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The Internet Changed Chess Rules: Queen Is Equal to Pawn. How Social Media Influence Opinion Spreading

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Abstract

Studies of social influence in large groups show that leaders are crucial in infecting followers with new ideas and that it requires time. This reflects social impact models based on Nowak, Szamrej, and Latané's dynamic theory (1990), which are still being presented, modified and developed in the literature. However, recent mass events, e.g., the Arab Spring, 15-M Movement, protests in the Gezi Park in Turkey, Polish democratic movements (KOD, AkcjaDemokracja), do not seem to fit the aforementioned models: changes happened rapidly and without the presence of opinion leaders. In a series of simulation studies, we propose that global communication (Internet, mobiles, social media) is responsible for the difference between the theoretical model and recent mass events. Our results indicate that global communication dramatically decreases the role of leaders, increases the speed of spreading new ideas in the population, increases the influence of followers on the speed of social transformation, and that leaders who use the Internet can change their attitudes as quickly and as often as followers do.

Keywords
social change, social influence, global communication, computer simulation, Dynamical Social Psychology

Up to this point in history, the paradigm of social changes has resembled a game of chess, the goal of which was to enforce relevant ideas ushered by prominent figures (Nowak, Lewenstein, & Szamrej, 1993; Nowak & Vallacher, 1998). To win meant to have chess pieces - leaders like a queen - stronger than your opponent's. Grand changes that the world witnessed in the past were spearheaded by great leaders, such as Lech Walesa (Europe), Mahatma Gandhi (India), Nelson Mandela (Africa), Martin Luther King (Northern America), which seems to confirm the crucial role of a leader in social movements. Moreover, in cases of historical social change, it is worth noting that the process of change implementation required considerable time, as sometimes it took even decades for an introduced idea to come to fruition (see: Moghadam, 2003; Nicholls, 2008; Nowak, Lewenstein, & Frejlak, 1996; Upham, 2009).

Surprisingly and importantly, contrary to the assumptions mentioned above, the most recent grand changes, e.g., in Northern Africa (the Arab Spring), USA and Europe (15-M Movement), or Poland (AntyNC+, AntiActa, stopacta2, KOD, AkcjaDemokracja / Obywatele Decydują democratic movements), revealed a completely different way of forming a social movement. Firstly, those changes took place without participation of the leaders (or they remain unknown during the change). Secondly, those social changes unfolded rapidly - the opposition in each case managed to abolish the existing government over the course of several months, which came as a surprise to the majority of the diplomatic community (Blanche, 2012). For example, the mentioned movements started on social media, gained strong support and managed to press their influence within just a few days. In the present paper, we introduce and test an updated theoretical model of social influence which deals with described differences between the classical social influence models and real-world observations.

Among the many models of social complexity (Edmonds & Meyer, 2013; Kindler, Solomon, & Stauffer, 2013; Nowak, Borkowski, & Winkowska-Nowak, 2009; Takahashi, Sallach, & Rouchier, 2007) one seems to be especially interesting and this model was put under our empirical investigation. The groundbreaking work by Nowak and Latané, created on the basis of computer simulations, reflects a traditional chess game in a social environment (Nowak, Szamrej, & Latané, 1990; Nowak & Vallacher, 2005). In our studies, we simulated and tested the theory of social impact by Latané (1981, 1996, 2000), which focuses on how public opinion affects and changes individuals' attitudes.

It's like a game of chess, where the prize is the enforcement of a relevant idea and crucial instruments used in achieving victory are strong figures (Coleman, Vallacher, Nowak, & Bui-Wrzosinska, 2007; Latané & Nowak, 1997; Lewenstein, Nowak, & Latané,

1992; Nowak, Lewenstein, & Frejlak, 1996; Vallacher, Coleman, Nowak, & Bui-Wrzosinska, 2010), defining locality of changes and its pace (Nowak, Lewenstein, & Szamrej, 1993). Jago (1982) indicates that leaders can carry out processes of change by applying their leadership knowledge and skills (see also: Ferris, Treadway, Perrewé, Brouer, Douglas, & Lux, 2007; Kerr & Tindale, 2004; Mumford, Campion, & Morgeson, 2007). It is also a leader who makes his or her followers want to achieve high goals (Rowe, 2007). In detail, leaders of change impose their opinion on weaker individuals, much like a strong chess piece, which is worth more than a pawn. Locality of change refers to new opinions that can be spread like an growing bubble within the closest environment of leaders; main figures have a limited radius of influence. The concept of pace describes long periods of time that are needed to affect a whole group or society (e.g., Bartoli, Bui-Wrzosinska & Nowak, 2010; Ney, Beckmann, Graebnitz, & Mirkovic, 2014). What, therefore, might be missing in Nowak and Latané's model that could explain contemporary changes?

