The silent voters: Simulation models for the mapping of the electoral behaviour of silent voters

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Abstract

This paper investigates the behaviour of voters in public opinion polls about party preferences using an agent based simulation of a threshold model including both micro and macro level processes. The theoretical background describing the macro processes is the spiral of silence concept developed by Noelle-Neumann (1974); and the micro level model is a general threshold model (Granovetter (1978), Krassa(1988)) both arguing that people only assert their opinions if they perceive a minimal support from a relevant proportion of others. We apply a model including both approaches to uncover the behaviour of voters not sharing their party preferences during polls. Based on current survey data we approximate real using historic data as well. It is shown that the minority opinions were more widely-held than was declared in opinion polls as a consequence of different distributions of the threshold values of opinion assertion. We demonstrate this phenomenon on the 2010 Hungarian elections by presenting our historic results and give a short analysis on the 2014 Hungarian parliamentary elections.

Keywords: spiral of silence, threshold model, electoral forecasts, opinion assertion

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Introduction

"Knowledge about the internal structure of public opinions, nevertheless, is still limited and lags far behind measurement."- Elisabeth Noelle-Neumann cites W. Phillips Davidson (Noelle-Neumann 1984, 3). Despite the improvement in survey methodologies, this quote still applies to current methodologies, as a very significant proportion of the responders refuses to share their opinions – we refer to them as the 'grey zone' of respondents. This phenomenon is extremely strong in terms of political party preferences. In the Hungarian polls this ratio can reach even 70% (300 responders are willing to share their opinion out of 1000), which renders the predictions unreliable and the poll results highly unstable in general.

Here we try to uncover some features of the internal structure of the public opinion by modelling responder behaviour considering both micro and macro level effects. We introduce our pre-election results in the 2010 elections with a short analysis comparing with actual results. It's important to note that our proposed model contains hypothetical values as input parameters, as we try to uncover the underlying processes of the voters' behaviour not having been researched yet. First we elaborate the theory of the spiral of silence, which is the basis for the simulation model introduced in this paper. [1]

Park (1930) introduces the term collective behaviour as "the behaviour of individuals under the influence of an impulse that is common and collective, an impulse, in other words, that is the result of social interaction."0 Elementary forms of collective behaviour are crowd behaviour or social movements, but also have impact on voting, innovation diffusion and market behaviour. According to our hypothesis the spiral of silence is one of the key factors of how perception of dominant "crowd behaviour" impacts on the opinion assertion of the respondents concerning party preferences.

Public opinion polls have become one of the most important and widely used means of scanning the public mood, as well as its sudden and apparently inexplicable changes on the eve of national elections. There are many "irrational" elements of public behaviour, which account for why pre-election poll results – however objective and impartial – often prove not to match the actual preferences expressed in official results. The polls' role is not to predict the final results of elections but to measure the intentions of the possible voters in the moment of the conduction of the survey. This is based on the sample of voters who are usually asked the question: "If the election were held today, which party you would vote for?" There are, however, always a number of respondents, who give no definite answer ("I don' know") or choose not to answer.They constitute the silent masses. Various methods have been developed to deal with the "silent masses". One is, for example, to give them a proportional preference according to the measured preferences. Another method for the prediction of their preferences is to make clusters based on the individuals' other responses to various questions in the survey. (see: Tóth – Grajczjár 2013). In this paper we introduce an alternative method based on the theory of the spiral of silence.

In her pioneering book, *Die Schweigespirale: Öffentliche Meinung – unsere soziale Haut* (1980) Elisabeth Noelle-Neumann offered a new explanation for the formation of public opinion. Her spiral of silence theory has had a great impact on public opinion research, as is shown not only by the numerous theoretical studies which have been published so far but also by attempts to translate the theory into operational models (e.g.: Scheufele (1999), Scheufele and Moy (2000)). The present paper introduces a simulation model developed based on

[1] The spiral of silence has, of course, a wide literature. We used the original source because at this place our objective is not to introduce the literature but explain the theoretical background of the model.

models Granovetter (1978) and Krassa (1988) to model opinion contagion in collective behaviour, which is a key issue in the spiral of silence theory. The spiral of silence theory, on which the applied simulation model is based, starts from the assumption that people do *have* opinions about their political choices but they don't assert them if they don't perceive minimal social support. The political campaign is therefore important to mobilize or, on the contrary, silence people who already belong to a given camp.

The paper is organised in the following way. Firstly, we describe the macro and micro level theories which provide a background to our model. In section 2 we discuss the basic assumption of the spiral of silence theory – the macro level theory used in our model – followed by the brief description of the threshold model of collective behaviour, describing the micro level model used. Section 3 will describe our model and the agent-based simulation as its operationalization and the results for the 2010 Hungarian elections and possible scenarios for the 2014 elections are given in section 4. The review of these theories and a critical analysis of our model is found in section along with our proposals for research directions.

We show that it is possible for a public opinion poll to measure a minority opinion as being higher than it is in the real distribution of opinions because of the different distributions of the thresholds of opinion assertion. Given the political context of the Hungarian parliamentary elections, we believe that the spiral of silence theory offers a valid explanation for the electoral behaviour observed: namely that people hid their true political opinions from the polls. We stress, however, that the explanation is valid under certain premises, which are set by the applied model. Bearing in mind these limitations, the last part of the paper discusses the problems of the practical applicability of the model as well as giving a critical evaluation of the theory and proposing further research directions.

1. Background theories

a. The spiral of silence

In a more recent work, Noelle-Neumann differentiates between two meanings of public opinion: (1) public opinion as rationality, which makes it "instrumental… in the process of opinion formation and decision-making in a democracy"; and (2) public opinion as social control, where "its role is to promote social integration and to ensure that there is a sufficient level of consensus on which actions and decisions may be based".[2] Noelle-Neumann bases her theory on this second concept of public opinion, and she argues that consensus is motivated by individuals' fear of social isolation.

At this point we limit ourselves to an outline of the assumptions of the spiral of silence theory as they were outlined by Róbert Angelusz (2000b). These are the following: 1) The majority of people have a quasi-statistical perception of the formation of public opinion. 2) Perception of public opinion influences opinion assertion and through this, communication processes. The camp that feels the support of the majority will be more courageous, self-confident and therefore more assertive and visible. The other camp, where the people think that they are in a minority, will, on the contrary, feel insecure and withdraw. Some of them will sooner or later be effectively silenced by his/her own fear of representing an isolated opinion. 3) This change in communication behaviour will modify the conditions of perception. The withdrawing camp will seem to be smaller, while the more confident camp

[2] Elisabeth Noelle-Neumann, "Public opinion and rationality". In: Glasser, T. L. and Salmon, C. T. (eds.), *Public Opinion and the Communication of Consent* (New York: Guilford, 1995), 34

will appear to be greater than its actual size. This wrong optics of the perception of public opinion will further increase the differences in opinion assertion between the members of the two camps and the wrong perception of the expected formation of public opinion: on the one side we can observe the spiral of silence, on the other side the increasing spiral of opinion assertion.[3]

Thus, the theory assumes that some people do supress their opinion if they do not perceive minimal support from relevant population groups. This is what Noelle-Neumann calls the spiral of silence: it can happen that the people who hold an opinion *A* in fact constitute the majority, but in the case of unfavourable communication conditions appear to be the smaller camp. Naturally, a "loud" camp is capable of changing the individual's perception of public opinion, and thereby they can appear to be bigger than their actual size in a given country or community. The "louder" camp can thus set into motion the spiral of silence, and therefore the camp of the actual majority can *appear* to be in the minority in the eye of the public.[4]

We cannot include here all the criticisms of the spiral of silence theory.[5] None the less it is important to mention two points which are relevant to our later discussion of the use of the threshold model. The first is the problem of dual opinion climates. Noelle-Neumann argues that dual opinion climates are created mainly due to the influence of the mass media. We argue that dual opinion climates exist because an individual could perceive different public opinions, through the mass media and through his/her individual network. It can happen that in the individual's network supporters of opinion *A* constitute the majority, while nationally there is a perceived majority of the supporters of opinion *B*. People in this network can be still convinced that the majority supports opinion *A*, and therefore they can be louder in the local community. Angelusz (2000) distinguishes four types of perception: 1. realistic perception (both camps see their right size); 2. the case of parallel underestimation (both camps perceive themselves to be in the minority); 3. mirror perception (both camps perceive themselves to be in the majority); 4. inverse perception (the majority camp perceives itself to be the minority, while the minority camp perceives itself to be the majority). Both the third and the fourth cases can be explained by the different social networks in which individuals are embedded. It can therefore be very useful to integrate social networks into the model.

