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Agent-based Simulation of Socially-inspired Model of Resistance against Unpopular Norms

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Keywords: Agent-based Modeling and Simulation, Unpopular Norms, Emperors Dilemma, Norm Aversion.

Abstract: People lives in the society adhering to different norms. Some of these norms are unpopular. Sometimes, for the overall societal good, it is necessary to oppose and possibly avert unpopular norms. To achieve this goal, it is necessary to know the conditions, which enable persistence of the unpopular norms and models that support possible aversion of them. This study attempts to elaborate the conditions and reasons for the emergence, spreading and aversion of unpopular norms in society, using theory-driven agent-based simulation. The simulation results reveal that in addition to agents actively participating in averting the unpopular norm, incorporating a rational decision-making model in the population of agents is necessary to achieve a dominant norm aversion. The significance of these results concerning digital societies is enormous. In the new social landscape dominated by digital contents (particularly of social networking), it can be argued that careful amalgamation of social media contents can not only educate the people but also be useful in aversion of undesirable behavior, for example, retention and spreading of unpopular norms.

1 INTRODUCTION

Social norms (Manning, 2013) are concepts and practices prevalent in society. They play a vital role in development of social order (Ostrom, 2014). Norms can change, create and affect the behaviors and vice versa (Neighbors et al., 2015).

Social norms have a historical perspective, which evolves into traditions and standards to which a society can relate and act. An individual in a community is expected to behave according to the societal norms. However, the equation is not that simple. Even following a societal norm do not meant to accept it. There may be other conditions and incentives that force an individual to follow a social norm (Morrow, 2015).

Social norms can be unpopular; a situation in which majority of people do not agree. In fact, people personally do not conform to these so-called “unpopular norms”, but follow them and may be unintentionally enforce others to follow them. In sociology, such situations are dealt through a dilemma, named as **Emperors Dilemma** as given in (Nkomo, 1992). It relates to a tale in which everyone shows fake admiration for new gown worn by an emperor even though the emperor was naked. The cunning gown designers announced that the (non-existent) gown would not be visible to those who are not loyal to the emperor or who are dumb. The fear of being punished and identified as having inferior societal traits, no one spoke the truth. The truth that the emperor was in fact naked.

In many places around the world, manifestations of Emperors dilemma are evident. Whether it is foot-binding in neo-Confucian China or inter-cousin marriages and dowry in Asia (indicated by Blake in (Blake, 1994) and Hughes in (Hughes, 1978), respectively). People do not reveal what they believe due to the fear of being identified as ignorant or anti-social. However, there are evidences that a minority of activists can make a big difference if the environment is conducive as indicated by Khondker in (Khondker, 2011). Hence, the question *“Can a minority of activists change an unpopular norm adopted by the majority?”* becomes relevant.

Silently following an unpopular norm at an individual level is one thing. But, when a large population adopts it, following an unpopular norm becomes a kind of default behavior and influence the section of the population, which does not follow or remains neutral. As a consequence, it has been observed that people even start enforcing unpopular norm to which they personally disapprove. This behavior can be termed as **false enforcement**. (Merdes et al., 2017) have focused on discovering the reason of wrong enforce-

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ment. The authors opinion that people falsely enforce unpopular norms to create an illusion of sincerity rather than conviction. The study has been tested in two experiments of wine tasting and text evaluation. Both experiments reveal that people who enforced a norm, even against their actual belief, in fact, criticized deviants of the norm (the alternates of the unpopular norm). These outcomes indicate how social pressure can lead to false enforcement of an unpopular norm.

Essentially, norms propagation and transformation are co-relate to each other. Norms propagate through diffused influence. Since the subjects being influenced may have their perspective, they may decide to adhere or reject it. As a consequence, reciprocating influence of the subjects may transform the norm itself. Exploration of the scenarios of such nature (“being influenced and influencing reciprocally”) has been a subject of complex adaptive systems using agent-based modeling as given by Macy and Flache in (Macy and Flache, 2009; Macal and North, 2014). Understanding the emergence of norms in a society of agents is a challenge and an area of ongoing research (Vouros, 2015).

