Social Science Diliman (July-December 2013) 9:2; 73-95

Can Complaining Modify a Smoking Environment: A Study on the Effects of Complaining on Smoking Behavior in Different Bars Using Agent-Based Model Implementation

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ABSTRACT

In spite of the smoking ban that has been implemented in several European Union countries such as Portugal, Italy, Austria, Germany, and France, the Dutch have been reluctant to implement a total smoking ban in bars. The smoking ban is widely believed to reduce nicotine levels inhaled by bar workers and customers, reduce air pollution, indirectly help potential quitters move towards having a healthy lifestyle, and protect the public from potential health risks. Further, restrictions to smoking have led to a reduction in the number of individuals who smoke, provided smoke-free environments, and decreased the exposure of children and youth to advertisements encouraging smoking behavior. Although the potential benefits of the smoking ban have been established, some bar owners in The Netherlands are reluctant to follow the implementation of the ban. Reasons mentioned by bar owners for noncompliance include minimal sanctions, competitors that allowed smoking in their bar, and delayed enforcement. Reasons to comply include: if the cost for compliance were minimal, if competitors were complying, and if the implementation of law were consistent and coordinated. In this study we simulated the behavior of smoking and nonsmoking individuals with different addiction, annoyance, and intolerance levels. Using agent-based modelling our agents were initialized with these attributes either as 1 or 2 wherein 1 represented a low level and 2 a high level. In our model we simulated how a complaining behavior can enforce a social norm, such as "no smoking is allowed." We focused on how complaining elicits obedience to accepted norms on the basis that complaining promotes normative obedience and discourages misconduct about noncompliance of smoking individuals. Secondary to this goal is the expectation that because smoking is banned in bars but may be allowed in some other bars, a segregation of groups may emerge as a

ISSN 1655-1524 Print / ISSN 2012-0796 Online

consequence of sanctioning an illegal behavior in some bars but accepting it in other bars.

Keywords: Bars, complaining, emergent, nonsmoking, smoke, smoking, social norms, agent-based modelling, smoking ban

THE IMPORTANCE OF TOBACCO RESTRICTIONS

Smoking restrictions are an important component of tobacco control policy because they protect nonsmokers from the adverse effects of passive smoking, help smokers in their decision to quit smoking, and provide a clean air working environment (Bero, Montini, Bryan-Jones, & Mangurian, 2001). In practice, the effect of smoking behavior does not only harm the health of individuals exposed to it but even those who passively inhale the smoke in a social setting whether at home, in the workplace, or even in public transport. For instance, environmental tobacco smoke exposure is a cause of lung cancer among adults (Hackshaw, Law, & Wald, 1997). The costs of smoking per year can come in the form of diseases that are directly and indirectly related to smoking like lung cancer, asthma, allergies, emphysema, and cardiovascular diseases (Nebot et al., 2005). In addition, smoking is an important risk factor for chronic obstructive pulmonary disease (COPD), a worldwide disease which is an important cause of morbidity, mortality, and medical costs worldwide (Mannino & Buist, 2007).

Policies banning public smoking reduce the exposure of individuals to secondhand smoke which are associated with reduced daily consumption of cigarettes and more frequent attempts to quit smoking (Linnan, Weiner, Bowling, & Bunger, 2010). Albers, Siegel, Cheng, Biener, and Rigotti (2007), in their study on the effect of smoking regulations on the antismoking and quitting behaviors of smokers, found that bans promote and facilitate quitting among adult smokers. Most countries have smoking bans in the workplace as well as in public places, but there is a large divergence in terms of policy implementation in the hospitality sector.

For example, the case of Italy is notable: A smoking ban was enforced in 2005 in bars and restaurants that allowed smoking under several conditions. In practice, only 1% of these venues has allowed smoking since the law came into force (Gorini, Chellini, & Galeone, 2007). A study by Montini & Bero (2008) on the conditions that facilitate compliance of bar owners to smoking bans in bars showed that bar owners comply if the cost for compliance was minimal, if competitors comply, and if there is a uniform and coordinated enforcement of the smoking ban. At present, smoking control policies have represented a major step forward in protecting

nonsmokers from secondhand smoke, thus producing a substantial gain for public health (Nebot et al., 2009). In conjunction with this growing implementation of smoking bans in various places and social functions, a growing sentiment toward smoking bans in bars and restaurants is being widely adopted in various countries (Danishevski, Gilmore, & McKee, 2008).

SOCIAL NORMS AND THEIR ROLE IN MODIFYING HUMAN BEHAVIOR

Robert Axelrod (1986) in his influential work, *An Evolutionary Approach to Norms*, wrote that punishment is a key mechanism to achieve the necessary social control and to enforce social norms in a self-regulated society. Andrighetto & Villatoro (2011), in their theoretical and simulation study on the comparative effects of punishment and sanctions on cooperation, found that sanction is more effective in generating compliance than mere punishment. Complaining is part of sanctioning behavior because by voicing out your complaints to the aggressor or violator you undermine his/her behavior and send signals that he/she violated an accepted norm. Further, Axelrod (1986) mentioned examples of how prevailing norms shape society. For instance, in the past, duelling was an acceptable behavior among the gentry to settle insults or disgrace.

The repression of smoking habits is one of those social norms that is being recognized by enforcing no-smoking policies in bars and restaurants. In recent years the enactment of this ban was intended mainly to shield people from environmental tobacco smoke (ETS) and to protect people from secondhand smoke.

COMPLAINING BEHAVIOR AS A FUNCTION OF INTOLERANCE OR DISSATISFACTION LEVEL

Complaining behavior is mainly governed by an intolerance or dissatisfaction level which is pre-existing among individuals as their attitude towards a given situation (Kowalski, 1996, 2002). This intolerance or dissatisfaction can be heard of as frustration towards, for example, the weather (e.g., "It is snowing again," "I hate rainy evenings") or products (e.g., "I hate ice cream"). As stated above, complaining is a pervasive phenomenon that we rarely try to examine.

It happens on a daily basis as companies, service organizations, as well as individuals log in millions of complaints as people vent off their frustrations and dissatisfactions on products and services. The online version of Merriam-Webster defines complaining as: a) to express grief, pain, or discontent, and b) to make formal charge or accusation. According to Kowalski (2002), when this pain or discontent is released by the individual through his/her complaints, he/she feels satisfied, listened to, or

heard. Although dissatisfaction level and complaining are related, the threshold of these two emotions may differ and factors that affect them could be different or similar. In the case of dissatisfaction, a person could be dissatisfied of a product or situation and as a result voice his/her complaints.