Nowak and Latané's model has been used in many variations (e.g., Bowen & Bourgeois, 2001; Kenrick, Li, & Butner 2003; Nowak, Rychwalska, & Borkowski, 2013; Nowak, Vallacher, Tesser, & Borkowski, 2000; Nowak, Vallacher, & Zochowski, 2005; Vallacher & Nowak, 2008) but new global communication media and methods (Briggs & Burke, 2005; Marson, 1997; Easley & Kleinberg, 2010), i.e., the Internet (Bargh & McKenna, 2004; Ruthfield, 1995; Zając & Krejtz, 2007) and mobile phones (Farley, 2007; Kane, Alavi, Labianca, & Borgatti, 2014; Onnela et al., 2007), were not taken into consideration in the construction of Nowak and Latané's model, rather, authors were used to reinterpret the known model data results (e.g., Coleman, Vallacher, Nowak, & Bui-Wrzosinska, 2007; Nowak & Vallacher, 2005). From one point of view, these models still assume that communication remains local when its type ceased to be local. And indeed, in Africa thanks to global communication instruments (e.g., Facebook, Twitter, SMS/texting), a multitude of previously subordinate weakened individuals were able to organise mass protests. For example, in 2011 in Tunisia, Twitter and Facebook profiles encouraged people to protest after Bouazizi's self-immolation (Haddad & Schwedler, 2013; International Business Times, 2011). This resulted in a massive gathering of digitally-connected individuals in a physical space (Jurgenson, 2012). Another example comes from Egypt where in the beginning of the revolution the dictator first tried to shut down global communication and later sought to repress nascent opposition (Ahmari, 2012; Austen, 2011; Khondker, 2011; McLaughlin, 2011). As the classic model seems to disregard the potential of modern media, we propose its extension.

The aim of this article is threefold. Firstly, we attempt to expand the Nowak, Szamrej and Latané (1990) model (NSL, also known as the Dynamical Social Impact model – DSI) by one additional level of communication - namely global communication. Secondly, we test whether including global communication in the model can improve the accuracy of studying current changes in Europe, Africa and the US. Lastly, we reanalyse recent social changes on the basis of the proposed model.

Experiment

Method

Following the NSL model (Nowak et al., 1990), we transformed the rules that govern reactions of each individual in relation to a social environment into a computer program. Here we present the most important assumptions; details of the algorithm can be found in the original Nowak-Szamrej-Latane article; the model was written in Delphi environment for Windows and a simplified code is ready to download; other parts of the code are available upon request. Running a simulation allows a user to observe the consequences on the group level as individuals interact with each other over time. Each individual was characterized by a set of parameters or attributes that affect the degree to which an individual is influenced by and influences others: attitude, level of persuasiveness, and supportiveness. Individuals are represented in accordance to their parameter values in cells in a square matrix. At the start of a simulation, each individual is randomly assigned parameter values.

Attitude

This major attribute is a position or an opinion of each individual and it takes one of the two values (0 or 1). Values can be understood as "for" or "against" given ideas and those attributes divide the population into two groups holding different opinions on different specific topics.

Persuasiveness

A number in the range of 0 to 100 reflects one's strength in persuading others. Persuasiveness measures the motivation and results achieved by an individual in changing attitudes exhibited by other individuals who do not share his or her views.

Supportiveness

A construct parallel to persuasiveness; it characterizes groups of people who share the same opinion. It ranges from 0 to 100 and provides information on the ability to support members of one's group in resisting attitude change.

Immediacy

Nowak et al. (1990) describe immediacy as individuals' dependency on each other in structured groups and societies: "can be viewed as physical distances between individuals with specific spatial locations (...) can then be calculated as the Euclidean physical distance between the cells representing two individuals in the matrix. Such a group structure may correspond to people gathered in an auditorium or meeting room, where immediacy is just the physical distance" (Nowak et al., 1990; p. 366).

