6] Mindenegyben blog, Tudnodkell, Tudásfája, Hihetetlen történetek, Ezfasza.

One of the key conclusions of my thesis is that social media 'has given a boost' to public representations by placing within the click of a button a large number of representations that would have had quite a hard time making their way to the receiving public if only traditional channels had been involved. The limitations of how public representations can (be) spread have been reduced to a minimum: 1) Facebook and other social networking websites have made asynchronous and multispace communication possible. 2) In the form of digitized signals, public representations can spread at a speed close to that of light, while the spread of information is realized in infrastructural networks. 3) The friendship-based networks of relationships developed on social networking websites have democratized the spread of representations – wider public dissemination is not just the privilege of a narrow spectrum of élites. 4) Social networking websites strengthen the weak ties of society (cf. Granovetter 1983), thus creating a social supernet (cf. Donath 2007) enabling the rapid spread and mixing of information and representations. 5) The portable and always ready-to-use smartphones and smart devices combined with Wi-Fi technology and mobile Internet make it possible to access from practically anywhere and at any given point in time the public representations spreading in the virtual space. 6) Creating identical public representations can be done at the touch of a button, making them instantly ready for showing up in the news feeds of hundreds of other people thanks to the algorithms put to work.

The present thesis proposes the introduction of the term *mixed reality* into the realm of social sciences as well as its reinterpretation. My case study includes a detailed discussion of how deep has fraudulent and misleading content built into and infiltrated representation networks, also transforming the mental networks at the individual level. As a result, fake news and conspiracy theories proliferating in recent years as well as falsehoods mixed up with authentic content have brought into existence a mixed reality where the mental representations of reality and those stemming from fake news have inseparably intermingled. Thereby, such a mixture of the system of knowledge and beliefs has come to life that has become the hallmark of the modern man. The specific problem of the age of mixed reality is not limited to the mixing of knowledge and beliefs, but it includes the divergent process that, parallel to the globalizing world, can be captured in the growing disconnection between the knowledge and belief systems of individuals sharing the same environment.

News portals and misleading websites apply different strategies on their Facebook pages. Mainstream editorial agencies follow the dynamics of the daily news, and so events, relevant news, and up-to-date information shape their daily agenda, whereas the so-termed iffy websites more often share content without consideration of the timeliness factor. One implication of this is that Facebook pages of news portals do not usually share the same article/link several times over, whereas Facebook pages drawing on unreliable sources have the general tendency of 'recycling' the previously published public representations. During the period of the two months under study, I came across several links in the latter category that were shared 11 times over, included in a new post on every occasion.

Since news portals view each other as competitors, the different websites did not publish any content from another website. On the other hand, there is a much greater overlap between iffy Facebook pages. Two pairs of pages out of the total five making up this category are presumably closely related to each other, and there is a good chance they share the same teams of administrators managing these 'twin' Facebook pages, as a result of which whatever content is published on one of these platforms is most likely to enter the news feed of the other one. These pages do not only use the same domains as their sources but also publish the same content at the same time (the Facebook pages of *Ezfasza* and *Tudásfája*) or in close succession (the Facebook pages of *Hihetetlen történetek* and *Tudnodkell*).

As a consequence, each news portal fights hard as a separate entity to attract users' attention, while iffy pages form together an intertwined network, which poses a competitive advantage for members of the latter class. In this fashion, the size of the representation network is multiplied, any such content gains an extra veneer of credibility, repetitions are greatly conducive to imprinting, and the posted content is accepted as true. Concomitantly, they also reinforce their own 'brand', and some of the people will regard these pages constructing an alternative reality as actual editorial agencies forming an integral part of the media landscape. Since the majority of the interactions related to a specific post take place in the course of a single day, a particular topic or public representation can be kept on the agenda over a much longer period of time due to continuous reposting.

Links included in the posts published on the Facebook pages of news portals yield in total approximately two times the amount of interactions compared to the posts themselves shared on the social media websites of these news agencies. In the case of doubtful content, this ratio (the

total number of interactions generated by a link shared in a post/the number of interactions generated by a post) is thirty-fold, which means that misleading links exceed several times the interactions yielded by the content of news portals, which transforms the spread of representations.

In the period of April–May 2017, the five iffy Facebook pages shared a greater number of posts, but these posts contained less unique public representations in comparison with the posts published on the Facebook pages of news portals. With regard to the latter group, certain differences can also be noticed between the individual Facebook pages by looking at the number of posts shared on their platforms and of the interactions generated by these posts. Nevertheless, the former category reveals the outstanding dominance of the Facebook page run by *Mindenegyben blog* – this page produced over three times as much posts as the most productive news portal on its Facebook page (on average: 250 posts per day, approx. at intervals of five minutes). Considering the database under study, Facebook pages spreading fake news as well receive less reactions and comments, but the shares yielded outnumber the results of the news portals in this respect. This is the case even though a considerable part of the comments draw attention to the very fact that the content at issue is a hoax, misdirection, a lie, fake news.

The most popular iffy Facebook page, *Mindenegyben blog*, is a solid competitor to news portals even if editorial agencies would not deem it worthy to enter into the same competition with them at all. But since they are forced to share the same race track on Facebook, they must put every inch of screen space to good use in rivalling for users' attention. However, the algorithm run by Facebook performs the spreading of representations with a primary focus on interactions and not according to professional criteria, which is why it may happen that Facebook pages spreading junk news but managed by no more than a few administrators can often steal users' attention away from entire news agencies. The average number of interactions yielded by the individual posts published on the Facebook page of *Mindenegyben blog* showed a downward trend in the first half of 2017, probably reflecting the partial results of Facebook's fight put up against fake news.

The bipartite representation network of the analysed Facebook pages is a scale-free network where both the degree distribution of posts (indicating the number of users liking or commenting on a post) and the degree distribution of nodes marking the persons (indicating the number of posts triggering a specific user's interactions) follow the power-law distribution. This

implies that a great proportion of the posts triggered the interaction of just a couple of users, while some of the posts set a large number of people in motion. Likewise, the majority of users reacted to a single post, whereas some others interacted with several thousands of posts. In consequence, such hubs are developed between the posts of a specific representation network that attract a very large population of users and reach an extremely broad target group, thus shaping the mental network of many people through the public representations. At the same time, some of the users too will function as hubs, thus potentially becoming superspreaders.

I have created a network of the nearly one million users included in the database, where I connected the individual users to the Facebook pages (the ten pages under study) they had interacted with. This network reveals the common user base of the different Facebook pages. Although the active users of news portals and of Facebook pages spreading junk news are somewhat separated from each other, it can be generally said that the representation networks of junk news consumers are deeply intermingled with those of real news consumers, thereby giving birth to a phenomenon pervading the entire society.

Considering that public representations have a direct bearing on the representation network, the mixing of real and fake news renders their distinction increasingly problematic and tiresome at both the individual and social level. The amplified noise generated in the wake of representations makes it more and more difficult to encounter authentic and truly relevant public representations and build our lives and the decisions that affect the functioning of society upon them. In this scenario, one cannot even rule out the possibility of coming across an item of real news and mistaking it for fake news.

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