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Modeling Influence on Petty Corruption Attitudes

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Abstract**—**Corruption is an influential and widespread problem. One part of it is so-called petty corruption, related to large-scale bribe giving by ordinary citizens trying to influence the works of public administration or public services. As it is with all means of corruption, petty corruption is related to the level of democracy (or administration efficiency) in a society. The developed model captures some of the factors related to corruptive behavior, as well as people's attitude towards petty corruption. It has four basic elements: user's perception of corruption in the society of interest, the influence of social interactions, the influence of penalizing mechanism, and influence of campaigns against petty corruption. The model is agent-based, developed in NetLogo, with a lot of random settings that provide a wider scope of responses. Interactions of different settings for variables of elements provide insight into the influence of each element on attitude towards petty corruption, as well as petty corruptive behavior.

Keywords**—**Agent based model, attitude, influence, petty corruption, society.

I. Introduction

THERE are different definitions of corruption, as well as different approaches to exploring the sources, different strategies for fighting it, and different classifications. Yet, all agree that corruption is negatively reflected on the development of affected countries, and therefore it should be fought [1]-[3]. This is supported by the fact that there are many international institutions dedicated to fighting it, such as the World Bank, GRECO (Group of States against Corruption under Council of Europe), Transparency International, etc.

The latest research adds new insight; the risk of corruption can be linked to a wide set of factors [4]. Macro factors are related to the overall wealth of the society expressed in GDP, investments or economic growth, income inequality, culture and politics, and religion. The most important meso factor seems to be decentralization in the society (such as fiscal decentralization), but there are other elements of the system that underlies the functionalities of a society that can be important risk factors too. Micro factors are linked to the individual's social status, gender, education. Nevertheless, there is no proven causality among these factors and people's attitude towards corruption. There are some results that imply that in societies with more women in public administration, corruption is 5% less; however, there is no proven causality [4]. Furthermore, in a corrupt society, the education system can also be corrupt, so that level of education does not necessarily reflect the individual's education.

Corruption varies over the whole structure of a society, and while political corruption may be the most damaging to a society, so-called petty corruption if existing, is certainly the most widespread. Recent literature review shows that there are efforts on modeling corruption [5], but none dealing with quantification of petty corruption aspects.

There is a comprehensive Diagnostic Surveys of Corruption in Bosnia and Herzegovina (B&H) [6], prepared at the request of the Government of Bosnia and Herzegovina by the World Bank in the period of June-July and September 2000 with 700 public officials, 350 enterprise managers, and 1,200 individuals (general public).

The most contemporary data on corruption used in this research are from the Business Anti-Corruption Portal [7]. Concerning active petty corruption, it is said, "The offer and demand of bribes and gifts is criminalized in B&H. However, these practices are widespread." A more recent extensive research describes [8] people's perception of petty corruption in Bosnia and Herzegovina.

Here are some of the findings relevant to development of the model, as described in [8]:

- Corruption is almost as prevalent in rural areas as in urban areas (20.8% vs. 20.6%);
- More men (23.2%) than women (18.2%) pay bribes, but women are more likely to pay a bribe in kind – in the shape of food and drink;
- On average, 20.1% of citizens aged 18 to 64 years have been exposed - either directly or through a household member - to a bribery experience with a public official in the 12 months before the survey;
- The percentage of citizens of Bosnia and Herzegovina who pay at least one bribe in the 12 months before the survey – among those who have contacts with the public administration – is 20.7%, and those who pay at least one bribe in that period do so once every 10 weeks;
- Citizens themselves offer almost 40% of bribes paid;
- For every eight citizens who paid a bribe to a public official during the year, there is only one who turns down such a request;
- Only a negligible amount of bribe-payers (2.4%) report their experience to the authorities;
- While men in their 30s are those most exposed to bribery, characteristics such as income, education level or employment status, do not appear to have a clear effect on the probability of experiencing bribery;

Although the prevalence of bribery decreases slightly with income level, its frequency does exactly the opposite and the average number of bribes paid is actually higher among higher income bribe-payers than those with a lower income.