Secondly, there may be a big difference among the threshold values of individuals, which are dependent on many variables such as age, gender, education, occupation, etc. (Scheufele and Eveland (2001)). Scheufele and Moy (2000) argue that culture may be an important variable determining the degree to which individuals are susceptible to perceptions of opinion climates. They argue that in individualistic cultures consistency between private self-image and public self-image is highly valued, whereas in collectivistic cultures individual opinions are more dependent on the social environment. We shall point out however, that many historical examples can be quoted to challenge this dichotomy. (Germany, for instance, belongs to the individualistic cultures, but still public and private opinions differed markedly in the GDR and many other Eastern European socialist countries). They suggest that the phenomenon that Noelle-Neumann calls 'hardcores' or 'avant-gardes' should be taken into account in future empirical research.

[3] For a detailed analysis see Angelusz (2000b).

[4] On the bases of these arguments Elisabeth Noelle-Neumann explained the surprise of the 1965 parliamentary elections in the Federal Republic of Germany. According to the polls, the voters' preferences for the two big parties – the CDU and the SPD – were very close. That's why it came as a surprise that CDU won by 8%. According to Noelle-Neumann, one explanation for the wrong forecast could be the silence of many CDU-supporters, who thought that they represented the minority opinion.

[5] For an overview see Scheufele and Moy, op. cit., 2000. For a theoretical criticism of the spiral of silence see Angelusz, op. cit., 2000.

b. Threshold models of collective behaviour

Threshold models of collective behaviour are based on the assumption that individual behaviour partially depends on the number of individuals who already exhibit similar behaviour. Granovetter's (1978) threshold model was a pioneering attempt to formalise this kind of behaviour using the example of riots. The model assumes that individuals are willing to act rationally in order to maximize their utility (hence it is among rational choice models). "The threshold is simply that point where the perceived benefits to an individual of doing the thing in question (here, joining the riot) exceed the perceived costs." (Granovetter 1978 p.1422). Each individual has a threshold such that he or she will act only if a given number of others – defined by a threshold – have already acted.[6]

An analogous case is the contagion of the public assertion of the opinions. The level of public support from the population that the individual needs for the public assertion of his or her opinion is precisely the threshold value that Granovetter uses in the analysis of riots. The level of opinion assertion thus largely depends on the distribution of the thresholds in a given population (Krassa 1988). According to Noelle-Neumann, because of the fear of social exclusion people assert their opinion loudly only if they see a minimal level of support from others. Granovetter (1978) and Krassa (1988) acknowledge that people do not perceive public opinion in a "uniform" way. Some attribute greater significance to certain social groups than others and certain groups can even have a contradictory, negative effect: it can happen that some people choose to be silent precisely because certain social groups assert an opinion *X*.

Krassa (1988) attempts to solve this problem with the help of the ties between people thus connecting the above theory with social network theory. Every person can be described as being embedded in a particular network, where everyone is connected to everyone else by ties. The strength of these ties depends on the relationship between the two people. The strength of the tie between individuals A and B depends on (1) how important B is from the perspective of A's decision-making, and (2) in a particular case, to what extent A is conscious of B's actions independently of the assertion of his preferences. A possible representation of the ties is by means of two multipliers: (1) the level of consciousness, ranging between 0 and 1, and (2) the significance one attributes to the other in the case of an unlimited interval of hesitation. The tie can then be seen as the product of these two factors, and it signifies how much B's actions count in relation to A's threshold.

By using the above relationships, Krassa builds the concepts of "weighting" and the "network" (which themselves substitute for the more general concepts of selective perception and social groups) into a model. To use this model for simulations we need to assign threshold values to every individual within the population. Furthermore, we need a population-matrix that indicates the strength of the ties between each (direction-oriented) pair within the population. These mutual relationships take into account both the network and the weighting, and so for each *i-j* pair they indicate to what extent *i* is informed of the actions of *j* under the condition of a weighting scale that shows the significance of the actions of *j* from the

[6] For example, a riot threshold is the percentage of people who join the riot before one would also decide to join. A person with 0% threshold would be a leader of a riot: he or she does not need to see other people join before. On the other hand, someone with a high threshold (i.e. 90%) is very unlikely to join the riot. The final number of people who decide to make either of two decisions (here to join the riot or not) depends on the distribution of thresholds in a population. Let's consider 10 people: one with threshold 0, one with 1, one with 2 and so on up to the last with threshold 9. The action is started by an individual with threshold 0, he activates the second with threshold 1 and the final outcome is that all 10 people are activated. But if among these 10 people the distribution of thresholds is different i.e. instead of one with threshold 1, two individuals with threshold 2, the action will cease after the first individual with threshold 0.

perspective of the decision-making of *i.* Hence the network assumed in this model is an asymmetric directed network.

We assign an assertion value of 1 to every person who expresses his or her preference, while those who remain silent are given the value of 0. The following formula gives the estimation of the social support for a certain cause X:

$$P_{i,x} = \sum_{j=1}^{n} \left(A_{j|x} * E_{e|i,x} * N_{j|i,x} \right)$$

where:

$P_{/i,x}$= the proportion of the population, which would assert a preference for cause X according to the calculation of the individual *i*;

$A_{j/x}$ = the opinion assertion value of the individual *j* with respect to the cause X, where *Aj/x* is a dichotomous variable that can take either value 1 or 0;

$E_{j/i,x}$ =the significance or the evaluation of the individual *j* from the perspective of the individual *i*;

$N_{j/i,x}$ = the social group of the individual *j*, who are important references to the individual *i* particularly with respect to the cause X.

This means that within a given population every individual makes a subjective calculation of the proportion of the population that shares a given opinion by adding up the number of individuals who agree with this opinion – this may be interpreted as a quasi-statistic belief about public opinion. Not every individual *j* is, however, visible to *i*: this is shown by the formulation $N_{j/i,x}$, which expresses that every *j* is included in the "network" of *i* from which we have to deduct how much *i* evaluates *j*, that is to say, what weight *i* attaches to the opinion of *j* ($E_{j/i,x}$). We have to multiply this result by the variable (1,0), which shows whether or not the individuals *j* express their opinions ($A_{j/x}$), and then we have to add these results. This process is repeated for every individual within the given population and in this way we represent how individuals estimate the social support for a certain opinion or cause. This serves as a basis for the individual's decision.

Simulations based on the model can produce various interesting dynamics of behavioural contagion. In reality we often have the experience that a certain opinion or idea suddenly captivates the population, or the opposite when enthusiasm rapidly disappears. Simulations can clearly show that no radical opinion change is needed for such phenomena. Let us take the simplest case and examine a population where everybody agrees with a certain opinion, but nobody expresses it under the condition that they all have a threshold value of 1 or above. With this threshold value, it is enough if only one or two individuals start to assert their opinion in public for it to rapidly become popular, once someone starts the process and sets the contagion dynamics in motion.