The mechanism of complaining is more often perceived as caused by the individual's comparison of his/her current state or situation with his/her expected standard (Carver & Scheier, 1981; Ingram, Cruet, Johnson, & Wisnicki, 1988; Pyszczynski, Hamilton, Greenberg, & Becker, 1991). Whenever this standard is surpassed or violated, the individual would be happier or grumpier.

In addition to perceived benefits of complaining among relationships, a study in the United States confirmed that only 30% of people voice their complaints on product and service failures, making complaints an integral part of product modification or acceptance (TARP, 1986). This low percentage of complaint turnout makes complaining a vital process among companies to make them aware of the flaws of their products or services. Thus, market information from complaints can help in product development, tactical decisions, and prevent customers from switching to other brands (Nyer, 1999, 2000).

Complaining can be therefore viewed as a behavioral reaction to a situation that affects one's level of dissatisfaction or intolerance. As shown in the cases mentioned above, the same can be said with addiction to nicotine. Once individuals develop a nicotine addiction, the frequency of their smoking habit can be dictated by this addiction level. In a group setting such as a bar, both complaining and smoking are dictated by the atmosphere of the bar. In a predominantly nonsmoking bar, we would expect that when somebody starts smoking, nonsmokers will immediately sanction or reprimand that individual in order to discourage such habit from dominating their environment.

In contrast, we would expect that in a predominantly smoking bar, complainers or nonsmokers, especially those with high intolerance level for smoke, would simply leave the bar unless their cases could be heard and the smokers would cease smoking. In both cases, group dynamics plays an important role in determining which habit will be expressed in the environment.

DESCRIPTION AND HYPOTHESES OF THE STUDY

In this study, we investigated the effect of complaining on smoking behavior and how the interaction between people with different addiction, annoyance, and

intolerance levels in the same bar could modify their behavior. We hypothesized that smoking behavior would have a great disincentive and would be stigmatized in a bar with predominantly nonsmoking people. In association with this, we also hypothesized that an emergent property of the model would be a segregation between smokers and nonsmokers. This will be representative of how social norms, beliefs, acceptable behaviors, or social habits in one segment of the population are accepted by a community and how in another community such behaviors are ridiculed or considered taboo. Furthermore, this will allow us to test ideas on effects of policies that are accepted by communities, how they become accepted as social norms, become reinforced through time, and become established social habits of the community among a segment of the population.

RESEARCH GOALS

The purpose of this project in relation to the problem:

How would people behave when reprimanded and how does it influence their smoking behavior in bars?

The purpose of this project in relation to the research:

Simulate people's behavior regarding complaining and smoking in bars.

Research Question

Overarching question: What is the role of complaining in modifying a smoking environment?

Q1. What is the effect of complaining on smoking behavior in bars?

Q2. How does the number of people with different smoking habits (smoking/nonsmoking) affect the behavior of smoking in a bar?

Q3. Does segregation occur as a result of people's behavior in relation to complaining and smoking?

METHOD

In our work we used agent-based modelling (ABM) to simulate and study the behavior and interaction of a system in which people in bars have different preferences with regard to smoking. This method uses agents that are assigned attributes and tasks

to perform, e.g., simulate interactions between different people. ABM has been used in social, environmental, and consumer behavior studies (Deffuant, Amblard, Weisbuch, & Faure, 2002; Grimm & Railsback, 2005; Izquierdo & Izquierdo, 2006) in which it gave a useful insight into the behavior of the system.

ABM allows for the study of heterogeneous systems and their emergent properties, e.g., behavior of individuals and their interactions (Bonabeau, 2002; Parker & Meretsky, 2004), in which a system is simplified to give an improved understanding of a real-world phenomenon (Holling, 1994). This makes ABM a useful tool for studying the smoking behavior of people and their conduct as applied in this research. Moreover, this method allows for a direct visualization of the results of a simulation, making it easier to understand the output of the model and more accessible to those who do not have any, or only partly have knowledge of the system being modelled.

We applied ABM using the NetLogo platform version 5.0.3 as it is practical to use because of its coding language and integrated experimentation software. Using ABM we simulated a system in which different smoking preferences prevail and how one behavior such as complaining could have an impact on the other behavior such as smoking.

By simulating these two behaviors using ABM, we aimed to study the effects of the interaction of these two behaviors in bars. Our model assumed the existence of smoking and nonsmoking bars resulting from the two divergent behaviors of the agents in the model.

The focus was on the effect of complaining and how this modulates or affects smoking behavior in bars. For instance, in a predominantly nonsmoking bar, smokers present may not be aware of the social unacceptability of such behavior in that situation, while in a predominantly smoking bar, complaining may or may not be utilized at all by nonsmokers to achieve their goal of getting smokers to stop their smoking and consider their pleas.

Model Description

This model simulates the interaction between smokers and nonsmokers in a bar and how complaining by nonsmokers could affect the response of smokers who are smoking. An environment is created with four bars at the start of the simulation representing a social setting. In this virtual world, there are people who smoke and people who do not smoke; they are referred to as smokers and nonsmokers for the purpose of this model.

The smokers' interaction with the nonsmokers is represented by the attributes of addiction level that reflect their preference to smoke, as well as their annoyance level that will influence how they will respond to the complaints of nonsmokers. Both addiction and annoyance levels are initially loaded during the simulation as either low or high represented by 1 or 2 in their attributes and randomly distributed.

This range of addiction and annoyance level reflects the normal distribution of human behavioral properties which could either be high or low in a set of population. The nonsmokers are assigned an intolerance level that influences the urge to complain to a smoking smoker; it resembles how well someone is able to tolerate the smoke, with 1 representing a low level and 2 representing a high level of intolerance. When the simulation starts, all the people of the virtual world will go out for the evening to meet each other and socialize, leaving their houses and seeking out the nearby bars in their town to have a good time.

Upon arrival in a bar, the people will start to socialize with each other. When a smoker enters a bar, he or she either lights up a cigarette and starts smoking immediately or waits until he or she sees other people who start to smoke. The urge to smoke is determined by the personal addiction level of the smoker. Depending on this level the smoker can decide to smoke out of his or her own initiative, or he or she might also start to smoke as a response to other smokers already smoking in the vicinity.

When a smoker starts to smoke, a nonsmoker in the vicinity might decide to lodge a complaint asking the smoker to stop smoking; the nonsmokers' intolerance level will modify this chance. The complaining nonsmoker will wait for the smoking smoker's response after lodging a complaint and see whether it is accepted or ignored. When complaints are successful, the nonsmokers will stay or, when complaining is a failure—as when complaints are either ignored or impossible (e.g., too many smoking smokers)—the nonsmoker may decide not to complain and leave because that situation does not permit complaining.