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Even the extensive literature search on the topic of fighting petty corruption did not provide clear directions for modeling. For example, it is obvious that bribing does not necessarily have to include money, and even if it does, it is, for example, difficult to estimate the effect of employing an under skilled worker on the effectiveness of public services, as well as the number of such cases. Furthermore, if there is a high level of corruption in the country, chances are that penalizing such behavior will not be effective in all cases (because of corruption) and the vicious circle just goes on. Thus, money was excluded from modeling, and the main variable became personal attitude towards petty corruption. The reasoning is the following: the least expensive, and most probably achievable goal in fighting petty corruption can be to influence people's attitude by online campaigning. This might be seen as development of the personal integrity of citizens, and so, might produce a society which is more open towards democratic values. If this can be achieved, simple defiance of active participation in petty corruption would reduce overall corruption in the country, and increase possibilities for economic progress.

Therefore, the goal of the proposed model is to enable social researchers to explore how social interactions and online campaigning affect the attitude towards active petty corruption, or "bribing attitude", over time. An additional feature in the model is the exploration of a penalizing bribe on bribing attitude. Model parameters can be adjusted by the user according to their scientifically founded beliefs of the existing data.

The model simulations for various settings give insight into the slowly changing nature of attitude towards bribing, how this attitude can be affected in the most efficient way, and how measures against petty corruption acceptance reflect on actual bribing.

II. Pilot Survey Methodology

In order to sieve the quantitative observations from research on corruption in Bosnia and Herzegovina, a pilot survey was conducted. The questionnaire was posted on Facebook in March 2017, and the results were analyzed after seven days in which no one accessed the Google form. Upon submission of questionnaire, each participant was assigned a reference number. The questionnaire consisted of questions about participants (how they found out about the questionnaire, the reference number of the person who recommended questionnaire, age, gender, place of residence, number of they have children), about similarities of their opinions with opinions of their parents and children, about their attitude towards conform to the environment, about values they teach their children, are they prepared to give money, present or favor in return for a service, what they think about quality of life in their community, are they witnessed someone turning down a bribe, etc.).

This pilot survey had several goals: to estimate the reach of a regular online user, the length of online interest, to estimate the average willingness to participate actively in petty corruption, and to provide insight into people's general attitude towards bribing and to provide estimate on peoples willingness to change their attitude towards bribing. The questionnaire was developed with the help of local psychologist, so the questions are easy to understand. The predicted problem was capturing real attitudes towards bribing; thus, implicit questions were introduced.

The reference number served to explore online relations, as every participant was to refer to a person from whose Facebook post they heard about the survey. Questions related to the similarities of participants' opinions with those of their parents and children were introduced to explore possible inheritance behavior, and all other questions about children were part of the control mechanism. The pair of questions related to participants' attitudes towards conforming to the environment and the values they teach their children was designed to capture "the gap in integrity", meaning that if people were likely to think something for themselves, and not being willing to recommend the same to their children, they were likely to do the different thing themselves. Questions related to participants' opinions about quality of life in their community served to estimate their perceptions of their quality of life, while questions about witnessing or believing that someone is turning down a bribe were dealing with people's perceptions of how likely they were to change their attitude towards petty corruption if having positive or negative experiences, and if they heard about the positive or negative experiences of others (both online and offline). In total, 165 people completed the questionnaire in full. The majority of results were obtained within three days of posting, with the number of responses decreasing rapidly (roughly 62%, 33%, 5% on days one, two and three, respectively). The survey was reposted once, and the answers followed the same pattern.

The survey results were biased by its design, for friends of people with certain attitude are expected to have similar attitudes, but it still captured the nature of changing mindsets, and helped decide on minimal values for bribing attitude.