To avert unpopular norms, it is necessary to understand the conditions that help to stop propagation of these norms. Especially, it is imperative to find the conditions necessary to establish the **alternative norm** (a reciprocal norm of prevailing unpopular norm) and the conditions that enforce others (people other than activists) to follow the alternative norm. Towards this, the social interaction model of unpopular norm, proposed in (Centola et al., 2005) is customized and extended.

Studying norms in society has been one of the research focus of agent-based modeling community. A lot of theoretical work has been done, in which agents are supposed to comply with the social norms as given in (Conte and Castelfranchi, 2001) and (Meneguzzi et al., 2015). The fear of punishment from the society is evidenced as the predominant factor behind compliance of norms as presented in (Briggs and Cook, 1995). There are other examples, which focused on the emergence of the norms and described strategies that shows how norms prevail in any society explained in (Sanchez-Anguix et al., 2013) and (Sato, 2012), mainly governed by societal influence. Agents set their goals and frequently change their behavior based on societal influence (Vouros, 2015), until balanced. By contrast there is limited work on how unpopular norms can be averted. To the best our knowledge, we found not a single agent-based model on this topic except for our previous work (Zareen et al., 2016). In this paper, we propose a model of (unpopular) norm aversion. The agent-based model is simulated asking important “what-if” questions to elaborate the conditions and reasons for the emergence, spreading and aversion of unpopular norms. Such conditions can be analyzed and mapped onto the behavioral progressions of real people and patterns of their interactions to achieve improved societal traits especially using the new social landscape dominated by digital contents and social networking. Hence, it can argue that careful amalgamation of social media contents, can not only educate the people but also be useful in the aversion of undesirable behavior, such as retention and spreading of unpopular norms.

The rest of the paper is organized as follows. In section 2, the motivation of the proposed model is presented, followed by the proposed model. In Section 3, the simulation scenarios and analysis of simulation results is presented. The paper ends with conclusions of the study.

2 MODELS

2.1 Motivation

(Centola et al., 2005) state the Emperors Dilemma as: “Hans Christian Andersen tells the story of three rogues who sell a foolish monarch a nonexistent robe that they claim cannot be seen by those who are “unfit for office” or “incorrigibly stupid.” Fear of exposure leads the emperor, and in turn, each of the citizens, to express admiration for the new clothes, which then reinforces the illusion of widespread support for the norm. The spell is broken when a child, innocent of the norm, laughs at the naked old man.”

The authors consider two type of agents; True Believers (TB) are those agents who follow or comply with and enforce the unpopular norm, and Disbelievers (DB) are agents who do not genuinely believe in the sanctity of the norm. The *belief* of an agent corresponds to its true feeling about the unpopular norm; 1 for TB and -1 for DB. Based on their beliefs, agents adopt a two-state compliance behavior (to comply or not to comply). The initial value of *compliance* of the norm is also set to 1 for TB, and -1 for DB. The *strength* of an agent is directed by the relationship of belief and compliance; hence, its value is equal to 1 for TB and a low random floating point number (0:0 to 1:0) for DB. A complying agent can also enforce a norm. The *enforcement* is a by-product of agents interaction in their proximity and dependent on *enforcement need*.

Each agent’s decision to comply with the norm is given by a two-state value, which is dependent on the social pressure exerted by the neighbors and strength of its belief.

$$C_i = \begin{cases} -B_i \; if \; \frac{-B_i}{N_i} \sum_{j=1}^{N_i} E_j > S_i \\ B_i \qquad otherwise \end{cases} \tag{1}$$

In equation 1, C_i is compliance of agent i, assigned a two-state value either equal to the negation of its belief or equal to its belief as it is. The compliance is opposite of i's original belief (B_i) if aggregated enforcement (E) exerted by its neighbors (N_i for all j's from 1 to count of N_i) is more than its own strength (S_i). Otherwise, it does not change.