The aim of the simulation is to see what happens when many individuals with different levels of attitude, persuasiveness, supportiveness and immediacy gather together. The

probability of changing an individual's opinion will be positively associated with strength (persuasiveness), immediacy, and the number of other individuals advocating change, but negatively with strength (supportiveness), immediacy, and the number of individuals sharing his or her point of view. Considering formulas with immediacy, both persuasiveness and supportiveness need to be divided by a square of the distance to the recipient (Nowak et al., 1990); in this way, immediacy is expressed by the distance between individuals. Psychosocial law, dependent on the number of sources, was calculated as a mean impact of all sources and multiplied by the square root of the total number of sources. The formulas used to calculate society's total persuasive impact on a single individual, or social support from people sharing the same opinion was the same as in Nowak et al.'s (1990) study:

$$\hat{\imath}_p = \sqrt{N_o}\left(\sum \frac{p_i}{d_i^2} / N_o\right) \quad \text{and} \quad \hat{\imath}_s = \sqrt{N_s}\left(\sum \frac{s_i}{d_i^2} / N_s\right)$$

where according to Nowak et al. (1990, pp. 366): "i_p and i_s denotes persuasive and supportive impact on recipient, N_o the number of sources (individuals with an opposing view), N_s the number of individuals sharing the same opinion (including an individual), p_i and s_i the persuasiveness and supportiveness of source i, and d_i the (social) distance between source i and the recipient.

In the real world, it may be that someone changes his opinion even within a group that shares the same attitude. The same phenomenon could be observed during the simulation. Individuals were randomly selected by the computer and whenever the impact of a contradictious group (persuasiveness) was greater than one's own group (supportiveness), an individual changed his opinion and his parameters of persuasiveness and supportiveness were reassigned at random.

Proposed Model

For the purpose of the study, and in order to compare the NSL model with the model proposed by us, we created a new model named the Global Communication Model (GCM), which includes the Internet, SMS and Facebook (social portals) as core media of global communication (Goode, 2009; Sasseen, Olmstead, & Mitchell, 2013; Villi & Noguera-Vivo, 2017). The GCM model emphasizes a lack of distance as everyone can access the Internet and public forums at any time and from any place in the world (e.g., Bargh & McKenna, 2004; Merrill & Lowenstein, 1973; McQuail, 2000; Tamir & Ward, 2015; Wallace, 2001). A short review of the literature and cases revealed that it is thanks to the Internet and wireless communication that everyone has equal and ubiquitous access to any information (Goode, 2009; Johnson, Kaye, Bichard, & Wong 2007; Katz, 2008; Korenman & Wyatt, 1996; Lewis, 2012) with a high degree of control over information and active and selective media use (Johnson & Kaye, 2009; O'Reilly, 2007). Importantly, networked technology gives the ability to self-organise to those who are geographically distributed (Donath & Boyd, 2004; Wellman, Haase, Witte, & Hampton, 2001; Wiley & Edwards, 2002). Hence, classic concepts of distance are devaluated on the Internet (Wallace, 2001). As an online contact

network is similar in size and structure to a natural contact network (see: Centola, 2010), to determine the size of the simulation we assumed that individuals can have contact with an entire online social network (see: Hill & Dunbar, 2003) and the main determinant of impact results from individual characteristics.

To apply the NSL model to an online environment and present forms of communication, we modified formulas by reducing the distance factor from the original NSL model. The current social world enables people to communicate with each other through different channels. Therefore, global communication media created an additional set of contacts in the model. It means that people are able to communicate (e.g., through the Internet) not only with people directly in their neighbourhood, but also with those located further afield who could not be reached by means of direct communication. Importantly, as one may see, all the symbols in the equations remain unchanged from the NSL model. The distance factor has been removed from the formula and it constitutes the only alteration to the original formula. As a result, we propose the following measures of online persuasiveness and supportiveness which together represent an equation of influence power:

online persuasiveness:

$$\hat{\imath}_{pi} = \sqrt{N_o}\left(\sum p_i / N_o\right)$$

online supportiveness:

$$\hat{\imath}_{si} = \sqrt{N_s}\left(\sum s_i / N_s\right)$$

Because in real situations individuals use both traditional and modern forms of communication, the model includes local ($\hat{\imath}_S$ and $\hat{\imath}_P$) and global communication ($\hat{\imath}_{SI}$ and $\hat{\imath}_{PI}$). General supportiveness (I_S) and persuasiveness (I_P) are expressed by the formulas:

$$I_S = \hat{i}_{si} + \hat{i}_s \text{ and } I_P = \hat{i}_{pi} + \hat{i}_p$$

Because not all members of social network sites are equal in their participation, and they may vary in terms of their online activeness (Brandtzæg, 2012), the model retains unchanged characteristics of the individuals, which are responsible for the strength of the impact of both classic contact and contact online. Therefore, we propose a model that does not change the basis of the NSL model, but extends it by an additional communication channel. In our article, we compare the functionality of social influence models (the NSL and different variations of the proposed GCM) in three consequent simulations.