III. Agent Based Model

This model is agent based [9], encountering for behavior of people as well as influences of the environment. There are two basic types of agents: stationary and mobile. Stationary agents represent places or situations in which people can be involved in active petty corruption. There are further two types of mobile agents: people and campaigners. People are primary mobile agents in this model, and they represent people moving around at random and stepping into patches where they can bribe someone. They have a set of attributes and behavioral rules, some of which are user defined. When people come into situation where they can give bribe, they interact with other people in order to decide if they will give bribe or not. The campaign against corruption is simulated via the generation of campaigners at any given time with a user defined number and influence. Campaigners move around at random and interact with people, affecting their bribing attitude directly. The model allows users to define time, in order to simulate behavior patterns in a given period, or in accordance with real-life patterns of time based estimates of occurrence frequency

for exposure to places or situations, where people can be tempted to give bribe. Since the model was developed in NetLogo, in further model description, references to model elements are described according their implementation in this software.

NetLogo is "a programmable modeling environment for simulating natural and social phenomena. Modelers can give instructions to hundreds or thousands of "agents" all operating independently. This makes it possible to explore the connection between the micro-level behavior of individuals and the macro-level patterns that emerge from their interaction" [10].

The software allows two types of agents; stationary agents referred to as patches, and mobile agents referred to as turtles.

Modeling in NetLogo is designed to simulate changes over time. The smallest time unit is one tick. For the proposed model, it is convenient to relate one tick to one day, or to one week. Nevertheless, this is related to one's estimate of how many times is a person likely to step on potential bribing spots, or, in other words, how many times per year will a person be in situation where they can offer bribe, or be asked for bribe. For example, if BribeSpotPrev is set to 5, and CorruptBribeSpots% is 50%, then, if one tick corresponds to one day, each agent will have a chance of stepping on potential bribe spot 19 times on average (this number varries with regard to spatial distribution of randomly selected patches that represent potential bribing spots).

Patches can be regular patches (predominant in the model) or possible bribing spots. The name refers only to the places and situations in which people can be tempted to offer bribe, and does not relate to evidence of how many public servants are corrupt. The ratio of bribing spots also affects the perception of time. The prevalence of bribing spots is adjustable (BribeSpotPrev), and it reflects users perception of how likely people are to be in the situation to try to bribe someone, taking values from 1 to 100, simulating percentages. In order to decide if a patch is a possible bribing spot, the program generates a random number between 0 and 1, and if rnd < (BribeSpotPrev / 100), the patch becomes a possible bribe spot, colored in gray. Another slider, CorruptBribeSpots%, enables user to declare given percentage of potential bribing spots as actual bribing spots (colored in pink), and this percentage, together with the previous, will decide on how many of the bribing spots will accept the offered bribe. The decision if a bribe spot is corrupt is random. If a randomly generated number rand < (CorruptBribeSpots% / 100), the patch becomes corrupt. This distribution can be set only at the beginning of the simulation and remains fixed until the end.

Furthermore, bribing spots can ask for a bribe or not, which is another attribute that the user can adjust. Slider BribingTrashold represents a user's perception of how corrupt the society is in general, and at the same time, the chance that a bribe spot will ask a citizen to give bribe. In order to differentiate between the two kinds of bribe spots, those that will not ask for bribe are gray, while those that will ask for bribe are pink. In determining both possible bribing spots and actual bribing spots, a random number is generated, and if it is greater than BribeSpotPrev or less than CorruptEnvironment, the patches attain their respective state. This part is coded in the procedure setup-patches.

People are mobile agents who interact with bribing spots, each other, and campaigners. As the aim of the model is to simulate influence on their active bribing attitude, their main attribute is variable BAttitude. That variable can take values between 0 and 1, simulating percentages. The initial distribution is Normal, with user-adjustable mean and standard deviation, by sliders MeanBribingAttitude, and StDevBribingAttitude, respectively. This variable changes with each interaction among mobile agents, and active bribing spots, and is always truncated in order to not exceed minimum or maximum. Its mean (over all 500 agents) can be used to adjust Bribing threshold with sliders AdjustmentCoefficient and AdjustTresholdEveryNMonths.