On the other hand, the smoker has two ways to respond to the complaints of the nonsmokers: he/she can stop smoking, in which case he/she might also decide to leave because the fun is spoiled for him/her, or ignore the complaint. This chance to either ignore the complaint or leave is modified by the annoyance level of the smoker (see conceptual diagram in Fig. 1).

Coding concept and conceptual diagram. In order to let the system that is created with the model behave in a plausible way, a logical flow of the model is depicted in a flowchart. In the flowchart in Fig. 1 all the steps are arranged in a chronological

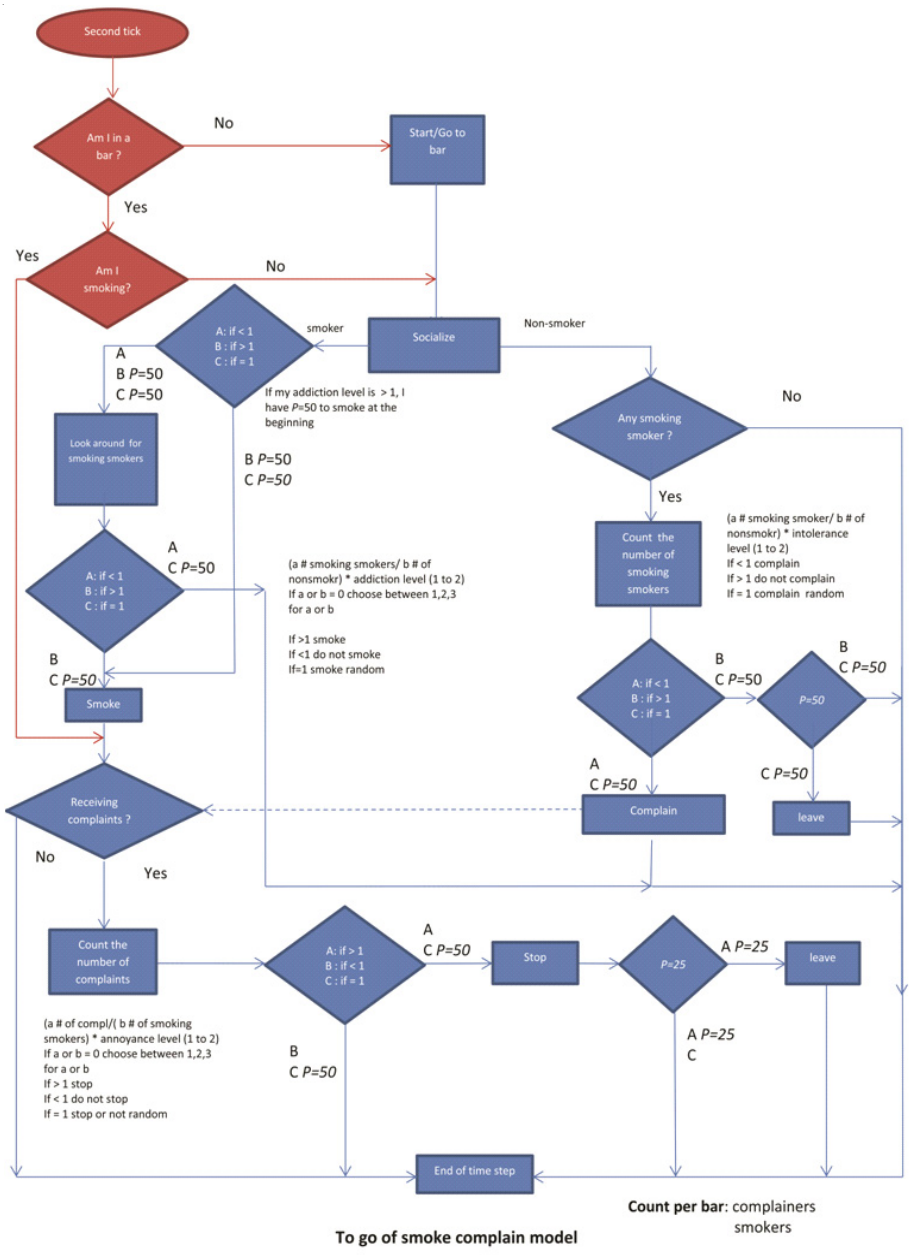

Figure 1. Conceptual flow of the smoke-complain model

order and are connected by arrows to depict the flow of the system. Junction points at which decisions must be made about which path and steps should be taken are depicted with their conditions and resulting actions as formulas or simple yes or no pathways. For our model we made use of both formulas and simple yes or no pathways; the simple pathways are self-evident and do not require any explanation.

The formulas are based on the principle that first the number of agents that meet certain conditions, e.g., smoking smokers, are counted and divided by the number of other agents, e.g., nonsmokers. In the second step, the outcome of this calculation is then multiplied with an agent's own value, e.g., addiction level, annoyance level, and intolerance level. The final result is then compared with a set of conditions resulting in a predefined action, e.g., stop smoking, leave, or complain. In this way each agent will make its own decision reflecting the heterogeneity among people that is also present in real life.

Parameter description. In the simulation, the agents in this model represent people who are able to "see" their environment and react to these observations based on how they are programmed to respond. Table 1 gives an overview of how the agents can perceive their environment, which actions they can take as a result of an

Table 1. Agent Perception and Action

Perception	See bars See other people and their behavior (smoking and complaining)	
Performance	Motion:	
		Agents can move to a random bar or leave a bar Agents can change their status (color, smoke and complain) depending on their actions and observations
	Communication:	
	Send:	Agents can send out their smoking behavior (smoking) Agents can respond to other agents' smoking behavior (complaining)
	Receive:	Agents can receive signals of other agents who smoke Agents can receive signals of complaints by other agents Agents can receive position information
	Action:	Visit bars (enter bar) Socialize (stay in bar) Self starts smoking (smoke based on agent's preference) Observe surroundings Smoke and stop smoking (based on surroundings) Complain and stop complaining Move out of bar (leave bar)
Memory	In the current version of the model, agents do not have a memory	
Policy	Determine behavior	
Model Output	Mean number of complaining nonsmokers and smokers in total and per bar and visualisation per bar of population (composition smokers/nonsmokers)	

observation, and how they are to interact with each other to create their overall behavior

Procedures. The main goal of the model is to simulate the interaction between smokers and nonsmokers in such a way that it results in a behavior in which a system is created that is representative of the real situation from which meaningful observations can be derived.