The size of the matrices in each model is 40x40 cells (agents). The duration of simulation of each model is measured by a number of steps in a simulation needed to acquire a stable equilibrium (steps of simulation as dependent variable). Simulations continue until there are no further changes in attitudes - in a matrix there are no individuals who will change their attitude (social space of simulation is stable). A smaller number of steps needed to achieve the equilibrium means a faster social change in comparison to the greater number of those steps. As a next step, we test whether the model changes acceleration of social changes. The results present averaged outcomes of 101 simulations for every considered model.

General Results and Model Differences

In contrast to the classical NSL model (A), changes in the GCM (B) unfold simultaneously in the whole population. When observing the simulation process in Model A, we notice that changes tend to gather in groups around leaders; in Model B the new idea encompasses the whole social area, preventing opponents from forming groups (see: Figure 1).

Furthermore, it can easily be noticed (see: Figure 2) that the level of change spread differs between models. In Model A, the starting proportion of cells is more approximate to the final proportion of cells, which makes minority groups more likely to stay in the popu-

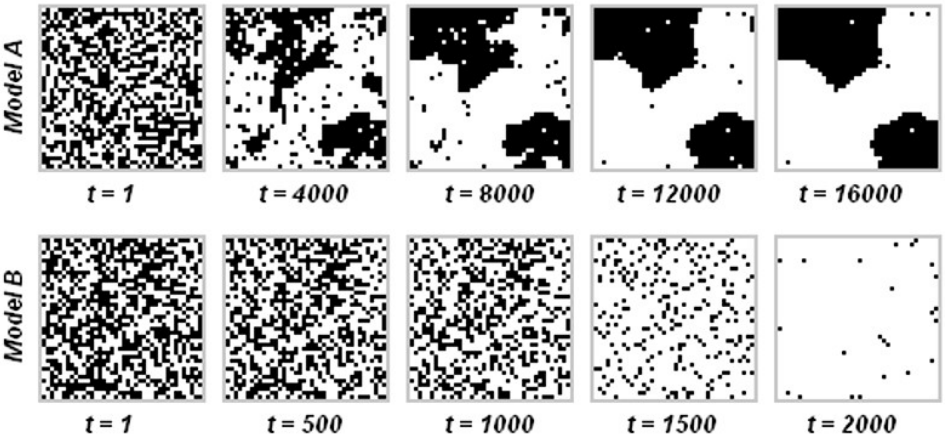

Figure 1. Steps of simulation for Model A – Local communication (Nowak-Szamrej-Latané-NSL) and Model B – Global Communication Model (GCM): screenshots of matrix images for the time measured in iterations. Black and white pixels represent opposing attitudes of society.

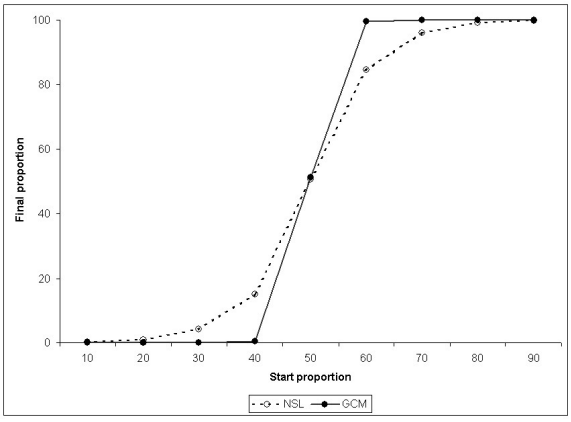

Figure 2. Final proportion holding an opinion as a function of initial proportion for models: the Nowak, Szamrej & Latané Model (NSL) and Global Communication Model (GCM).

lation. In the Model B, infection of an idea that the majority group endorses reaches almost 100% of the population in most of the analysed cases.

Simulation 1 – Adding Global Communication to the Social Influence Matrix

The aim of Simulation 1 was to compare the time needed for changes to occur in the computer environment for the NSL (A) and GCM (B) model. Results in iterations for series of simulations were averaged in model-subgroups.

Results

Results reveal a significant difference in the simulation time duration, $t(100.18) = 33.55$, $p < .001$, $r = .92$. The simulation was in general longer for the NSL model (A) ($M = 16283.26$, $SD = 4056.37$) than for the GCM (B) ($M = 2736.94$, $SD = 121.36$).

The simulations in which the society could communicate globally (Model B) reached a stable equilibrium much more quickly than the local Model A (Figure 1). Therefore, global communication can be considered a catalyst for social change: it speeds up and enlarges the area of change.