Another important characteristic of people agents in this model is their openness to change (Openess2Change). Each agent is assigned a value between 0 and 1, but this variable does not change value over time. The distribution is Normal, with user-adjustable mean and standard deviation, by sliders MeanOpeness2Change, and StDevOpeness2Change, respectively. It expresses people's chances to change bribing attitudes based on their personal experience with bribing.

The third related characteristic is keeping memory of previous personal experiences. Whenever an agent is asked for a bribe, their experience is negative, and therefore memory is decreased by 1, and if they are on a bribing spot, and not asked for a bribe, their memory is positive, what is expressed as adding 1 to their memory. In order to setup individual values for each agent, the user should adjust the two following sliders, PersExpMem, and PersExpGrowthRate.

Equation (1) links the three variables and simulates the slow increase/decrease in bribing attitude with accumulation of negative/positive experiences:

$$BA = BA - O \cdot \frac{\left(\sqrt{E+120} - \sqrt{120}\right)}{R} \quad (1)$$

where BA stands for bribing attitude, O for openness to change, E for previous experience, and R for user input from slider PersExpGrowthRate. If an experience is negative, the denominator will be negative, and thus the BA will increase.

Campaigners are variables with the following attributes: CRadius, CDuration, and CInfluence. CRadius is user adjustable; the setting a value for MaxCampRadius slider generates a random integer in the range from 0 to MaxCampRadius for each of the campaigners, and that one can spread influence to all persons on the patches in a given radius. CDuration is a random number between 0 and MaxCampDuration, and describes how many ticks will that agent live. CInfluence is a random number with N(MeanInfluencedBy, StDevInfluencedBy), assigned to every campaigner agent to describe the magnitude of influence that an agent has on people agents in the radius, during its "life".

Agents move around at random. When they have

experience with active bribing spots, they can change their behavior according the Openess2Change.

Agents meet other agents and share bribery attitude. Their attitude is influenced by all their neighbors, according the Influenceability that is user defined with normal distribution N(MeanSEBAttitudeInfluence, MeanSEBAttitudeInfluence).

Agents come to bribery patches at random, and decide if they will give bribe or not.

The actual estimate of whether a person will give a bribe will depend on the BribingThreshold. If BAttitude is above the threshold, the person will give a bribe.

Memory of previous experiences (to last for one day initially) will be calculated as the influence from the last meeting minus the current influence; it will be updated after the bribing decision with the difference.

Upon meeting: one sees all neighbors and their Bribery attitudes, averages them, substitutes from their own Bribing attitude, multiplies the difference by their Influenceability and adds it to their Bribing attitude.

Upon stepping on a patch where a person can be asked for bribe, the agent gives (offers) a bribe if their bribing attitude is greater than the BribingTreshold. The act of giving a bribe reduces the memory by one.

The main procedure dealing with active corruption (bribing) is give_bribe. It deals only with bribing spots, and firstly asks if the person is asked for a bribe. If yes, their previous experience will decrease by one, and if not, it will increase by one. The question is whether a person has an attitude towards bribing. If the answer is yes, the model assumes they gave a bribe. If a person gave a bribe, their attitude will adjust with concern to their previous experience, the magnitude of that previous experience (positive or negative), and their influenceability. The formula simulates very slow growth, according the results of pilot survey, and cannot be modified by user, unless one accesses code.

In this model it is also possible to explore the effect of penalty on bribing, and that is user adjustable by switching on the BribingConsequences switch. This procedure is related only to those possible bribing spots that are not actual bribing spots (the gray ones) and explores what happens when someone offers a bribe when not asked for. The logic behind this is the following: if a patch asks for a bribe, it is highly unlikely that they will report bribing, for they would thus implicate themselves. There is a chance that people will be reported (if a randomly generated number is greater than CorruptBribeSpots%), and if reported, a person can again be penalized or not with the same chance. If a person is caught but not penalized, their attitude towards bribing will increase, as will their negative experience, and if person is penalized for bribing, their bribing attitude will decrease concerning their Influenceability, and their previous experience will be set to (positive) maximum. The magnitude of consequences of penalizing bribery can be adjusted by the user with sliders PenalizedCoef and IncreaseMemoryIfPenalized. Equations (2) and (3) express these relations.

$$BA = BA - BA * P \tag{2}$$

$$E = E + IM \tag{3}$$

where BA stands for bribing attitude, P for user input from the slider PenalizedCoef, E for PrevExpBin, and IM for user input from the slider IncreaseMemoryIfPenalized. All values are truncated in the code so as not to exceed the appropriate limits.