In order to do this, the agents in the model representing the real people are made to interact with each other by making them "aware" of their surroundings and other agents by the use of procedures, a set of conditions and commands that should be executed (if certain conditions are met). For simulating the behavior and interaction between smokers and nonsmokers the procedures as listed in Table 2 were used.

RESULTS

With the smoke-complain model that was built, several simulations were run in order to answer the central research question and its subquestions. The results of these simulations were the output of our model represented both in numbers and visual images. Figure 2 shows the results of the simulation run with an equal number of smokers and nonsmokers and with smoke and complain times both set at two ticks.

It can be clearly observed in Figure 2 that a segregation occurred between the nonsmokers and smokers after about 100 ticks, effectively creating several smoking bars and only one nonsmoking bar in which a few smokers can be found surrounded by non-smokers complaining about the smokers smoking in "their" bar and wanting them to leave or stop smoking.

In order to study the influence of the ratio between people with different smoking habits (smoking/nonsmoking) on the behavior of smoking in a bar, several simulations were run. In these simulations the number of smokers and nonsmokers were varied for each run to study the effect of a different ratio on the population in the bar and the behavior of the system. First, we increased the number of smokers in each run while keeping the nonsmokers at 25 to see if the segregation effect would be amplified. At around 36 to 37 smokers, segregation was observed as shown in Figure 3 that was strong enough to turn all the four bars into smoking bars; the smoking time and complain time were both kept at 2 ticks.

When the simulation was run with more smokers than nonsmokers (up to 37 smokers compared with 25 nonsmokers), an absolute segregation already occurred at around

Table 2. Description of Procedures and Their Functions

Procedure	Description	Actions
Set up	Create the simulation world, four bars and smokers and nonsmokers	Bar patches and turtles are created with their programmed values
Visit bars	Let the agents visit the four bars	All turtles move to one of the four bar patches if they are not in a bar patch
Socialize	Let the agents stay in the bar for interaction until bar clock is reached	All turtles will, if they do not decide to leave, stay in their bar for a certain duration
Self starts smoking	Smoker agents might smoke based on their addiction level	Smokers who decide to smoke will set their smoking to true and color to red; if smoking time is reached, it sets smoking to false and color to blue
Surrounding-smoking	Smoker agents might smoke based on their environment and addiction level	Smokers who decide to smoke will set their smoking to true and color level to red; if smoking time is reached, it sets smoking to false and color to blue
Look around nonsmokers	Nonsmoker agents will look for smoking smoker agents	If smoking smoker agent present, nonsmoker executes complain procedure
Complain	Nonsmoker agent might start to complain based on his or her surroundings and intolerance level	If nonsmoker complains, set its complaining to true and color to yellow; if not, complaining nonsmoker then might move out of bar; if complain time is reached, set complaining to false and color to white
Leave bar	Smokers based on their surroundings and annoyance level might stop smoking and stay, or stop smoking and leave, or ignore complaints of nonsmokers	If smoker stops smoking set its smoking to false and color to blue; if it decides to leave, let it move out of the bar

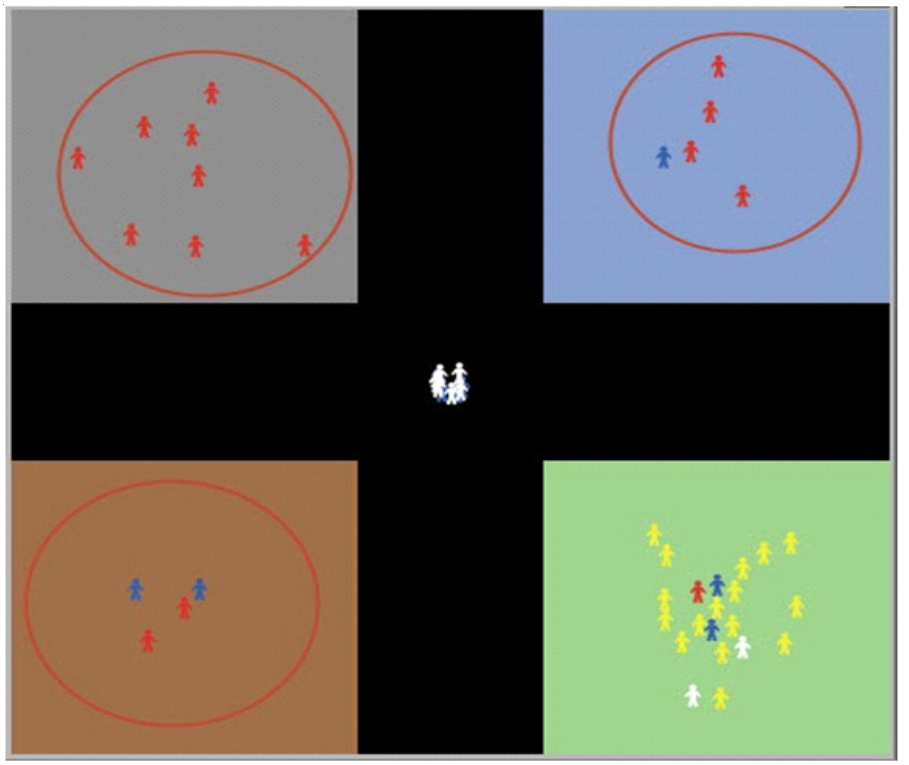

Figure 2. Bar segregation between a predominantly nonsmoking bar (quadrant with predominantly white and yellow people) and a predominantly smoking bar (quadrants with red and blue people) as seen in the simulation run with 25 smokers and 25 nonsmokers.

25 ticks. This caused almost all the nonsmokers to leave the bars and stand outside on the street patches (black area). In this situation, the smokers clearly dominated and were in "total control" of all the four bars, effectively evicting all nonsmokers from "their" bars.

After the results of absolute segregation were obtained by only changing the number of smokers and keeping the number of nonsmokers constant, the influence of varying the number of nonsmokers was studied. For this purpose the number of smokers was kept constant and the number of nonsmokers was increased for each simulation run. When the simulation was run with 25 smokers and twice as many nonsmokers, still no segregation effect occurred and the smokers still dominated.

Only after reducing the number of smokers to 15 and keeping the nonsmokers at 50 as shown in Figure 4 were we able to obtain a kind of situation in which the smokers were "less dominating" compared to the nonsmokers.