The other issue remains unresolved. Who is behind this change: leaders or followers? In the classic NSL model, changes were focused on the leaders. So, did their crucial role in the global communication (social change) undergo an alteration? The next simulation was designed and run to address this important question.

Simulation 2 – Examining Strength of Individuals in Global Communication

Simulation 2 aimed to find out who specifically is responsible for changes in social opinion. To do so, we added a new element to the GCM model (B), which allowed us to distinguish between groups of leaders and followers. All individuals still communicated locally like in the NSL model (A). However, we clearly indicated which of the groups (leaders vs. followers) could additionally communicate on the global level.

We found that inclusion of leaders and followers in the matrix is crucial for the GCM model, as it was proved that this time leaders played a crucial rule in social changes. Jago (1982) indicates that leaders can carry out processes of change by applying their leadership knowledge and skills (see also: Ferris et al., 2007; Kerr & Tindale, 2004; Mumford, Campion, & Morgeson, 2007). It is also a leader who makes his or her followers want to achieve high goals (Rowe, 2007). Because leaders are generalists rather than specialists, both innately and in their pattern of skill acquisition (Lazear, 2010; Northouse, 2007), we decided to summarize numerical characteristics of individuals. We argued that, according to the normal distribution, the number of extraordinary individuals (leaders) in the populations will be placed above one standard deviation. In other words, we assumed that in simulated communities about 16% of individuals with the highest levels of persuasiveness and supportiveness in the initial randomly assigned matrix would become leaders. It should be noted that this is not a new characteristic of individuals, but only a separation of individuals for obtained effect explanation.

When general supportiveness (I_S) and persuasiveness (I_P) are the sum of local ($\hat{\imath}_S$ and $\hat{\imath}_P$) and global communication ($\hat{\imath}_{SI}$ and $\hat{\imath}_{PI}$) during the simulation it is possible to choose whether two individuals use only local (when global impact is equal to 0), only global or both types of communication at the same time. Therefore models created as a result of the aforementioned assumption are: Model C where leaders communicate only with other leaders on a global level (e.g., revolution coordination, strategy) and locally with followers; and Model D in which followers use global communication with other followers (e.g., agreeing to hold a protest outside the communication channel for group leaders) and locally with leaders. It is worth mentioning that in the NSL (Model A) followers did not have any influence on social change and that is why the proposed Model D will include them as users of global communication.

Results

A significant difference in the duration of the simulation was observed, $t(100.24) = 41.56$, $p < .001$, $r = .94$. The duration of the simulation for Model C (the model in which only leaders communicate mutually among themselves on a global level ($M = 16393.32$, $SD = 3308.08$) was considerably longer than for Model D (in which only followers use global communication ($M = 2704.36$, $SD = 113.6$)). One-way analysis of variance for all models showed significant differences between compared means, $F(2, 192.43) = 661.65$, $p < .001$, $\eta^2 = .88$. Post-hoc testing conducted using the Dunnet T3 method revealed statistical differences for all models. Results are presented in Figure 3.

Results obtained from the first simulation (Figure 3 and Table 1) reveal that in a scenario where only leaders communicate globally (Model C), a balance is reached as late as in the NSL model (Model A). When followers can communicate globally (Model D), the changes are rapid – as rapid as in the GCM (B). Results indicate that the effect obtained in Simulation 1 is indeed a result of followers' interaction.

The results of Simulation 2 may also indicate that the role of leaders in regards to the rate of alterations might be inferior to that of followers. There is no assurance that only followers are responsible for the acceleration of changes in the case of global communication, because when leaders and followers (Model B) had access to a network, change also occurred quickly. Therefore, in the next simulation we investigated whether changes are the result of interactions conducted by followers only, or a cooperation of followers with leaders. In other words, we wanted to test who is responsible for the rapid change described above.

Table 1

Differences in Simulation Mean-Time (in Iterations) for Important Comparisons of Models

Model	A	B	C	D	E	F	G	H
A	x	13546.32*	-110.06	13578.90*	122.13	-419.5	13618.24*	13593.68*
B	-13546.32*	x	-13656.38*	32.58	-13424.19*	-13965.82*	71.92	47.37

*$p < .001$.