Similarly, an opposite dynamic can also be observed. Large segments of the population can be silenced - even though their actual opinion does not change – as a consequence of the silencing or elimination of certain key individuals. But the simulations showed that the more complex and fragmented social networks are, the more useless it is to try to change mass behaviour by influencing the behaviour of any individual. With the weakening of networks, individual decision-making reacts less sensitively to the actions of other people. Thus, in a fragmented society it is more difficult to de-mobilize the mobilized population or, on the contrary, to mobilize the silent people. The relationship can be reversed: with a densification of social groups individual decision-making is more influenced by the actions of others and behaviour becomes more collective, not only the indicator of a lucky coincidence.

c. The disappearance of a minority opinion demonstrated with a threshold model

Assume a threshold model, where we have two contradictory opinions (A and B) which are present in society in a given ratio. The use of two opinions instead of one is explained by the fact that in this way the opinions can be interpreted as preferences for one of the two major rival parties competing in an election.

The simulation itself is the iteration of a simple step: the people who have a lower threshold level than the proportion of people sharing this opinion in the previous step will assert their opinions, the other people will not. The opinion of each person is given and constant from the beginning. Lazarsfeld (1948) describing the hierarchy of stability, puts the election preferences at the top as being very stable and difficult to be influenced by new experiences, information etc. This premise can of course be problematic in a "real-life" campaign situation. The spiral of silence theory, however, *presupposes* that people have their opinion, only that they don't assert it if they don't feel a certain level of social support. The impact of the campaign is, however, taken into account insofar as the visibility of each camp influences people to assert, or, on the contrary, hide their opinions.

The proportion of people asserting each opinion at a given moment thus depends on the proportion of people asserting the given opinion in the previous moment, and on the distribution of the threshold levels within the group of people sharing the given opinion.

$$P_t = f(P_{t-1,} F(V_i))$$

Where P_t and P_{t-1} stand for the ratio of people asserting a given opinion in the *t*-th and *(t-1)th* moment (that is, the probability of asserting one's opinion), and $F(V_i)$ is the distribution function of the threshold levels of those who share the *i*-th opinion. The threshold levels can be interpreted as percentages, with the threshold value for each person generated by a random number generator from a uniform distribution between 0 and 100 percent by default. The input parameters of the model are the proportion of each opinion and the minimum and maximum values of the threshold distributions for each group of people with different opinions separately, so that the willingness to express opinions can be different in the two groups. When modifying the distributions of the threshold levels, we always take care that the difference between the maximum and the minimum value should be equal in the two opinion-groups. This is necessary to ensure that the height of each density function is equal.

When we choose equal parameters of the threshold distributions in the two opinion groups, the simulation leads to the result that people with the minority opinion will be silent after a few steps, and the opinion of the majority will be the only visible opinion, regardless of the specific distribution of the opinions. Figure 1 presents the situation with a distribution of opinions 30:70 and with the same threshold max and min (scaled between 0-100) for both groups (80, 20).

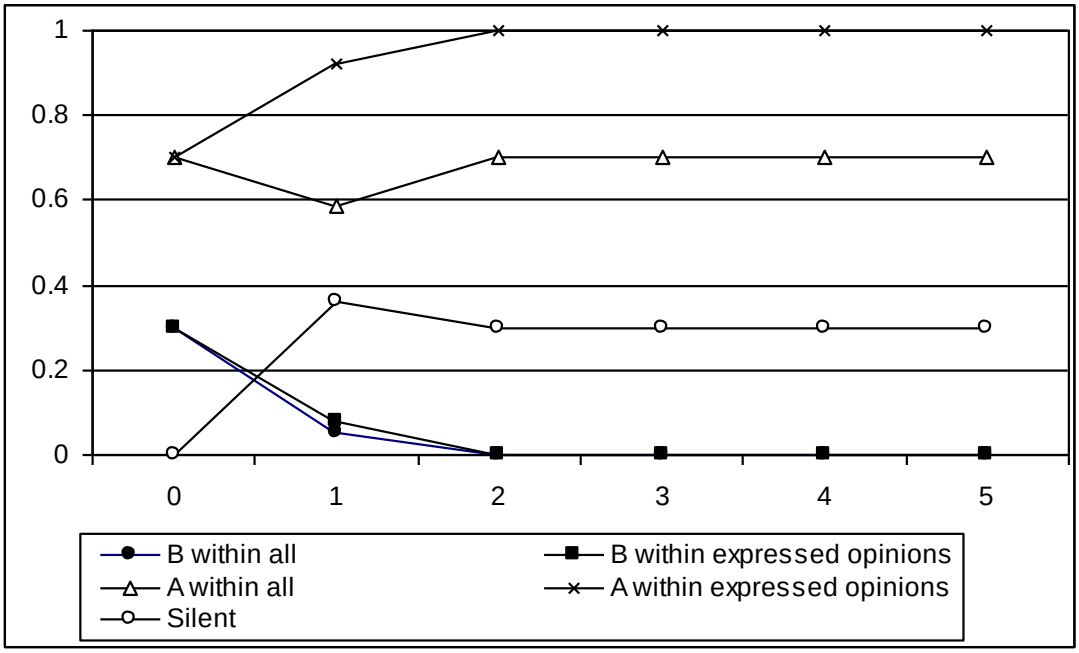

Figure 1. Simulation of the diffusion of opinions for opinion 30:70 and the same thresholds distribution 80,20.

Opinion	Proportion	Threshold Max	Threshold Min
(A)	30	80	20
(B)	70	80	20

Table 1. Sample model values

Another dynamics can be observed in the models where the distribution of the threshold levels is different in the two opinion groups.

Opinion	Proportion	Threshold Max	Threshold Min
(A)	30	60	0
(B)	70	100	40

Table 2. Sample model values

In this model the distribution of opinions is 30:70, and there is a great difference in the distribution of threshold levels between the two groups. People with the minority opinion A are more willing to assert their opinions, because they need a lower level of support. As the maximum of the threshold distribution is 60 percent, there is no person with opinion A who would remain silent if he perceives that at least 60 percent of the asserted opinions agree with his opinion. On the other hand, people with the majority opinion B need much more public support to express their opinions. In this group, the threshold levels are distributed between 40 and 100 percent. That is, if their opinion is not supported by at least 40 percent of the opinions observed, every person with this opinion will be silent.

With these parameters, the dynamics of the expressed opinions will go as shown in Figure 2. The number of persons with majority opinion B asserting their opinion – because of their lower willingness to do so – will decrease step by step, while more and more members of group A will assert their opinions, due to the decreasing proportion of the majority group. In

the end, the minority opinion will completely win over the majority, and opinion A will be the only opinion observable.