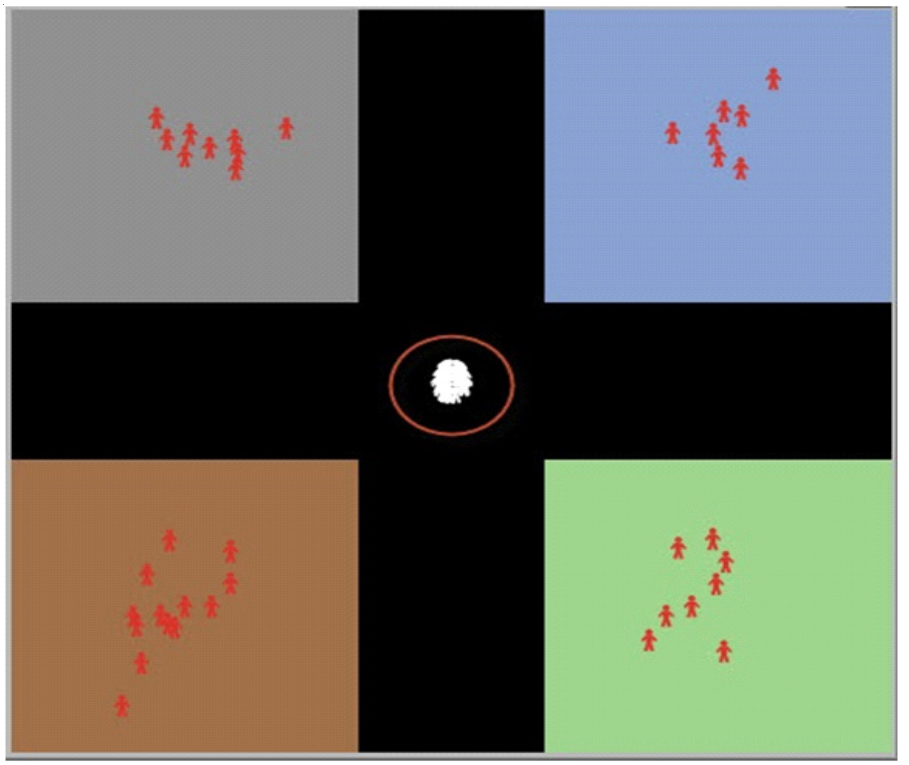

Figure 3. High level of segregation between smokers (quadrants with red people) and nonsmokers (black space with white people). Simulation run with 37 smokers and 25 nonsmokers with nonsmokers ending up on the street.

By reducing the number of smokers to 15 and putting the nonsmoker population at the maximum of 50, true nonsmoker bars were created after 35 ticks in which the smokers ended up more in the streets than the nonsmokers. Also, it can be observed that all the nonsmokers were complaining to smoking smokers in "their" bar causing the latter to leave or stop smoking.

To investigate the influence of the different model parameters on the actual outcome of the model, a sensitivity analysis was carried out in which each parameter was tested separately by changing the parameter under study and keeping all the other parameters at a constant value.

For this purpose we used the behavior space application of Net Logo in which we could simultaneously perform several simulation runs using different parameters to investigate their effect on the results that were obtained from the model. (Net Logo is outfitted with the built-in tool *behavior space* that allows the user to run

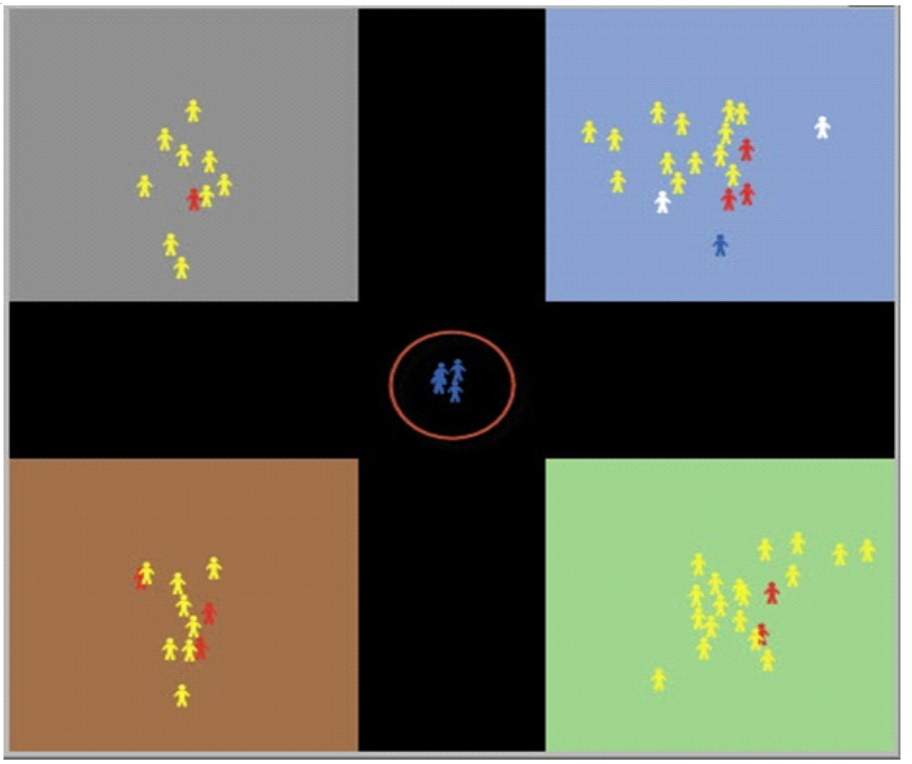

Figure 4. High-level separation between nonsmokers and smokers, with most smokers ending up in the street (black space) was observed in the simulation run with 15 smokers and 50 nonsmokers creating four nonsmoking bars (see four quadrants).

several model simulations in one sequence for the purpose of model analysis. With behavior space, several experiments can be created by varying a model's parameter value for a single parameter; multiple parameters can also be studied using this tool. Moreover, it is possible to define the condition(s) when a simulation run should be stopped to allow for an easy replication of experiments. The results of each experiment can be stored as an output file in Excel for further data analysis.)