An agent's willingness to comply with the unpopular norm can lead to norm enforcement (E_i). Agent enforcement can be true enforcement or false enforcement, depending upon the situation.

$$E_i = \begin{cases} -B_i \;\; if \; (\frac{-B_i}{N_i} \sum_{j=1}^{N_i} E_j > (S_i + k)) \\ \qquad \bigwedge (B_i \neq C_i) \\ \\ +B_i \;\; if \; (S_i W_i > k) \bigwedge (Bi = Ci) \\ 0 \qquad otherwise \end{cases} \tag{2}$$

In equation 2, E_i is enforcement of agent i which is assigned a three-state value either equal to negation of its belief or opposite of it (the belief set through equation 1 above) or 0. The enforcement is negation of belief set through equation 1 if aggregated enforcement (E_i) exerted by its neighbors (N_i for all j's from 1 to count of N_i) is more than its strength (S_i) plus a constant k AND compliance and belief of the agent are opposite to each other. Otherwise, if compliance and belief of the agent are equal AND strength (S_i) of the agent weighted with enforcement need (W_i) is greater than constant k, the enforcement is equal to the belief. Otherwise, there is no enforcement. The factor need for enforcement (W_i) is amount of agent's neighbors whose behaviors does not match with agent's belief, calculated by equation 3.

$$Wi = \frac{1 - (\frac{Bi}{Ni}) \sum_{j=1}^{Ni} Cj}{2} \tag{3}$$

2.2 The Proposed Model

As it is showed in the model presented above that a TB is not a normal agent; i.e., it would never be affected by whats happening in its surroundings. Our model is based on reciprocity of this behavior. In the proposed model, a notion of an activist is introduced. An activist (ACT) is a DB who is ambitious and aims to avert the unpopular norm. Like TBs, these ACTs will never be affected by their surroundings. Hence, they act as reciprocating influence to TBs.

Algorithm 1. *Extended decision-making model of DBs*

```
for each DB which do not comply with unpopular norm do
  S ← set_of_neighbours
  N ← count(S)
  RLikes ← count(DB_l)/N {"l" is a DB which does not comply}
  RComp ← count(DB_c)/N {"c" is a DB which complies}
  RCompAll ← count(DB_ca)/N {"ca" is a DB which complies including activists}
  if (RLikes > 0.5&RComp > 0.25) then
    payoff ← 20
  else
    if (RLikes > 0.5&RComp <= 0.25) then
      payoff ← 40
    else
      if (RComp >= 0.5) then
        payoff ← 50
      else
        if (RCompAll > 0.5) then
          payoff ← 90
        else
          payoff ← 70
        end if
      end if
    end if
  end if
end for
end
```

Figure 1: Extended decision-making model of DBs.

The ACTs role will be triggered by the presence of TBs in the surroundings, especially who are enforcing. An activist would change its belief from -1 to 1 after encountered by the enforcement of norms from its neighborhood. This is accomplished by the progressive increment of the value of S_i by a constant k. If this value reaches to 1 or greater, the belief of the agent is changed from -1 to 1, which means that now the agent believes in the aversion of the unpopular norm and acts to avert it.

In our recent work (Zareen et al., 2016), it is evidenced that high density conditions of agent population with a high percentage of norm aversion activists, the aversion of unpopular norms can be achieved. In this paper, the model is further extended to incorporate the decision-making of a DB because of neighborhood condition. It is proposed that DBs (who are not ACTs) should not be considered as entirely a numb entity. We propose a probabilistic decision-making model. Figure 1 outlines the algorithm of the proposed model.