In this model, the user can launch an online campaign against corruption and so directly influence people's attitudes towards bribing. Duration of the campaign is measured in ticks. The Launch Campaign button calls the procedure that creates the user defined number of campaigners agents, lifespan, radius, and influence. Campaigner agents directly influence people agents' bribing attitude following the rule as in (4).

$$BA = BA - O * CI \tag{4}$$

where BA stands for bribing attitude, O for openness to change, and CI for CInfluence.

IV. Results

The chances that a person will give a bribe were expressed in the range from zero to 10. The average of all responses was 2.818, with standard deviation 3.197. There were no significant correlations of chances to give a bribe with either age, gender, or any other numerical variable.

The answers to question 16 to question 18 are presented in Table I. Question 16 and question 17 are related to positive experiences, personal and others' respectively, but question 18 is related to negative experiences. The questions were stated in the following manner: "If you (or witnessed someone in question 16) experienced that someone turned down a bribe (or accepted it for question 18) how much would your perception of quality of life in your community increase (decrease for question 18)?

TABLE I
Responses to Questions 16-18 in the Pilot Survey

Response	Q16 (%)	Q17 (%)	Q18 (%)
Not in the slightest, it could be an isolated case	33	36	23
A bit, maybe 1%	9	14	5
About 2-5%	8	7	16
If it happened a few times in a row it would surely increase/ decrease between 1% and 5%	9	10	10
If I witnessed it at least five times in a row it would surely increase/decrease anywhere between 6% and 10%	13	9	8
If, within a year, everybody turned down a bribe it would surely increase/ decrease 10% to 15%	13	8	19
The amount of people taking bribes has nothing to do with the quality of life here	16	16	19

Some 16% to 19% of participants explicitly said that petty corruption is not related to the life quality in the country. Their average age was the highest (38.5), but their probability to give a bribe was medium (2.78 from the range of 1.73 to 4.87), with an additional 33% to 36% thinking that if they had one positive experience that they would not change their

active attitude towards bribing, as opposed to 23% who think that if they had one negative experience that they would not change their attitude. These results show that if there is an increase in positive experiences, there will be a slow decrease in the number of people that will give a bribe, and thus, leading to the choice of a slow function for "correcting" people's attitudes towards bribing, taking into account the accumulation of positive and negative experiences. The function is simulated with a fraction in (1), where user defined R allows user to adjust growth rate.

V. Model Analysis

The research used an agent-based model. As the model aims to describe interactions in a society, it enables the user to quantify the corruption of the society, as well as certain characteristics of people. It has two built-in mechanisms for a possibility to penalize corruptive behavior, and the possibility to launch a campaign against corruption. The majority of personal characteristics are user-defined in order for the model to be more universal. The main contribution is that the model allows to monitor changes in attitude towards petty corruption (in further text bribing attitude) over time. Nevertheless, in order to define time, one has to have available data from published research.

The proposed model is designed to serve two purposes, which are to provide a basic for analysis of attitude's influence on bribing with the existing data, as well to provide a platform for simulations where data are not available. As such, it can provide evidence for answering the following research questions:

1. How long it will take for the bribing attitude to change for a given set of input parameters?
2. If the goal is to explore the influence of an online campaign (that is targeting people's bribing attitude) on actual bribing, the model will provide estimates on how long the campaign should be, how influential campaigners should be, and what their reach should be. The model can then serve to design the best campaigning strategy.
3. The model can also provide estimates for how social exchanges influence people's bribing attitude; this can be obtained by fixing any of the three factors (social radius, social influence, or memory influence).
4. Additionally, the model can provide estimates on how changes in the policy of penalizing bribing affect bribing attitudes, as well as incidents of actual bribing.