Table 3 shows the results of varying the smoke time and complain time and keeping all the other parameters constant, having 25 smokers and 25 nonsmokers, and running the simulation for 500 ticks 25 times. On the left side of the table, *variable* shows the parameter that was tested and its value — smoke time for segment A and complain time for segment B. *Final* shows the average value that was reported at the end for all simulations and the mean value of all the runs. The other columns show the total mean count for all the bars and next to this, the final and mean for

Table 3. Results of Sensitivity Analysis of Varying Smoke Time and Complain Time

A		SUM		BAR 1		BAR 2		BAR 3		BAR 4	
Variable		smoking	complaining	smoking	complaining	smoking	complaining	smoking	complaining	smoking	complaining
Smoking	final	12	18	3	5	3	6	3	4	3	3
Time 1	Mean	12	17	3	5	3	5	3	4	3	3
Smoking	final	16	18	4	5	4	4	4	4	4	5
Time 2	Mean	16	17	4	5	4	4	4	4	4	4
Smoking	final	16	18	4	4	4	4	4	6	4	4
Time 4	Mean	16	18	4	4	4	4	4	6	4	4
Smoking	final	16	18	4	4	4	7	4	3	4	4
Time 5	Mean	16	18	4	4	4	6	4	4	4	4
Smoking	final	16	17	4	7	4	5	4	2	4	3
Time 9	Mean	18	18	4	7	5	4	5	3	4	4

B		SUM		BAR 1		BAR 2		BAR 3		BAR 4	
Variable		smoking	complaining	smoking	complaining	smoking	complaining	smoking	complaining	smoking	complaining
Complain	final	16	16	4	4	4	5	4	5	4	2
Time 1	Mean	16	16	4	3	4	5	4	5	4	3
Complain	final	17	18	4	4	4	4	4	4	5	6
Time 2	Mean	19	18	5	4	5	4	4	4	5	6
Complain	final	12	18	3	2	3	5	3	4	3	7
Time 4	Mean	13	19	4	2	3	6	3	4	3	7
Complain	final	16	20	4	6	4	4	4	5	4	5
Time 5	Mean	16	20	4	6	4	4	4	5	4	5
Complain	final	16	21	4	3	4	7	4	6	4	5
Time 9	Mean	16	21	4	3	4	7	4	6	4	5

each bar are separately reported. Finally, *smoking* indicates the number of smoking smokers and *complaining* the number of nonsmokers who complained. For testing the smoke time, the complain time was set at 2 and for testing the complain time, the smoke time was also set at 2 for all the test runs.

Overall, changing the smoking time or complaining time (the number of ticks that it takes for a smoker to smoke a cigarette and the number of ticks a non-smoker will voice out a complaint) had a minimal effect on the outcome of each simulation run. In segment Table 3A for the smoking time, an increase in the sum of the number of smokers of 6 is reported for the mean while in that case the smoking has been varied from 1 to the extreme of 9 ticks. The same holds true in segment Table 3B for the complaining time despite changing this to extreme values in which only 5 complainers were reported.

We further tested the influence of the number of smokers compared with the number of nonsmokers and vice versa using the behavior tool of Net Logo in which 25 runs were performed for each change in the parameter. For these simulations, the complaint time and smoke time were both set at 2 and the simulation automatically stopped at 500 ticks.

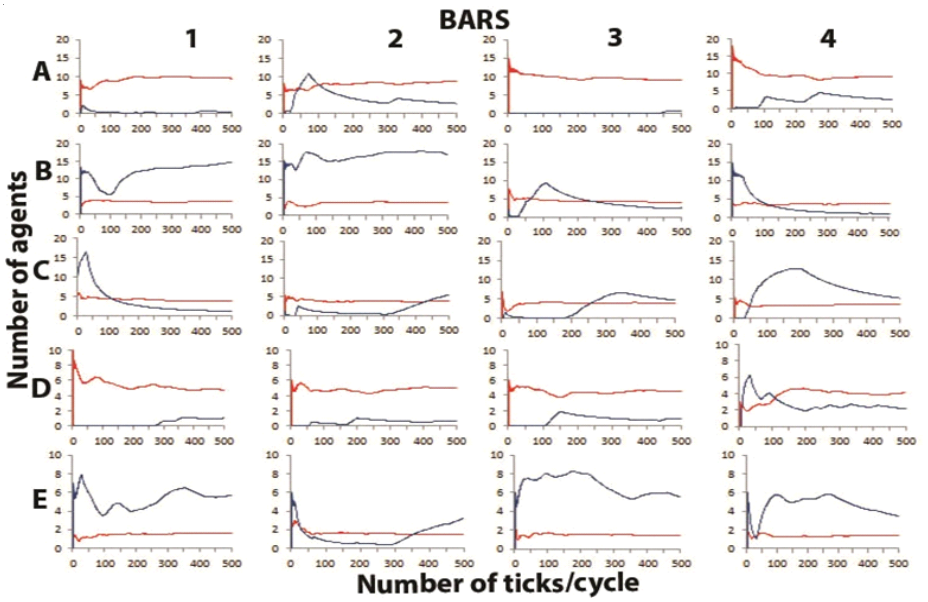

Figure 5. The effect of complaining on smoking behavior in the different bars. Vertical (Y) axis represents variation in number of smokers and non-smokers (agents) in various simulation scenarios varying the number of smokers and non-smokers (A to D). Horizontal (X) axis represents number of ticks or 1 cycle of simulation; red line represents mean number of smoking smokers; blue line represents mean number of complaining nonsmokers.

DISCUSSION

Segregation as Production of Habitat Specialization

Our model addressed the question: How does complaining affect the smoking behavior of smokers in a bar? Obviously, such a question would need validation by interviewing bar patrons as well as nonbar patrons to give us a valid result. This could be in different bars in one city or in multiple cities with different kinds of bars. That we did not do this leaves something to be desired and would mean that our results are mainly a theoretical study but with the underpinnings of a literature survey of how people behave.

We can still infer from the results that indeed people with different addiction, annoyance, and intolerance levels may behave differently under certain conditions. For instance, high-addiction level smokers can start smoking once in bars, while low-addiction level smokers might smoke when encouraged by the sight of smoking around them.

This mimicking behavior based on group behavior is also demonstrated in nature when, for instance, young gazelles flock together with other adult gazelles to migrate within the African landscape. Most of the young animals in this group simply mimic the group behavior of the adult animals and move with them. In other animal groups, mimicry is widely perceived as a revolutionary adaptation for defense, such as that of chameleons or walking sticks that blend with the environment so that they may elude their predators.

Smoking, which is neither an evolutionary adaptation nor a necessary preoccupation among humans, can be said to be rather costly in terms of adverse health effects in real terms, but this is offset by a "positive" rationalization in man's psyche (e.g., group acceptance or belongingness and a sense of respectability). In the first example of positive rationalization, a smoker can rationalize that "I smoke because my friends smoke; I am in the group." This sense of belongingness attracts other smokers to smoke together simply to talk about the weather and build up camaraderie.

In the latter example, smokers rationalize that since TV advertisements show that masculine and feminine stars smoke, smoking conjures the image of being "social, esteemed or respectable" (Elkind, 1985; Graham, 1987; Hunt, Hannah, & West, 2004). Because of these reasons, segregation happens when two groups of people with different smoking habits find themselves in the same space. Smokers will come together because they are happy to be with each other while nonsmokers have the same motivation.