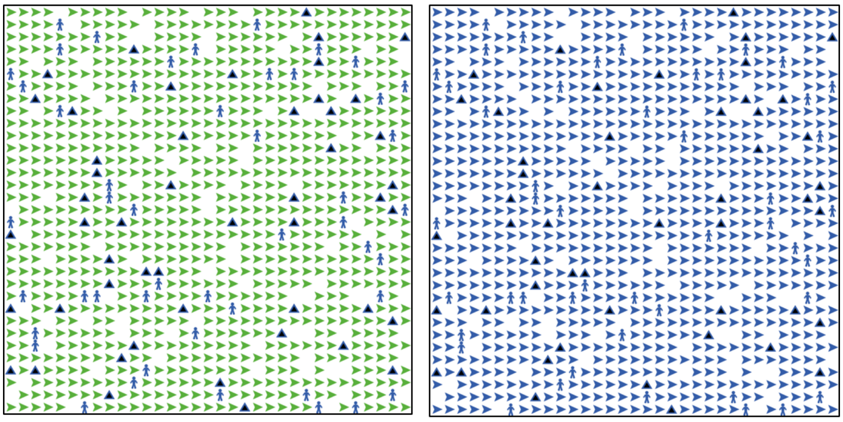

Figure 2: NetLogo Simulation. (a) Setup of 1000 agents with 5% TBs and 5% ACTs. Agents represented as filled blue triangles are TBs, whereas agents represented as blue persons are ACTs. The rest are DBs (in green). (b) Application of model Centola proposed (Centola et al., 2005). The situation after equilibrium with respects to state changes is achieved. All DBs comply with the unpopular norm B against their belief.

2.3 The Model Extension

Model is invoked by all the DBs which are not complying with the unpopular norm. These are the DBs which do not comply with the "unpopular norm", but still follow it (due to influence of the neighborhood). These are the DBs which are mere *followers* and in such a cognitive state which can be termed as "unsure". It is assumed that these *followers* would be affected by influence of the surrounding. If *N* is count of all the neighbors, *RLikes* represents the ratio of neighboring DBs which are of same kind. *RComp* is the ratio of neighboring DBs which comply to unpopular norm. Whereas, *RCompAll* is the ratio of neighboring DBs which comply to unpopular norm including ACTs. Hence, *RCompAll* also includes influence of ACTs in the surrounding. The attribute *payoff* is a calculated probabilistic factor which would avert a *follower* so that it starts complying to the "alternate norm". The following are the rules of change:

- **R1:** If majority of agents in the neighborhood of a follower are also followers, and also there is a significant number of complying DBs, the value of payoff is 20%. The incentive to deviate in this case is quite low as majority is either followers or DBs which comply to the unpopular norm.
- **R2:** If majority of agents in the neighborhood of a follower are also followers, and there is not a significant number of complying DBs, the value of payoff is 40%. The incentive to deviate in this case is a little bit high because there are not many complying DBs in the neighborhood.
- **R3:** If majority of agents in the neighborhood of a follower are not followers but complying DBs, the value of payoff is 50%. The incentive to deviate in this case is purely random.
- **R4:** If majority of agents in the neighborhood of a follower are not followers and complying DBs, then there must be significant number of ACTs in the neighborhood. Hence, the payoff increases; more in case of more ACTs (90%), and less in case of less ACTs (70%).

3 SIMULATIONS AND RESULTS

3.1 Results

The simulation is performed in Netlogo (Wilensky and Rand, 2015), a popular agent-based simulation tool with grid space support. The agents reside on cells of a spatial grid. We have used Moores neighbourhood to represent the surrounding of an agent which has been a popular strategy in many cell-based spatial configurations (Weidmann et al., 2014). The simulation space consist of a torus of 33×33 cells. 1000 agents are placed on cells without overlapping. Figure 2 (a) illustrates simulation setup. The simulation results are analyzed based on four quantities:

- **DBComplBCount**: The count of disbelievers which comply with the unpopular norm B against their belief.
- **DBFollBCount**: The count of disbelievers which do not comply with the unpopular norm B, but fol-