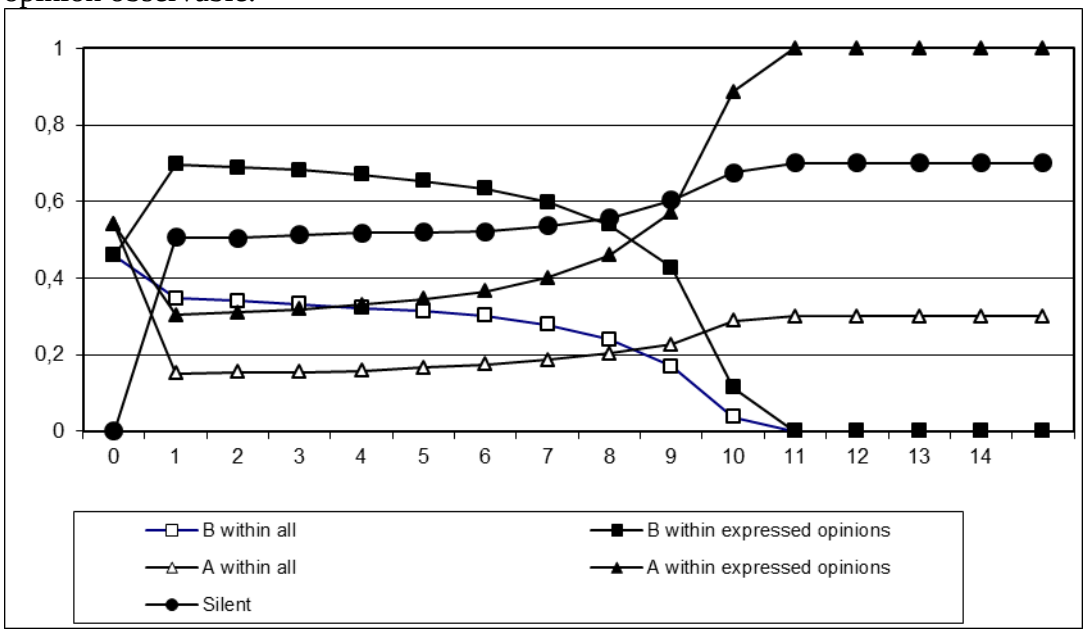

Figure 2. Simulation of the diffusion of opinions for proportion 30:70 with different threshold distributions (different simulation steps)

2. Measuring thresholds

Valente (1999) analyses the diffusion of innovations and determines the thresholds as the exposure at the time of adoption. Exposure is understood here as the proportion of the adopters in an individual's personal network: for example, if a doctor starts to prescript a new drug only after all of the doctors in his network adopted it, he has an adoption threshold of 100%.

Another way to determine the threshold is to ask people directly about their willingness to start an activity. Taylor (1984) used this method to determine thresholds in his analysis of residential segregation. White and black interviewees were asked whether they would move out of their residence if the proportion of two groups changed. If a white respondent accepts black/white ratios of 9/1, 7/3, 5/5, and so on, but rejects ratios of 10/0 and 1/9, he has a lower threshold of 10 percent (at least 10% of the neighbourhood population has to be white) and an upper threshold of 90 percent (at most 90 % of the neighbourhood population should be white).

Krassa (1988) determines the individual's threshold as a function of the intensity of the individual's opinion in issue and the risk aversion or fear of social isolation. Threshold rises with risk aversion and the lack of the interest in the subject. Thus, thresholds can be determined indirectly through determinants such as social class, education, occupation, social position etc.

Noelle- Neumann tried to measure individuals' readiness to stand up for their opinion as well as to determine factors, which negatively or positively influence opinion assertion. Interviewees were asked to answer the question: "Assuming that you have five hours of train travel ahead of you, and somebody in your compartment begins to talk about….Would you like to talk with this person or rather not, knowing that he or she is arguing for party X." (NN 19 p.150), If one is ready to join a conversation on the preferred party only with the supporters of the party, he has a higher threshold level than the respondents who are ready to

engage in a conversation with their opponents. Noelle-Neumann found significant differences in opinion assertion among the members of different social groups. The "loudest" interviewees were male, educated, young, and urban residents with a high income.

Thresholds are difficult to measure. It seems plausible that people with a smaller network need more support to express their opinions than people with a greater network, many of whom can be opinion leaders. It is also equally plausible that people with higher assets and a more secure social status are more likely to be opinion leaders, thus increasing their visibility and the size of their camp. Given the practical difficulty to determine thresholds, we have to rely on mathematical calculations and computer simulations. Here however, it is also worth mentioning that according to the calculations of Róbert Angelusz and Róbert Tardos (2011) homophilia in the political networks has nearly doubled between 2003 and 2009 (Angelusz-Tardos 2011, 361) and the chances of a convergent communications have largely decreased in Hungary.

3. An agent-based model of the voter's behaviour

A fundamental difference between the models of Noelle-Neumann and Krassa is that while the spiral of silence explains the spreading of opinions from a macro perspective, Krassa provides an explanation to it based on micro-level interactions. Thus combining these approaches basically means operationalizing how these two levels influence each other.

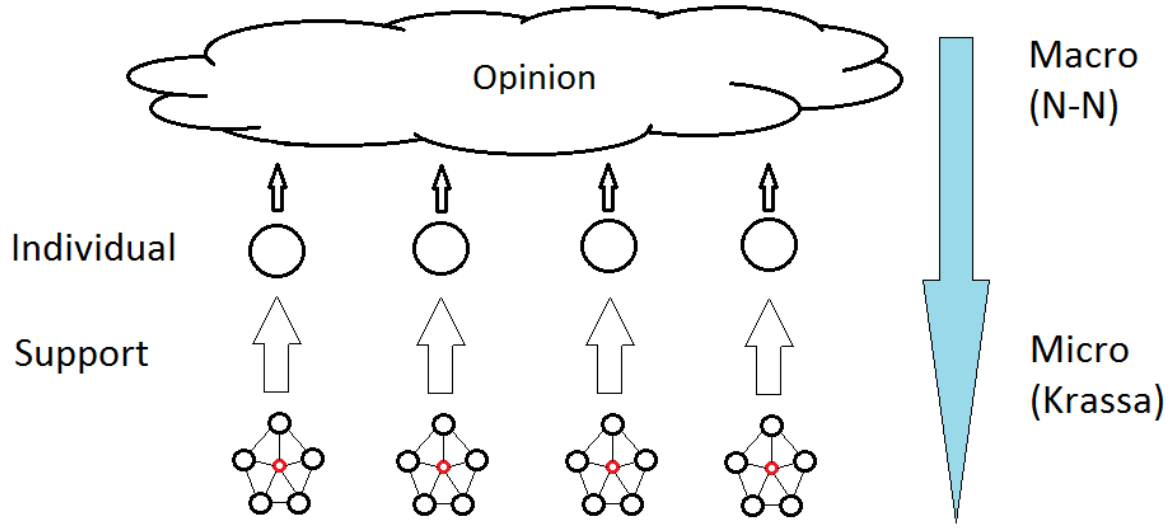

Figure 3. The interaction between micro and macro levels influencing a voter's behaviour

The connection between the micro and macro level is defined by how the model of Krassa is included in the approach of Noelle- Neumann. The pure analytic application of Krassa's model means that the probability given by the model is compared to the threshold value provided by Noelle-Neumann and evaluated dichotomously (express/supress opinion). As Krassa also remarks, we can't relax the assumption that the threshold value is heterogenous across the population, so this should be represented as a random distribution in our model

These models may be connected in an agent-based simulation where the agent's behaviour (how it is connected to the other agents, how its threshold is formulated and the decision about expressing/withholding its opinion) is described by the micro-level model (Krassa), but the effect of the other agents' behaviour (quasi-statistic perception of public opinion) is

described by the macro-level model. Basically the process of perception provides the link between these two models.

a. Our agent based model using the models of Krassa and Noelle-Neumann

Here we introduce the model formulated using Krassa's and Noelle-Neumann's model considering those written previously and we describe its implementation. The purpose of our model is to explain the results of polls starting from hypothetical opinion distributions – basically we wish to demonstrate that the results of polls are heavily influenced by the factors described in the previous section and the same poll results can result from vastly different opinion distributions. Besides that we would like to approximate opinion distribution in the 'grey zone' of voters not expressing their opinions given the attitude and network patterns of voters having certain party preferences – moreover we assume that some voters would lie about their true preferences.