Simulation 3 – One-Way Communication

The algorithm of program progress in all preceding cases (Model A-D) accurately describes the most reciprocal communication statuses that occur in a natural environment. A leader who tries to infect a follower with his/her own ideas, could in turn be influenced by the message in which a follower tries to influence a leader in the next step of the algorithm. For any pair (dyad) in the matrix engaging in the interaction, both units can influence each other by participating in a dialogue. Heretofore, the communication was two-way and it is hard to say whose influence was decisive. It is possible that the interactive effect of leaders and followers influencing the environment together could induce the phenomenon of accelerated changes. That is why another element – one-sided communication – was added to the algorithm. In the next simulation, we wanted to test who holds more social influence charisma in changing others' opinion and make changes faster: leaders or followers.

As a result, this model indicates that one group influences the other through a global network, but the other group cannot communicate with the first using this channel. Thereby, it will be possible to indicate which group sets changes in motion. In the next step, we manipulated who (leader vs. follower) influences whom (leader vs. follower) and in what way (one-way vs. two-way communication). Simulation 3 introduces four

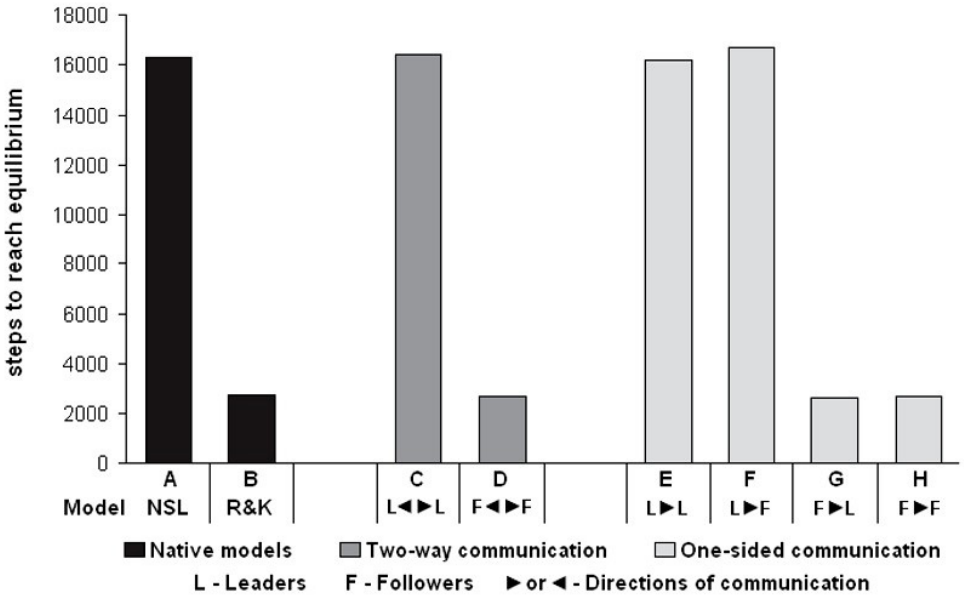

Figure 3. Average duration of simulation for each model.

new models. Model E (One-Way Leader to Leader Communication) which assumes that leaders of one option influence via network leaders from the opposite fraction, but those cannot respond to the action of the influence in same way. In other words, similar to simulation 2, the impact of the leaders of one faction was computed using the sum of the global and local communication equation, but all other individuals' impact was computed using the local communication equation only. Model F (One-Way Leader to Followers) assumes that leaders influence followers online: it presumes that leaders can directly proclaim their ideas online to a mass of people through the use of global and local communication, but receivers can respond to the leaders using local communication only. Model G finds followers influencing leaders through global communication (One-Way Followers to Leaders Global Communication): they can send their postulates to the leaders in the absence of an inverse relation. Model H assumes that followers influence each other (One-Way Followers to Followers Global Communication): followers from opposite groups leave information online, but no one can respond to it (and information is not accessible by leaders).

Results

A one-way ANOVA revealed significant differences between compared mean durations of models' simulation, $F(7, 335.15) = 884.59$, $p < .001$, $\eta^2 = .89$.

Models E (leaders influence leaders; $M = 16161.13$, $SD = 2943.78$) and F (leaders influence followers; $M = 16702.76$, $SD = 3921.92$) reach the equilibrium very slowly, while models G (followers influence leaders; $M = 2665.02$, $SD = 166.36$) and H (followers influence each other; $M = 2689.57$, $SD = 115.81$) do so rapidly. It demonstrates that the social changes in global communication are the effect of followers' interaction, while the role of leaders can be ignored. Therefore, to shorten the time of reaching a social conclusion in global communication, followers need to have access to the means of global communication (e.g., Internet, social media, SMS/texting, etc.).