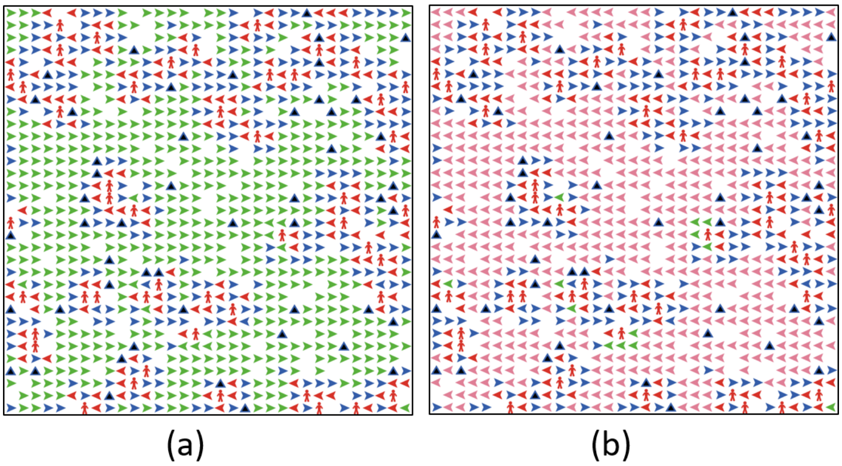

Figure 3: NetLogo Simulation. (a) Setup of 1000 agents with 5% TBs and 5% ACTs. Agents represented as filled blue triangles are TBs, whereas agents represented as blue persons are ACTs. The rest are DBs. Application of model Zareen proposed (Zareen et al., 2016). The situation after equilibrium with respects to state changes is achieved. DBs in the neighborhood of ACTs start following (blue) and complying (red) norm A against their belief. (b) Application of proposed model extension. The situation after equilibrium with respects to state changes is achieved. In addition to DBs in the neighborhood of ACTs start following (blue) and complying (red) norm A against their belief, most DBs start complying norm A with a belief in it (represented in pink color).

low it against their belief.

- **DBComplACount**: The count of disbelievers which comply with the alternate norm A, but still do not believe in it.
- **DBBelACount**: The count of disbelievers which comply with the alternate norm A, and believe in it.

The purpose and intention of the proposed model is to reduce the value of **DBFollBCount**, because these agents are unsure and their belief can potentially be averted. The possible aversion may transform agents from following status to those which are complying with the alternate norm (**DBComplACount**). The model Centola proposed (Centola et al., 2005) only formulates the spread of unpopular norm. The results of application of the model settles in an equilibrium after 5^{th} iteration. The graph corresponding to visualization of Figure 2 (b) is shown in Figure 4 (a). It is evident from the graph that all DBs after started following the unpopular norm, quickly, start complying it.

After all DBs start complying with norm B, a change in strategy is tested. The ACTs start playing their role as proposed in (Zareen et al., 2016). The results of application of the model settles in an equilibrium after $10-12^{th}$ iteration. The graph corresponding to visualization of Figure 3 (a) is shown in Figure 4 (b). It is evident from the graph that DBs start complying with alternate norm A under the influence of ACTs. The number of DBs which are merely following again goes up in the start but it does not drop to 0, after transforming to compliance state. The DBs following and complying to norm B stabilizes with followers more than agents which are complying. As shown in Figure 3 (a), DBs in the neighborhood of ACTs start following and complying norm A, against their belief.

The proposed model extension again achieve an equilibrium. The graph corresponding to visualization of Figure 3 (b) is shown in Figure 5 (a). It is evident from the graph that DBs start complying with alternate norm A under the influence of ACTs. However, a large majority of DBs start complying norm A with a belief in it. And number of DBs following norm B reduces to almost nothing.

Finally, we have compared the above situation with a situation in which there are more TBs and more ACTs than before. By comparing the two graphs (Figure 5 (a) to (b)) it is evidenced that the pattern and rate of state changes is similar, but, aggregate number of DBs in state DBBelACount and DBFollBCount has decreased substantially when compared with aggregate count of DBComplACount and DBComplBCount. It means the DBs which believed in norm A has decreased to almost half as the number of TBs and ACTs is doubled.