Again this recalls in the wild two birds of the same species but with different adaptations to their environment. One bird that has a longer beak than the other bird uses its beak to crack open a tree trunk and pick up worms; the other bird with a shorter beak simply picks up nuts from the ground. Two birds of the same species but with different beak lengths meet each other in the same space or habitat but they are specialized in terms of foraging habit and rarely mate with each other. This effectively creates a subgroup for these two birds of the same species but with different phenotypes.

Segregation is, therefore, a result of a barrier created by the outcome of species specialization. They can be genetically the same but the phenotypic differences have made it impossible for the birds to mate or blend together. In our model, we have demonstrated that two opposing "habits" – complaining and smoking – cannot blend together.

Smoking and Enforcement of Social Norms through Cooperation

In human societies the acceptability of a norm or its rejection can take years or it may also quickly be turned away. Robert Axelrod (1986) writes that human societies need norms to express their values, practices, or expectations: "norms exist in a given social setting to the extent that individuals usually act in a certain way and are often punished when seen not to be acting in this way" (p. 1097). Some examples of norms that were previously acceptable include colonialism, duelling, the death penalty, and slavery. These societal norms took time to be changed or reversed.

An example of a norm that hastily disappeared after World War II is colonialism, and currently what once was socially acceptable, such as smoking in public or in bars, has been put into question. In our model, we explored how complaining can actually enforce a legitimately acceptable norm and question what once was socially acceptable. In our simulations and tests where agents were given different believable attributes such as annoyance and intolerance, the enforcement of no smoking occurred whenever a nonsmoker complained to the smoking smoker.

Agents with decision-making power, such as nonsmokers, have the rational capacity to complain in a given situation depending on the level of their intolerance to smoke, which well represented their dissatisfaction with their present situation. By complaining, a nonsmoker asserted his/her right to good health, pleasant air, as well as enforced a social norm.

In our model, we have demonstrated that whenever smoking people dominate a bar, enforcing a norm like "no smoking" in such an environment is deemed ineffective although possibly some "brave" nonsmokers can still complain. Leaving such places would be most effective, and the cause is not lost because in a bar that is predominantly composed of nonsmokers, they can complain and effectively enforce "no smoking" to smoking smokers who may dare to smoke in such bars where smoking is not allowed.

From this result, it can be inferred that a determining factor is the number of complainers and their common property of intolerance to such unacceptable practice, in this case "smoking." The presence of a number of nonsmokers in such a bar reflects a system-level cooperation. This can be observed in Figure 5 in which there are 50 nonsmokers and half the number of smokers and, most often, nonsmokers dominated at least two bars. This number allows interaction between the two groups even though oscillations may occur in both. This oscillation of which group dominates in bars can be related to what is acceptable or not acceptable

in a society; where intolerance occurs, a tug of war ensues until one group dominates the other through force or subjugation. This human tendency to find one's own in-group keeps everyone a suspect and stranger until they find belongingness or a common ground (Allport, 1954; Mahoney & McEvoy, 2012).

Effects of Complaining on Smoking

Complaining in business economics deals more with satisfying or pleasing the demands of customers. In psychology, it has something more to do with releasing a burden that is painful or harmful to one's health (Kowalski, 2002). Complaining in social settings, such as in a bar, can be said to be governed by small group dynamics which is a behavioral response that may differ from that on a personal level. Group dynamics is very different from the dynamics of individual behavior. For instance, when bullying occurs in schools, usually groups are responsible for this in that the group guides the conduct of its individual members according to the social norms of the group (Salmivalli, Huttunen, & Lagerspetz, 1997).

With this common observation in mind, we can infer that complaining or smoking can have very different group dynamics apart from being modulated by addiction levels or intolerance levels. This is the basis of the formula where we added that the agents need to count their peers in their environment. Our human behavior is quite predictable in group situations in which we have the same habits or preferences.

To illustrate our point, let us talk about Horatio and Sofia, two hypothetical personalities who are both sophomore students with different fields of specialization. The former specializes in ecology and the latter, in history. Both were approached by an animal conservation society to be recruited as members. Our guess is that Horatio would actually sign up for the society because this helps in his curriculum vitae as well as fits his interests but Sofia, whose interests or preferences are not represented by the society, might decline the invitation.

Horatio is an ecologist and therefore can find belongingness in that type of society, but not Sofia. In our model, we have demonstrated that by complaining to smoking smokers, nonsmokers are simply demanding their rights, enforcing their interests or preferences of standards in such a situation to achieve their common goal of a smoke-free environment. Parallel to this, in a smoking bar, we would actually find that nonsmokers do not belong to such places and therefore should not have even entered it in the first place.

CONCLUSION

In our research question, we asked how complaining affects smoking behavior in bars and what this behavior generally implies. This question is very broad and we broke it down to three subquestions which are: What is the effect of complaining on smoking behavior in bars; how the ratio of smokers and nonsmokers affects the behavior of smoking in bars; and whether segregation occurs as a result of differing preferences.

We assume that based on the results of our simulation study, complaining behavior is generally effective in enforcing a social norm such as no smoking in bars, but this is generally affected by the number or ratio of nonsmokers present in the bar and their intolerance level.

When the intolerance level is high, there is also a higher chance for nonsmokers to complain of the smoke. In relation to this, a smoking bar is predominantly occupied by smokers who are happier in such bars without resistance to their smoking habits. They are accepted in such bars, well regarded by their peers, and therefore they can always smoke in such places.

It is a common observation that when our natural tendencies or habits are acceptable, our lives could be less stressful. Humans prefer the least resistance and stay in such places or situations where least resistance or conflict could be found. Peace of mind and happiness could be the primal reason why agents or actors would choose to stay in their bars of preference given the freedom of choice.

Our hypothesis that smoking behavior will have a great disincentive and would be stigmatized in a bar with predominantly nonsmoking agents has been confirmed. We also have confirmed that due to differing smoking habits and intolerance levels, segregation between smokers and nonsmokers did occur in our model. This makes our model a useful tool for studying human behavior and predicting the group dynamics given a number of actors or agents in a given situation.

REFERENCES

Albers, A.B., Siegel, M., Cheng, D.M., Biener, L., & Rigotti, N.A. (2007). Effect of smoking regulations in local restaurants on smokers' anti-smoking attitudes and quitting behavior. *Tobacco Control*, *16*(2), 101-106.

Allport, G. (1954). *The nature of prejudice*. Cambridge, MA: Perseus Books Publishing.