Additional Observation of Opinion-Time in Simulations

Another interesting observation is noteworthy here. In the simulation context, the longer an individual withstands social influences in the social matrix, the longer he/she can support opinions of his own group and infect other individuals in the environment with his/her views (affect social space). For all the simulations we measured the average duration of opinions exhibited by individuals in interactions: for how long an individual held the same point of view before being persuaded by the environment to change his mind. We expected that strong units, such as leaders / queen, can "survive" longer in the simulation, so their effects are simply extended. We averaged the lifetime of the opinion, depending on how high the general characteristics of an individual were. Results for the classical model and model featuring global communications are shown in Figure 4.

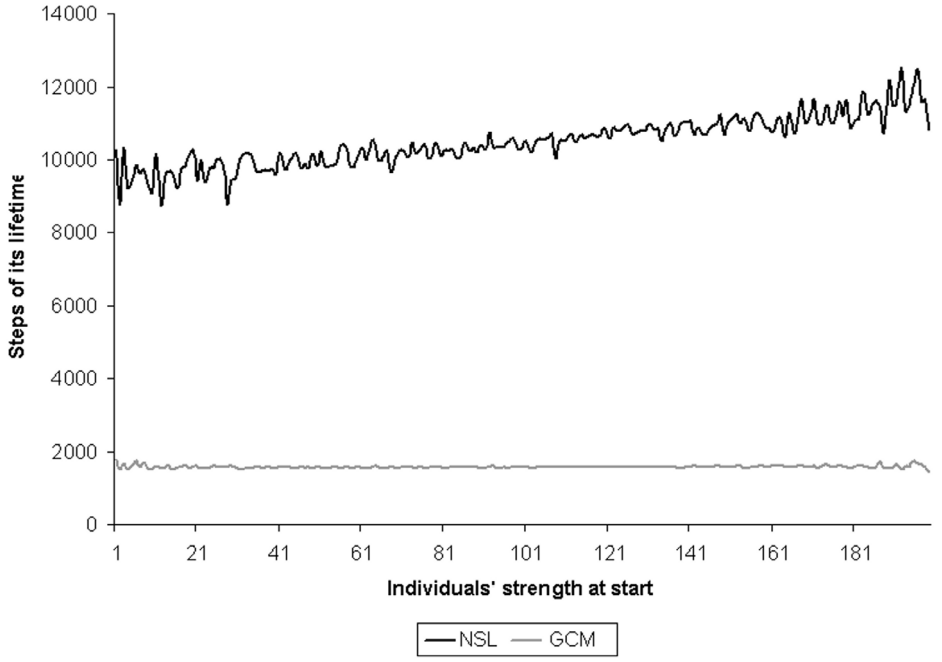

Figure 4. Time of individuals holding opinion as a function of initial strength (abilities) at the start of the simulation: Nowak, Szamrej, and Latané Model (NSL) and Global Communication Model (GCM).

We observed that, in fact, the classic NSL model allows strong individuals (leaders) to maintain their opinion for longer than weak individuals (followers). This means that without global communication leaders may have a lasting impact on followers, whereas followers may change their mind much more quickly. But when the model includes global communication, the difference between leaders and followers during maintenance of its opinion disappears, and a change in opinion occurs much more quickly in all units in the matrix. We indicate that the social order online is utterly different from the one considered in the classic models – everyone is equal, everyone has the same opportunity to exist, to start a quick revolution, to change the world… or just to change their point of view. We consider this effect as Queen and Pawn equality.

Discussion

Computer simulations of individual behaviour have quite a long tradition and in practice there are countless alternative models and theories (see: Wilkins, 2013; Winsberg, 2010). Our article's aim is obviously not to present their history or choose the best one, or even prove the advantages of this method - we only refer to a narrow group based on the SNL paradigm which can be explored in a new way.

In several simulations, we tested the classic NSL model of social influence by including the factor of global communication and adjusting the model to the current forms of communication. We aimed to answer the question of how opinion changes work nowadays, and whether social movements still need a formal leader. Based on our results, we can assume that global communication can possibly enforce current major social changes, but only under the condition that followers are able to access global communication media. Results indicate that communication and mass coordination have a stronger influence than leaders themselves - to spread the concept one do not need a queen but a lot of pawns.

It is important to note that we are able to observe changes all over the world and not only in Africa, Turkey or other places referenced above, but at any place in the world which has access to the Internet and mobile phones (Aker & Mbiti, 2010; Farrell, 2012). As the results of our simulations show, it is no longer necessary to acquire the support of leaders, but to network societies and allow them to exchange opinions easily. This discovery could be applied in diplomacy and in fostering social changes (e.g., in Belarus, Afghanistan, Iraq) – networking opposition and society instead of just funding and supporting opposition. Of course, we realize that the simulation conditions we have proposed and the obtained results - that is, the total strength of followers is greater than the total strength of leaders - do not always have to be a repetitive social rule, although we believe that modern societies can (and will) favor such forms of social change.