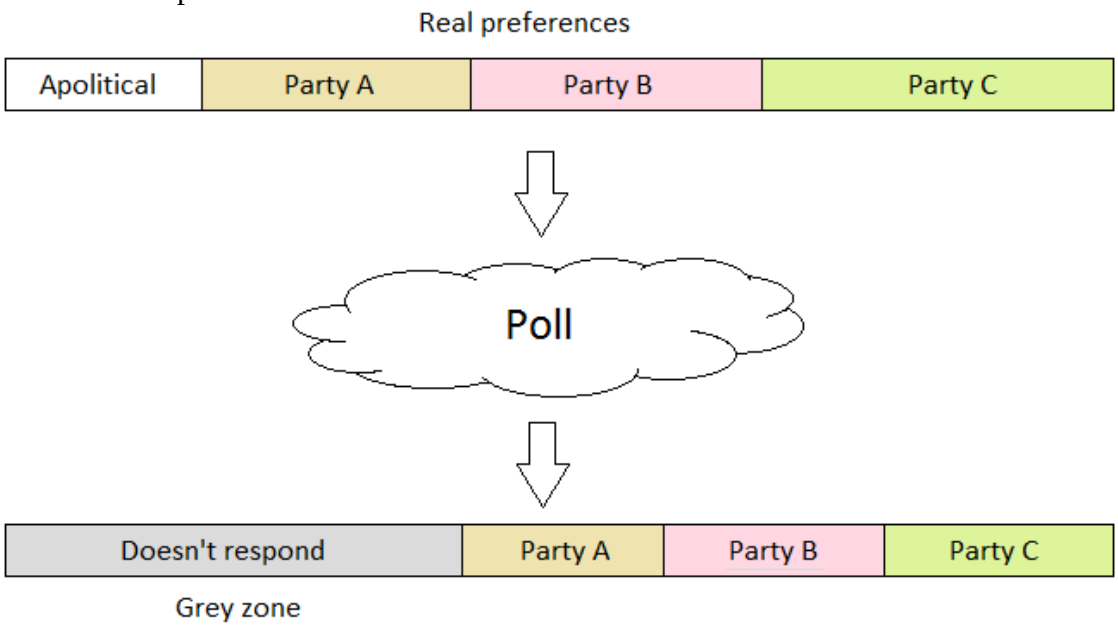

Figure 4. How real preferences map to poll results

Using these approximations of the real preference distribution and also assuming the mobilisation capabilities of different parties, one can also predict the outcome of the elections by simple analytical methods, or simulations.

b. The behaviour model of the agents

In our model the agents' behaviour is described by Krassa's model. Hence an agent will express its opinion if it receives sufficient support from its ego-network. The ego network of the agent consists of other agents with similar and different opinions. Besides this support we also assume that the agents may lie about their party preference with a given probability and that this bias works always towards the governing party(ies).

Furthermore we assume that the agents having similar party preferences are somewhat homogenous. Their homogenity applies for the following properties:

- Average threshold value
- Probability of lying

- Average the network density (percentage of other agents known from the whole network)
- Average network composition (ration of supporters/non-supporters)

The following figure illustrates an agent's behaviour:

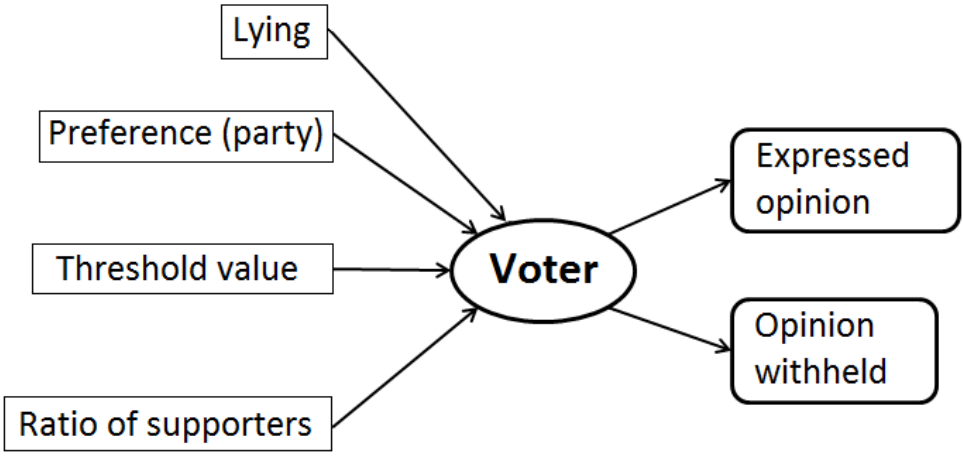

Figure 5. Our model of voter behaviour

In our model we assign a party preference to each agent and based on that we randomize the threshold value, an ego-network with a given ratio of supporters and a probability of lying. The network is dichotomous, so we do not consider weighted ties – there are no opinion leaders. The decision of expressing the party preference is a dichotomous variable (express/withhold), while the preference expressed is a discrete variable – its value is determined by the initially assigned party preference and the lying probability (if the agent lies it automatically expresses a preference for the governing party).

Our model connects to Noelle-Neumann's model through the quasi statistic perception of public opinion, which is obtained from the ego-network of the agent using a simple subjective calculation. The agent assumes that the opinion in its own ego-network represents the public opinion and makes the choice about expressing or withholding its own opinion based on Krassa's model.

Based on this behaviour model, we produced a simulated context where we want to approximate the real party preferences of the voters in the grey zone. The input variables of this simulation are the following:

- Number of agents
- Assumed party preference distribution (party-specific variables are here below)
    - Distribution of threshold values
    - Network properties
    - Lying probability
    - (Participation probability)

The number of agents influences the speed of the simulation and also indirectly influences the network properties. The party preference distribution is assumed for the whole population, so for each individual agent it is randomized. Then all the party-dependent properties are assigned to the agent (some of them random).

The distribution of the threshold value is represented by the average value resulting from the distribution. For the sake of simplicity we only assume easily computable distributions –

flat or exponential distributions are preferred, here we assumed an exponential distribution assuming that people are generally outspoken. Then the upper value of the threshold value is then randomized based on this distribution in the first step and in the second step the real threshold value is randomized using a flat distribution between 0 and this value. This is required in order to take into account the momentary shifts in people's willingness to speak. During a poll a voter does not explicitly feel the 'pressure' of the public opinion, thus while in one case a voter may express its opinion, in other cases it won't. Also a practical reason is that in small networks for small parties (1%) a simple randomization would result in their voters never getting enough support to express their opinions.

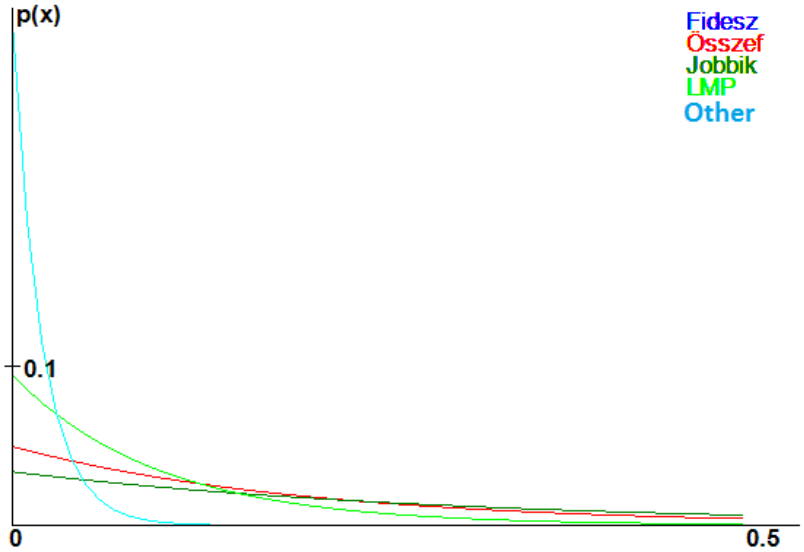

Figure 6. A sample distribution of thresholds depending on party (exponential distributions assumed)

c. The simulated network

The network in the simulation is also created randomly and the ties are directed. They symbolize the interest of an agents' opinion from the perspective of the other. A tie from *i* to *j* means that when *i* decides to formulate its opinion, he takes the opinion of *j* into account. Basically the randomization takes place for the ego-networks. For each agent an ego-network is randomized based on two input parameters: 'inside' and 'outside' density. The 'inside' density means the ratio of those people with the same opinion to whom the agent is connected (they are 'inside' the group sharing the same opinion), while 'outside' density means the ratio of people with different opinions in the network to whom the agent is connected.