The following three examples illustrate how the model can provide insight into the research questions. The setting of variables is chosen to illustrate model possibilities; the first two examples show the importance of penalizing, and the third shows the importance of more influential social exchange and longer campaign duration.

VI. Decrease/ Increase of Bribing Related to Penalizing

Penalizing bribing is supposed to be the most efficient way to decrease petty corruption, and yet, in all countries with significant prevalence of bribing, there exist laws against it. Therefore, the element of this model simulating the influence of bribing consequences should be carefully adjusted. The initial value set for the model was:

Patches – BribeSpotPrev = 5, CorruptBribeSpots% = 50, BribingThreshold = 50 (no adjustment);

People – MeanBribingAttitude = 0.34 with StDevBribingAttitude = 0.18, MeanOpeness2Change = 0.29 with StDevOpeness2Change = 0.13, PersExpMem = 6, PersExpGrowthRate = 9

Social Exchange (ON) – MeanSocRadius = 3, StDevSocRadius = 1.6, MeanSEBAttitudeInfluence = 0.21, StDevSEBAttitudeInfluence = 0.12, MeanSEBMemoryInfluence = 0.16, StDevSEBMemoryInfluence = 0.09;

Bribing Consequences (ON) – ChangeBAttitudeIfPenalized = 0.32, ChangeBAttitudeIfNOTPenalized = -0.10, IncreaseMemoryIfPenalized = 1, DecreaseMemoryIfNOTPenalized = 2;

Campaign (has to be launched) – CampaignersNumber = 40, MeanInfluencedBy = 0.26, StDevInfluencedBy = 0.13, MaxCampaignDuration = 30 ticks, MaxCampRadius = 4.

The simulation was stopped after 732 ticks. This corresponds to two years (if the average number of encounters with possibility for bribing per year is 19.4), or to 14 years (if the average number of encounters with the possibility for bribing per year is 2.76). The average bribing ratio decreased from the initial 34% to 22%, while the percentage of people who gave a bribe when they had a chance declined to 13% from maximal 16%. After this period, the simulation was resumed, and a campaign was launched twice with 200 ticks distance. Fig. 1 illustrates the change in bribing attitude (decrease to 18% after the first campaign, and 14% after the second). From Fig. 1, the achieved decrease in average bribing attitude did not significantly influence the actual bribing. This campaign (if one tick corresponds to one day) was designed to simulate a month-long effort.

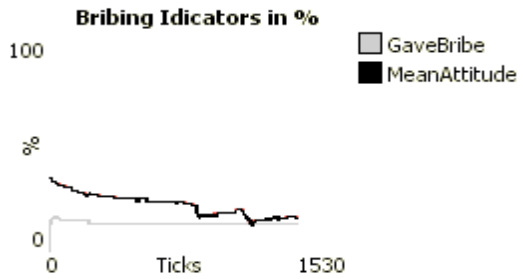

Fig. 1 NetLogo generated plot for average bribing attitude (MeanAttitude, black) and percentage of agents who gave a bribe when they were asked for (GaveBribe, gray) after launching two campaigns

As it is obvious that there is no increase in bribing, despite the significantly higher bribing attitude, it can be concluded that the initial setting is not very realistic. The setting of ChangeBAttitudeIfPenalized to 0.32 means that people will decrease their bribing attitude by 32% if they are penalized,

and ChangeBAttitudeIfNOTPenalized = -0.10 means that people will have 10% lower bribing attitude if they manage to avoid punishment. The slow decrease of bribing attitude shows that it is not necessarily the same as the actual bribing, and that penalizing can better correct the actual behavior than people's attitude. On the other hand, while actual campaigning causes fast and immediate decrease in bribing attitude, it does not fully change attitude towards giving bribe.