3.2 Discussion

The main idea is to reduce the disbelievers complying with unpopular norm B. This is achieved by simulat-

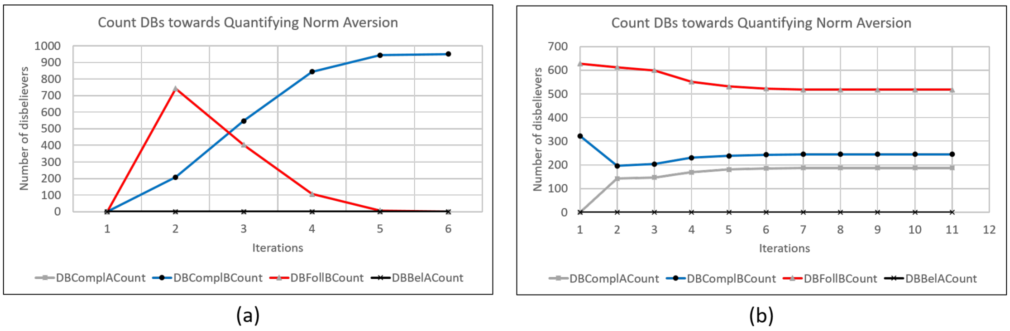

Figure 4: Graphs of Number of DBs in different states vs. Simulation Time. (a) Results of model Centola proposed (Centola et al., 2005). (b) Results of model proposed in (Zareen et al., 2016).

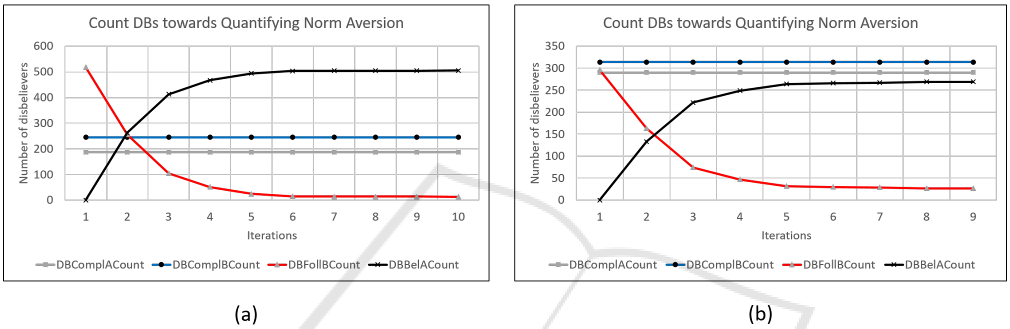

Figure 5: Graphs of Number of DBs in different states vs. Simulation Time. (a) Results of proposed model extension with 5% TBs and 5% ACTs. (b) Results of proposed model extension with 10% TBs and 10% ACTs.

ing model proposed from 95% agents to almost 25% agents. However, 50% agents still follow norm B, and the only 20% start complying with alternate norm A. These results are evident from graphs in Figure 4. The credit goes to introduction of ACTs in the population of agents.

The introduction of rational-decision making while making a choice to follow / comply / believe in unpopular norm (as proposed in this paper) significantly improves the results. While the disbelievers complying with unpopular norm does not change much, but, the majority of disbelievers start believing in alternate norm instead of following unpopular norm. This is evident when graphs of Figures 4 (b) and 5 (a) are compared with each other. Hence rational thought process changes even the beliefs of majority of the agents. Increasing the percentage of TBs and ACTs in the population also significantly change the situation when applied in conjunction with rational thought process.

4 CONCLUSION

In this work, it is argued that for societal good, it is necessary to oppose and possibly avert the unpopular norms. Hence, an attempt is made to realize the conditions that result in emergence of unpopular norms and define situations under which these norms can be changed and averted.