So if an agent has the 'inside' density of 20% and 'outside' density of 50%, then the agent is connected to 20% of those people who share the same opinion and 50% of those who doesn't. Of course this is an indirect way of providing the opinion ratios in the ego-network, these parameters were chosen out of practical reasons (easier to randomize).

d. Interpreting simulation results

Creating the simulation context we run a 'virtual poll' what we then compare to the actual polls. If the results are similar to the poll, then we may say that our assumptions may be valid, but it is vital to emphasize here that the same poll results may come from vastly different input parameters! Of course our main interest here is the range of possible underlying party preference distributions that may result in the poll results we see today.

Then we may assume a set of numbers describing mobilization capabilities of the individual parties which may then be used to calculate the outcome of the elections. The participation ratio on the elections in Hungary is traditionally between 60 and 70%, thus in the following simulations we set these participation ratios accordingly.

In the next section we will demonstrate the applicability of the model in practice, with political examples related to the Hungarian elections of 2010 and we give an estimation of the possible results of the upcoming 2014 parliamentary elections based on the simulation program.

4. Simulation results

In this section we introduce the results obtained by the simulations using our model. First we show the methodologies and parameters used to describe the elections in 2010, then we attempt to outline some scenarios possible for the elections in 2014. We wish to emphasize that our goal here for the current elections is not to give a prediction of the outcomes, but rather to point out that vastly different real party preference distributions may lead to the very same poll outcomes.

a. Hungarian parliamentary elections in 2010

For the parliamentary elections in 2010 we used our simulation in a two-step process: first we attempted to estimate the real party preferences within the society, then we simulated the elections using a hypothetical value set for participation probabilities. Our baseline to estimate real world party preferences were the polls of various public opinion research centres – with TÁRKI, Nézőpont and Szonda Ipsos among them.

We provided input parameter sets which resulted in a simulation being in line with these poll results. Following that we went on with simulating an actual election, setting the overall participation to the range of 60-70% (as expected).

In this elections there were 5 major parties to take into account: Fidesz, MSZP, MDF, LMP and Jobbik. The two major parties were Fidesz (currently governing) and MSZP, both Jobbik and LMP were newcomers to the Hungarian political life and MDF – although having a long lasting history since the fall of the communist regime – lagging far behind fighting for the minimal quota for parliamentary participation.

When setting up the simulation we assume a fixed network pattern: Jobbik was assumed to be very well ‘networked’ (in the ego-network of Jobbik supporters the proportion of other supporters was much higher for the other parties) followed by LMP (who based their campaign on a bottom-up strategy) with the other parties being less networked.

There were two dimensions on which we outlined our scenarios (as mentioned before):

- The party preferences
- The participation ratio of party supporters.

In both dimensions we outlined three scenarios, which resulted in 9 overall scenarios summarized in the following tables.

Scenario	Fidesz	MSZP	MDF	Jobbik	LMP	Impulsive
1	0.42	0.2	0.04	0.11	0.055	0.175
2	0.44	0.185	0.035	0.1	0.06	0.18
3	0.445	0.18	0.03	0.105	0.06	0.18

Table 3. Party preference scenarios

Scenario	Fidesz	MSZP	MDF	Jobbik	LMP
1	0.80	0.7	0.75	0.85	0.90
2	0.75	0.7	0.8	0.90	0.85
3	0.80	0.7	0.75	0.90	0.85

Table 4. Table 2: Mobilization scenarios

Here we assumed that only the 'party voters' would go and participate on the vote, so that 'impulsive' voters – without stable party preferences – will not participate on the elections. Using the distributions in Table 1 we produced similar results as the TÁRKI polls and combining them with the mobilization scenarios found in Table 2 we obtained our election predictions.

It turned out that the third party preference distribution scenario got closest to the real outcomes, its results are seen below along with the differences from the actual outcome.

3.	Fidesz	MSZP	MDF	Jobbik	LMP	Participation
Party pref. scen	0.445	0.18	0.03	0.105	0.06	
1. Mob. scenario	0.8	0.7	0.75	0.85	0.9	
Results	55.16%	19.58%	3.40%	13.90%	7.96%	64.58%
Difference (%)	-2.43%	-0.28%	-0.73%	2.77%	-0.48%	-0.20%
2. Mob. scenario	0.75	0.7	0.8	0.9	0.85	
Results	52.80%	20.01%	3.65%	14.98%	8.55%	63.45%
Difference (%)	-0.07%	-0.71%	-0.98%	1.69%	-1.07%	0.93%
2. Mob. scenario	0.8	0.7	0.75	0.9	0.85	
Results	54.37%	19.52%	3.36%	14.49%	8.26%	65.38%
Difference (%)	-1.64%	-0.22%	-0.69%	2.18%	-0.78%	-1.00%

Table 5. results of party preference scenario 3

As seen in this table the results were within 3% of the actual results in each case, which is a very good result especially since the values provided by the poll agencies were more different. All over all scenarios the biggest difference was 3,75%, which is still acceptable. This was the first attempt to use our model with real data providing exact estimates. However the political situation was much clearer during this cycle as in the present one as for this simulation we completely neglected the cases when the voter would actually lie about its party preference.

b. Hungarian parliamentary elections in 2014

There are key differences between the election of 2010 and 2014 which have to be addressed before even trying to outline certain scenarios. In the political sense the parties in

the elections went through huge changes in the last democratic cycle. LMP and Jobbik has taken up different roles from their 2010 attitude, aiming at different voter groups while trying to retain their voter-base (See: Tóth-Grajczár 2013b, Tóth 2013).

It also should be noted that in 2010 a new dividing line has developed: the moderate/radical (Angelusz-Tardos 2011), which is also characteristic – or even more characteristic today.

The position of Fidesz has also changed drastically as from an oppositionist party it became a governing party controlling much of the media. Also, Fidesz have been associated with cases of abusing power and silencing dissident voices.

MSZP is not alone running against FIDESZ, but it is in a broader coalition of left and liberal forces under the label "Kormányváltás" (Change of government). None the less, the new coalition suffers from similar image problems as Fidesz due to the composition of the electoral alliance, which includes Ferenc Gyurcsány and the liberals. The image is further destroyed by the publicization of high profile corruption campaign. Kormányváltás is also under constant fire by most of the media controlled by Fidesz.

Due to these circumstences, unlike in 2010, the ratio of people who deny to assert their political opinion or even give an outright misleading answer is assumed to be relatively high. Thus, the polls in 2014 could be trusted even less.

Using our simulation theory, we will review again 3 scenarios of extreme party preference distributions (extreme compared to current poll results) and assume a plausible mobilisation ratio. We will show that even extreme party preferences may result in the current polls and that with these extreme, yet by far not surrealistic, as our model shows, values the upcoming elections may bring unexpected results from either side.