VII. Decrease/ Increase of Bribing Related to More Influential Social Exchanges

Now, let there be modifications in the parameters of social exchange (MeanSEBAttitudeInfluence = 0.57, StDevSEBAttitudeInfluence = 0.22), bribing consequences (ChangeBAttitudeIfPenalized = 0.10, ChangeBAttitudeIfNOTPenalized = -0.12), and campaigning (MaxCampaignDuration = 121 ticks).

Again, the simulation was stopped after 730 ticks. This corresponds to 2 years (if the average number of encounters with possibility for bribing per year is 19.31), or to 14 years (if the average number of encounters with possibility for bribing per year is 2.75). The average bribing ratio has decreased from an initial 34% to 22%, and the percentage of people who gave a bribe when they had a chance, reached 18%. After this period, the simulation was resumed and a campaign was launched twice with 200 ticks distance. Fig. 2 illustrates the change in bribing attitude (drops to a minimum of 14% after first campaign, and 8% after the second). From Fig. 2, it is noticeable that the achieved decrease in average bribing attitude did matter for the actual bribing, decreasing the bribe ratio to 15%. This campaign (if one tick corresponds to one day) was designed to simulate a month-long effort.

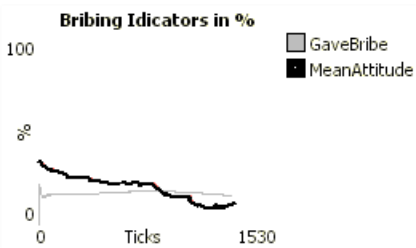

Fig. 2 NetLogo generated plot for average bribing attitude (MeanAttitude, black) and percentage of agents who gave bribe when they were asked for (GaveBribe, gray) after launching two campaigns

VIII. Conclusion

Corruption is a part of the development barrier for all developing countries. Nevertheless, when observed from the outside, the focus is seldom on petty corruption or on the attitude of citizens towards petty corruption. But, like any other social behavior, corruption, and especially petty corruption, would not exist if there were no citizens who are willing to participate actively in it by offering a bribe or bribing. When it comes to the active participants, there are two major mechanisms that can lower petty corruption. The first is intervention from the state, which is reflected in penalizing the act of bribery through the state juridical system. The second is an attempt to directly affect the active participants through changing their attitudes towards bribery. This research explores the effects of both afore mentioned mechanisms. As well, since people live in communities and interact with each other on daily basis, this model also explores the effect of those social interactions on correcting people's attitude towards bribing, as well as bribing itself. Furthermore, this model allows the user to simulate the effect of various magnitudes of consequences, as well as social influence, and campaign reach, magnitude and duration.

What is considered fixed in this model is the setting for petty corruption in the society. That setting requires a minimal number of variables, so the minimal influence on the interactions is fixed. Randomness incorporated in the model serves to incorporate uncertainty which follows from undetermined and not precisely quantified sources of corruption. Randomness is also partially due to the spatial distribution of bribing spots, as well as combinations of random settings for relevant variables. When users focus on one of the elements (social interactions, bribing consequences or campaign against corruption), they can explore a wide range of influences that element has on the model behavior; varying values for other elements provides deep insight into inter-correlation of model elements.

There are several directions for model advancements that can be foreseen at this moment, but still, they rely heavily on conducting studies in order to acquire the necessary information. One of the possibilities is to add a sub-population, if researchers have evidence of the existence and relevance. For example, in every society there can exist a subpopulation of individuals who will change their attitude towards petty corruption more slowly than it is foreseen in the model, and, if the subpopulation is deemed relevant, additional features can be involved in the model. Another possibility is to add age and gender to the model, in which case agents would have to age with time. In that case, it would be necessary to determine how age and gender reflect social changes, penalizing consequences, as well as receptiveness to the online campaign. It might turn out that age and gender are likely to be interesting factors in online campaigning, but that should be preceded by determining causalities from a larger research. The third possibility would be to quantify the effect of more socio-economic factors that influence both petty corruption and people's attitude, to add them to the model, and thus to explore the joint or inter-connected effect of all included factors.

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