In this paper, an agent-based simulation model of unpopular norm aversion is presented. The reciprocal nature of persistence and aversion of norms is utilized to define situations under which these norms can be changed and averted. The simulation results revealed that, in addition to agents actively participating in averting the unpopular norm, incorporating a rational decision making model for normal agents is necessary to achieve a dominant norm aversion. It was also evidenced that the percentage of true believers and activist play a significant role in norm aversion dynamics. Overall, the simulation results reveal that more educated and socially active individuals are the key to reduce undesirable norms in a society. The significance of this fact is also applicable to digital societies primarily created by social networks now-a-days.

REFERENCES

Blake, C. F. (1994). Foot-binding in neo-confucian china and the appropriation of female labor. *Signs: Journal of Women in Culture and Society*, 19(3):676–712.

Briggs, W. and Cook, D. (1995). Flexible social laws. In *International Joint Conference on Artificial Intelligence*, volume 14, pages 688–693. LAWRENCE ERLBAUM ASSOCIATES LTD.

Centola, D., Willer, R., and Macy, M. (2005). The emperors dilemma: A computational model of self-enforcing norms. *American Journal of Sociology*, 110(4):1009–1040.

Conte, R. and Castelfranchi, C. (2001). Are incentives good enough to achieve (info) social order? In *Social Order in Multiagent Systems*, pages 45–61. Springer.

Hughes, D. O. (1978). From brideprice to dowry in mediterranean europe. *Journal of family history*, 3(3):262–296.

Khondker, H. H. (2011). Role of the new media in the arab spring. *Globalizations*, 8(5):675–679.

Macal, C. and North, M. (2014). Introductory tutorial: Agent-based modeling and simulation. In *Proceedings of the 2014 Winter Simulation Conference*, pages 6–20. IEEE Press.

Macy, M. and Flache, A. (2009). Social dynamics from the bottom up: Agent-based models of social interaction. *The Oxford handbook of analytical sociology*, pages 245–268.

Manning, P. (2013). *Erving Goffman and modern sociology*. John Wiley & Sons.

Meneguzzi, F., Rodrigues, O., Oren, N., Vasconcelos, W. W., and Luck, M. (2015). Bdi reasoning with normative considerations. *Engineering Applications of Artificial Intelligence*, 43:127–146.

Merdes, C. et al. (2017). Growing unpopular norms. *Journal of Artificial Societies and Social Simulation*, 20(3):1–5.

Morrow, P. (2015). The thesis of norm transformation in the theory of mass atrocity. *Genocide Studies and Prevention: An International Journal*, 9(1):8.

Neighbors, C., Young, C., DiBello, A., Rinker, D., Rodriguez, L., Knee, C., and Lewis, M. (2015). Injunctive norms, deviance regulation, and social norms interventions. *Alcoholism: Clinical & Experimental Research*, 39:292A.

Nkomo, S. M. (1992). The emperor has no clothes: Rewriting race in organizations. *Academy of Management Review*, 17(3):487–513.

Ostrom, E. (2014). Collective action and the evolution of social norms. *Journal of Natural Resources Policy Research*, 6(4):235–252.

Sanchez-Anguix, V., Julian, V., Botti, V., and García-Fornes, A. (2013). Tasks for agent-based negotiation teams: Analysis, review, and challenges. *Engineering Applications of Artificial Intelligence*, 26(10):2480–2494.

Sato, T. (2012). Effect of interaction between rules on rule dynamics in a multi-group minority game. *Artificial Life and Robotics*, 16(4):493–496.

Vouros, G. A. (2015). The emergence of norms via contextual agreements in open societies. In *Advances in Social Computing and Multiagent Systems*, pages 185–201. Springer.

Weidmann, U., Kirsch, U., and Schreckenberg, M. (2014). *Pedestrian and Evacuation Dynamics 2012*. Springer Science & Business.

Wilensky, U. and Rand, W. (2015). *An introduction to agent-based modeling: modeling natural, social, and engineered complex systems with NetLogo*. MIT Press.

Zareen, Z., Zafar, M., and Zia, K. (2016). Conditions facilitating the aversion of unpopular norms: An agent-based simulation study. *International Journal of Advanced Computer Science and Applications*, 7(7):499–505.

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