According to the current polls the ratio of the voters in the 'grey zone' has increased in the last two months[7], which is not a typical scenario before the elections. In this timeframe do the party preferences get stabilized and the voters decide on whom they would support. We suspect that besides the losses of Kormányváltás, there is a restructuring process taking place producing this level of undecided votes.

The current poll results (TÁRKI 2014) are shown below.

Support (%)	**Fidesz**	**Összefogás**	**Jobbik**	**LMP**	**Other**	**N.R.**
2014 February	38	21	15	4	1	22
2014 March	38	16	15	4	2	26

Table 6. Latest poll results by TÁRKI

This results show that even though the election is getting near, the stabilization of the party preferences didn't take place yet. Here we will present three possible scenarios in which the very same results could have been obtained using our model presented before.

The first scenario shows that the real party preferences are in accordance with the polls. The most important feature here is that we assumed that all the votes are distributed (no apolitical voters) according to TÁRKI's distribution among 'stable voters'. Using those ratios TÁRKI's poll results could only have been obtained by taking surrealistically low values for the embeddedness of the Fidesz voters.

Also note that here we assumed that every party has less outspoken supporters compared to Fidesz, which is not likely (especially in case of Jobbik). Besides, the network densities were assumed to be the best for Fidesz, which is again a doubtful assumption considering Jobbik's strategies of organization and campaigning.

[7] See http://www.tarki.hu/hu/news/2014/kitekint/20140326_valasztas.html

Support (%)	**Fidesz**	Kormányváltás	**Jobbik**	**LMP**	**Other**	**N.R.**
Assumed support	51%	21%	20%	6%	2%	1%
Avg threshold	0,2	0,27	0,27	0,25	0,25	
Network supporter ratio	18,2%	10,63%	11,66%	5,1%	2 %	
Lie probability	0	0,1	0,15	0,05	0	
Simulated Poll (avg)	38,02%	15,3%	15,01%	4,8%	1,2%	25,44%

Table 7. Scenario 1, reality replicated well by TÁRKI

The second scenario presents a case, when the governing party's lead is caused by a significant amount of opinion forging, where a significant ratio of voters lies that he'd support the governing party Fidesz. Here we assumed that Jobbik is as well 'networked' as Fidesz is, while 'Kormányváltás' and 'LMP' lags behind. Note that the bad ratio at the LMP for the network supporters is due to the low support – if there aren't many people sharing one's opinion, it's less likely that his network will be dominated by those.

The difference between the governing party and the other parties is only 10% in this case, which is much less than reported, yet the simulated poll results are identical to TÁRKI's results. Here another interesting point is a very strong, yet not too 'loud' Jobbik – this assumption may be explained by the decreasing acceptance of extreme right directions a lot of Jobbik supporters still follow.

Support (%)	**Fidesz**	Kormányváltás	**Jobbik**	**LMP**	**Other**	**N.R.**
Assumed support	30%	20%	19%	6%	2,5%	22,5%
Avg threshold	0,08	0,35	0,3	0,1	0,02	
Network supporter ratio	42,8%	25%	46,9%	6,3%	2,6%	
Lie probability	0	0,1	0,15	0,05	0	
Simulated Poll (avg)	37,77%	16,25%	15,46%	4,36%	2,1%	24,04%

Table 8. Scenario 2 – strong, but silent extreme right

The third scenario again differs from the current results. Here we assumed that all smaller party voters (LMP and the Other parties) are outspoken along with Jobbik. Here our assumptions were that Fidesz is overrepresented in the polls, and just as in the previous case, the number of responders faking their preferences is substantial. This suggests a stronger presence on the side of Kormányváltás with a lot of non-responding supporters.

Support (%)	**Fidesz**	Kormányváltás	**Jobbik**	**LMP**	**Other**	**N.R.**
Assumed support	28%	22%	16%	5%	2%	1%
Avg threshold	0,1	0,4	0,05	0,05	0,05	
Network supporter ratio	38,8%	14,1%	40,9%	6,3%	2,4%	
Lie probability	0	0,2	0,15	0,1	0	
Simulated Poll (avg)	38,85%	15,96%	14,62%	4,44%	1,74%	24,3%

Table 9. Scenario 3 – outspoken small parties

As these scenarios have shown, even small changes in the network structure of voters and lies can substantially influence the outcome of the polls. Due to the immense changes in the voter behaviour during the last political cycles affecting both the rational and moral public opinion about party politics in general, the polls aiming to uncover the party preferences of voters may be very much biased. This bias may be influences by poll methods of course, but we suggest that the reluctance to assert an opinion and nowadays opinion faking are the key factor that distort poll results.

5. Discussion and conclusion

In this paper we introduced a model to describe the behaviour of the poll responders who do not wish to assert their opinions. This 'grey zone' of responders means a highly significant bias, which already led to miserable predictions of election outcomes. To mention but the most significant case in the last decade: the Hungarian parliamentary elections of 2002 likewise finished with the surprise victory of MSZP, although the pre-election polls indicated a victory for FIDESZ.

Another good example is found in the case of the British General election of 1992 the pre-election polls indicated the victory of the Labour Party,under Kinnock over the conservatives, led by John Major. In the event the Conservatives won their fourth general election in a row. In 2006 during the Italian parliamentary election Berlusconi accused the Italian pollsters of being biased in favour of the central-left. In fact, the central-left coalition won the election with a narrow margin of 0.1 percent of votes instead of the 3 to 4 percent, which was the forecast of the pre-election polls (Callegaro and Gasperoni 2008 p. 148). Last but not least, we can also mention here the 2007 Polish parliamentary elections, where the pre-election polls measured the preference for PiS to be 30% and for PO 28%. Eventually, PO won by 41,5%. Given the aggressive rhetoric of the Kaczynski-government, we can reasonably assume that many supporters of PO chose to be silent in pre-election polls.[8]

A wrong forecast can be of course explained through several factors: sampling error, undecided voters, specific context such as the famous Sheffield rally in the British case, where Kinnock appeared triumphant. This, given the British national character may well have put many voters off.

Our article sought to show that there is another possible explanation for the wrong forecast, which is supported by the spiral of silence theory: namely, that many respondents who believed that they held the minority opinion were reluctant to admit their preferences to pollsters putting the "spiral of silence" into motion. It can be, of course, argued how much the difference between "public" and "private" opinions depends on a given national culture; new research on the spiral of silence found that the Asian countries tend to be more "conformist" while the Western societies more individualistic. (Scheufele D.A., Moy P. (2000). If we want to give a more general explanation of voting behaviour, we have to disregard national specificities and also the question of how events such as the Sheffield rally can influence voters' preferences. For this reason, we likewise omitted the discussion of the 2010 Hungarian electoral campaign, but focused rather on results.

In order to summarize these processes we proposed a model based on the spiral of silence theory and threshold models (being closer to the threshold models). It was based on the model

[8] There are of course many alternative explanations offered for wrong electoral forecasts such as the impact of the campaign or the remarkably good (or alternatively bad) performance of the leaders of the rival parties. For such an analysis see: Simon Dyson, "Polls apart? The 1990 Nicaraguan and 1992 British General Elections". *Political Quarterly*, Vol., 65, Issue 4, October 1994, 425-431.

of Krassa, but introduced specific network structures – the embeddedness of responders – and the possibility of reporting fake preferences – basically lying, which is an important influencing factor nowadays.

The results of our threshold model provide a potential explanation for the significant disparity between pre-election preferences and official results, apart from conspiracy theories or motives of manipulation. We have shown that given an assumed hypothetical threshold distribution within a given population, it is possible to give a higher estimate than the actual size of a camp.

Concerning both the practical applicability of the model and its theoretical assumptions however, we can raise some criticisms.