Additionally, Latané, Liu, Nowak, Bonevento and Zheng (1995) demonstrate in their study that distance in the NSL model alters the power of influence (see also: Bradner & Mark, 2002; Latané & L'Herrou, 1996). The model proposed in this article excludes the factor of distance. It is worth noting that the Latané et al. (1995) theory concerns local communication, whereas our model describes the influence online. The diminished importance of distance also finds confirmation in Edwards, Lee and La Ferle's studies (Edwards, Lee, & La Ferle, 2009) or Mok and Wellman's works (Mok & Wellman, 2007; Mok, Wellman, & Carrasco, 2010). Other researchers have already proved that ideas spread on the Internet (Latané & Bourgeois, 1996), and that individuals adopt the opinions of virtual neighbours. Their experiments indicated that the distance had no influence on either effectiveness of communication or on perceived leader performance (Neufeld, Wan, & Fang, 2010). As can be seen on Figure 2, changes refer to the whole population and technology seems to reinforce social changes (e.g., Tapscott, 2009). Moreover, we conclude that the Internet diminishes the crucial role of leaders in social changes (Figure 3) by transforming leaders into followers.

The presented results allow us to look differently at means of global communication such as Twitter, Facebook, Google, and YouTube. These places ceased to be just sources of entertainment and became media of exchange for ideas and opinions, and instruments of total and widespread social influence (Ellison & Boyd, 2013; Kaplan & Haenlein, 2010). People responsible for controlling the content of portals indeed have the power to control possible social effects that can be caused by a video or a manifesto. Yet, those studies and

results do not provide an answer to the important question of who will win: leaders or followers, or who will dominate the majority. Thanks to this model, we only know that when the changes start, their effects will be fast and expansive, even if they have no structure, and without the need for a leader at the same time.

From the perspective of our research, recent political tendencies, which can be observed in many countries all over the world (keeping track of the mobile phone calls in the U.S., cutting off free access to the internet provided via Facebook described as the prevention of ideas spreading in Egypt; changes in law allowing surveillance of phone calls together with emails/internet activity in Poland and Hungary), may be more scary for democratic societies than it might seem at first glance. In our study we showed that once followers (masses, societies) have access to global communication, they can change the status quo, put pressure on leaders (politicians, presidents, prime ministers) to do better, and push for democracy against other political systems. Removing free access and free speech from this media may reduce followers from a significant group of voters to a society that only listens and does what politicians expect and say. Frankly, keeping global communication media free and available may be one of the key aspects for those who are interested in establishing and keeping democratic rules.

There is, however, one important and dangerous issue linked to the GCM. From our study, we know that thanks to access to the media described above, weaker followers may put pressure on leaders and change their opinion. This group may pass its message to other groups and take power in incorporating these ideas into real life. One should be safe when we speak of democracy and democratic values. Our study shows, however, that dangerous (for example, a call for terrorist attacks) ideas shared by previously ignored groups may affect leaders as well. In other words, the GCM predicts followers may influence powerful ones, but the content of ideas affecting the majority may be both positive and negative. Thus, free access to global communication is a double edge sword.

Ultimately, we would like to draw attention to the issue obtained in the last part of our experiment - the power of new mass media. Many studies indicate that on the Internet people collect information quantitatively and not qualitatively, which would be consistent with the results of our study (see: Cheung, Lee, & Rabjohn, 2008; Hwang et al., 2007; Janssen & Kies, 2005). In general, we can therefore imply a purely quantitative aspect of social matrix change and advise emerging social movements that in today's social networks a large number of coherent messages is needed, a large amount of similar information: it is better to invest in many pawns and the same message in many places, because the queen will most likely disappear in the social matrix.

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Competing Interests

The authors have declared that no competing interests exist.

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Data Availability

The results simulation are freely available via the PsychArchives repository. For further information see the "Supplementary Materials" section.

Supplementary Materials

The following supplementary materials are accessible via the PsychArchives repository: Simulation results with codebook and (simplified) code used to produce results.

Index of Supplementary Materials

Rak, T., Kulesza, W., & Chrobot, N. (2018). Supplementary materials to "The Internet changed chess rules: Queen is equal to pawn. How social media influence opinion spreading". PsychOpen. https://doi.org/10.23668/psycharchives.2346

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