Andrighetto, G., & Villatoro, D. (2011). Beyond the carrot and stick approach to enforcement: An agent-based model. In B. Kokinov, A. Karmiloff-Smith, N.J. Neressian (Eds.), *European perspectives on cognitive science*. Sofia, Bulgaria: New Bulgarian University Press. Retrieved September 11, 2013 from http://nbu.bg/cogs/eurocogsci2011/proceedings/index.html

Axelrod, R. (1986). An evolutionary approach to norms. *The American Political Science Review*, *80*(4), 1095-1111.

Bero, L.A., Montini, T., Bryan-Jones, K., & Mangurian C. (2001). Science in regulatory policy making: Case studies in the development of workplace smoking restrictions. *Tobacco Control*, *10*(4), 329-336.

Bonabeau, E. (2002). Agent-based modelling: Methods and techniques for simulating human systems. *Proceedings of the National Academy of Sciences USA*, *99*(3), 7280-7287.

Carver, C.S., & Scheier, M.F. (1981). *Attention and self-regulation*. New York: Springer-Verlag.

Complain [Def. 1 and 2]. (n.d.). *Merriam-Webster Online*. In Merriam-Webster. Retrieved March 8, 2013 from http://www.merriam-webster.com/dictionary/complain

Danishevski, K., Gilmore, A., & McKee, M. (2008). Public attitudes towards smoking and tobacco control policy in Russia. *Tobacco Control*, *17*(4), 276-283.

Deffuant, G., Amblard, F., Weisbuch, G., & Faure, T. (2002). How can extremism prevail? A study based on the relative agreement interaction model. *Journal of Artificial Societies and Social Simulation*, *5*(4). Retrieved September 11, 2013 from http://jasss.soc.surrey.ac.uk/5/4/1.html

Elkind, A.K. (1985). The social definition of women's smoking behaviour. *Social Science and Medicine, 20,* 1269-1278.

Gorini, G., Chellini, E., & Galeone, D. (2007). What happened in Italy? A brief summary of studies conducted in Italy to evaluate the impact of the smoking ban. *Annals of Oncology, 18*, 1620-1622.

Graham, H. (1987). Women's smoking and family health. *Social Science and Medicine, 25*, 47-56.

Grimm, V., & Railsback, S.F. (2005). *Individual-based modelling and ecology*. Princeton, NJ: Princeton University Press.

Hackshaw, A.K., Law, M.R., & Wald, N.J. (1997). The accumulated evidence on lung cancer and environmental tobacco smoke. *British Medical Journal*, *315*(7114), 980-988.

Hofstede, G. (1983). Culture's consequences: International differences in work-related values. *Administrative Science Quarterly, 28,* 625-629.

Holling, C.S. (1994). Simplifying the complex: The paradigms of ecological function and structure. *Futures*, *26*(6), 598-609.

Hunt, K., Hannah M-K., & West, P. (2004). Contextualizing smoking: Masculinity, femininity and class differences in smoking in men and women from three generations in the west of Scotland. *Health Education Research*, *19*(3), 239-249.

Ingram, R.E., Cruet, D., Johnson, B.R., & Wisnicki, K.S. (1988). Self-focused attention, gender, gender role, and vulnerability to negative affect. *Journal of Personality and Social Psychology*, *55*, 967-978.

Izquierdo, S. S., & Izquierdo, L.R. (2006). The impact on market efficiency of quality uncertainty without asymmetric information. Paper presented at the Workshop on Agent-Based Models of Consumer Behaviour and Market Dynamics, Guildford UK.

Kowalski, R.M. (1996). Complaints and complaining: Functions, antecedents, and consequences. *American Psychological Association*, *119*(2), 179-196.

Kowalski, R.M. (2002). Whining, griping, and complaining: Positivity in the negativity. *Journal of Clinical Psychology*, *58*(9), 1023–1035.

Linnan, L.A.,Weiner, B.J., Bowling, J.M., & Bunger, E.M. (2010). Views about second-hand smoke and smoke-free policies among North Carolina restaurant owners before passage of a law to prohibit smoking. *North Carolina Medical Journal*, *71*(4), 325-333.

Mahoney, A.E., & McEvoy, P.M. (2012). Changes in intolerance of uncertainty during cognitive behavior group therapy for social phobia. *Journal of Behavioral Therapy and Experimental Psychiatry*, *43*(2), 849-854.

Mannino, D.M., & Buist, S.A. (2007). Global burden of COPD: Risk factors, prevalence, and future trends. *Lancet*, 370(9589), 765-773.

Montini, T., & Bero, L.A. (2008). Implementation of a workplace smoking ban in bars: The limits of local discretion. *BMC Public Health*, *8*, 402.

Nebot, M., Lopez, M.J., Ariza, C., Perez-Rios, M., Fu, M., Schiaffino A., Muñoz, G., Salto, E., & Fernández, E. (2009). Impact of the Spanish smoking law on exposure to secondhand smoke in offices and hospitality venues: Before-and-after study. *Environmental Health Perspectives*, *117*(3), 344-347.

Nebot, M., Lopez, M.J., Gorini, G., Neuberger, M., Axelsson, S., Pilali, M., Fonseca, C., Abdennbi, K., Hackshaw, A., Moshammer, H., Laurent, A.M., Salles, J., Georgouli, M., Fondelli, M.C., Serrahima, E., Centrich, F., & Hammond, S.K. (2005). Environmental tobacco smoke exposure in public places of European cities. *Tobacco Control*, *14*, 60-63.

Nyer, P.U. (1999). Cathartic complaining as a means of reducting consumer dissatisfaction. *Journal of Consumer Satisfaction, Dissatisfaction and Complaining Behavior*, *12*, 15-25.

Nyer, P.U. (2000). An investigation into whether complaining can cause increased consumer satisfaction. *Journal of Consumer Marketing*, *17*(1), 9-19.

Parker, D.C., & Meretsky, V. (2004). Measuring pattern outcomes in an agent-based model of edge-effect externalities using spatial metrics. *Agriculture, Ecosystems & Environment*, *101*(2-3), 233-250.

Pyszczynski, T., Hamilton, J.C., Greenberg, J., & Becker, S.E. (1991). Self-awareness and psychological dysfunction. In C.R. Snyder & D.R. Forsyth (Eds.), *Handbook of social and clinical psychology* (pp. 138-157). New York: Pergamon Press.

Salmivalli, C., Huttunen, A., & Lagerspetz, K.M. J. (1997). Peer networks and bullying in schools. *Scandinavian Journal of Psychology*, *38*, 305-312.

TARP. (1986). *Consumer complaint handling in America: An update study*. Washington, DC: White House Office of Consumer Affairs.

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