First, our simple model does not take into account the network distribution of the perception of opinions, namely that individuals uniformly perceive the distribution of opinions – we excluded the opinion leaders here. The perception of individuals is influenced by the distribution of opinions that they see in their own social networks. In order to expand our model, it would be important to take into account "dual opinion climates", which can result in what Róbert Angelusz calls "optical misperceptions" (2000a).

The second problem is that the relationship between a tie and opinion dynamics is not so direct and obvious as the model assumes. It can happen that A is a good friend of B but it does not matter to A whether or not B supports the X cause because A considers B to be a born loser. At the same time A can be influenced by a person whom he or she has never met (e.g. a television reporter, politician or football player). It is possible to provide each individual with a general opinion value (e.g. the opinion of an intellectual "matters" more than that of a non-graduate). This is worth investigating in individual networks (although one disadvantage is that more parameters are included in the model. A further practical difficulty is the identification of the social groups in A's network which negatively influence his opinion assertion. In reality, it can happen that precisely those individuals connected with strong ties have a negative effect on each other (the most typical case is the revolt of sons against fathers). Moreover, the model makes no distinction between strong and weak ties (Granovetter 1973, later revisited in 1983). Note that whether contagion is faster in the case of stronger or weaker ties is questionable. Chwe (1999) shows that a strong-tie structure is advantageous while Macy (1991) finds the contrary. Yen-Sheng Chiang (2007) adds that not only is the strength of ties important, but also the threshold values of neighbours. He finds that at the beginning participation levels increase when neighbours have different thresholds, but a further increase in the heterogeneity of neighbour networks causes the diffusion of opinion to stop.

Furthermore, it is not necessarily true that willingness to express an opinion depends exclusively on perceived social support. The hypothesis that opinions are constant is likewise problematic. In the model, the change in the perceived distribution of opinions was only the result of a change in the proportion of people who expressed this opinion – while the ratio of actual supporters did not change. In reality, people's opinions change as well.

We can also mention one more factor that can influence thresholds and the free expression of political opinions: fear. Bartha (2011) conducted in-depth archival research in East Germany. The reports of the Institute for Public Opinion Research, which functioned under the control of the Central Committee of the SED, strictly focused on the technical details, without any attempt to interpret the results in a wider socio-political context. The surveys, of course, served primarily ideological and propaganda purposes: one recurring topic was the comparison between the GDR and West Germany according to given criteria and the TV-watching habits of the East German citizens. Even in this case they failed to admit openly that the purpose is to map when the East Germans watch Western channels and what could be

done in order to find a new occupation for the East Germans in the most frequented broadcasting periods.[9]

Last, with respect to opinion assertion, the model assumes that if people are willing to assert their opinion, they will say what they actually think – although in public opinion polls the separation of public and private opinions is a well-known phenomenon, when under a certain normative pressure individuals assert in public an opinion different to their internal conviction, to which they listen when they actually vote.

Apart from theoretical criticisms of the spiral of silence theory, if we want to apply Krassa's model the main technical difficulty is in determining the actual distribution of thresholds. We know neither the distribution function of the thresholds of opinion assertion nor the differences in the function between the two opinions. In the case of adoption of innovation, the threshold distribution is measured according to the exact exposure time of adoption (Valente 1999). Moreover, thresholds might not be constant in time, for example voter preferences can be drastically changed as the result of new information. That is why the model should be treated as dynamic.

Finally, it can be also questioned whether people's behaviour is contingent on others or is influenced by some exogenous factor as in the case of umbrellas: "Thus, if at the beginning of a shower a number of people on the street put up their umbrellas at the same time, this would not ordinarily be a case of action mutually oriented to that of each other, but rather of all reacting in the same way to the like need of protection from the rain" (Max Weber [I921]1968, pp. 23).

We believe that further development of threshold models is possible only through multidisciplinary research. The need for a combination of quantitative and qualitative methods, which would take into account not only the complex relationship between ties and opinion dynamics but would also consider the wider social context, is beyond doubt. While simulations operate in a context-free (or "controlled") environment, in reality where and which cause is supported by a "visible" majority is of no little consequence.

[9] The institute did all what they could in order to prove the ideological development of the citizens in the Honecker era of ideological dogmatism. They proudly reported that while in 1968, 65 per cent of the respondents thought that the GDR is socially more developed than the West German society, in 1973 this ratio was 73 per cent. Unfortunately, however, in the field of economy and science one third of the respondents held West Germany to be more developed (this ratio was 50 per cent among the intellectuals!). To the question of whether the GDR should be protected even militarily, 60 per cent chose to answer with the loyal yes, 10 per cent said no, 2 per cent refused to reply and 28 per cent chose the option that they would not tell their opinion. An equally high per cent refused to answer the question of whether he/she agrees with the statement that future development will be determined by socialism. Among the workers this ratio was 20 per cent. It is worth thinking it over, how strong political repression must have been if so many people refused to tell their opinions even in anonymous questionnaires or rather they did not dare to give a negative answer to the rather naïve question, which were supposed to measure ideological loyalty to the regime. Since East Germany was not prepared to answer the West German challenge of a Western standard of living by providing for a similar provision of her citizens with material goods, she reinforced the use of repressive methods to justify her ideological superiority – at least in the field of domestic propaganda. Therefore it is no surprise that Hungarian sociology was seen to be as 'liberal' even in the West: in fact, from the 1960s Hungarian scholars were officially allowed to travel to the United States in order to be acquainted with the American methods of public opinion research! To show the difference between the two countries, I will cite another example. Eberhard Nemitz conducted a survey among working-class trainees, and he found that the majority was, in fact, sympathetic to the regime and held the idea of socialism to be progressive. However, the picture was not altogether positive: the trainees criticized the shortage of certain consumer goods, the retaliation for watching Western TV-channels and the fierce propaganda campaign against West Germany. The study was eventually published in West Germany after the immigration of the author. Therefore in dictatorial regimes fear of retaliation can also influence the free expression of political opinions.

Besides these remarks on threshold models, we also consider it very important to try to uncover those processes in the society which were shown to be important. The effect of networks in opinion formation and assertion, the extent and cause of lying during a poll, and the factors influencing all these phenomena. In order to get better knowledge on these we suggest a qualitative and quantitative survey based research (some questions useful to be included may be found in the appendix) to gain better understanding of responder behaviour in case of political surveys.

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7. Appendix:

Our suggested questions for a survey are the following:
Questions for the mapping of the individual's network:

1. Do you often talk about politics with your parents/sisters or brothers/ relatives?
   - Yes: Has your political opinion changed during these talks?
   - No: Why do you avoid political topics? (If the respondent hesitates): Did you have a conflict because of political disagreement?
2. Do you often talk about politics with your friends?
   - Yes: Has your political opinion changed during these talks?
   - No: Why do you avoid political topics? (If the respondent hesitates): Did you have a conflict because of political disagreement?
3. Do you often talk about politics with your acquaintances?
   - Yes: Has your political opinion changed during these talks?
   - No: Why do you avoid political topics? (If the respondent hesitates): Did you have a conflict because of political disagreement?
4. Do you have many friends?
5. Do you have many acquaintances?

Questions for the expression of political opinions:

1. How far do you trust in public opinion polls –that they are anonymous?
2. Do you answer questions such as: "would you go to vote if the elections were held on this Sunday?"
   - Not: why not?
   - Wouldn't respond: Have you ever been afraid to tell your political opinion? If yes, then could you describe this situation?
   - Yes: Have you every answered differently to a question from what you actually thought? If yes, then why?
3. Do you know examples in your environment when someone was afraid that the interview is not anonymous?
4. Are you active politically?
5. Are your relatives/friends active politically?
6. Do you talk about politics with those, who have a different opinion?