Article

Sexual Harassment: A Complex Adaptive System Viewpoint

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Abstract

Despite the tremendous stress on sexual harassment (SH) policy, advances in policy construction, and a substantial body of research, SH remains a persistent presence in the workplace. This study examines SH from a complex adaptive system viewpoint. This adaptive system is modeled using agent-based simulation, where the influence of individual, situational, and organizational characteristics on SH can be studied. Our model accommodates the adjustment of each of these characteristics to reflect alternate organization environments. As such, the proposed model can be used as an effective tool to determine an organization's vulnerability to incidents of SH and, consequently, provide recommendations for organization-specific preventive actions. Implications and suggestions for future research and practice are also discussed.

Keywords

Sexual harassment, complex adaptive system, agent-based simulation

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Introduction

Sexual harassment (SH) constitutes a significant barrier to workplace communication, productivity, job satisfaction, organizational commitment, career success, and psychological well-being for women (Fitzgerald, Swan, & Magley, 1997; Merit Systems Protection Board, 1995; O'Leary-Kelly, Bowes-Sperry, Bates, & Lean, 2009; Willness, Steel, & Lee, 2007). The US Equal Employment Opportunity Commission (EEOC) defines "sexual harassment" as unwelcome sexual advances, requests for sexual favors, and other verbal or physical harassment of a sexual nature (U.S. EEOC, 2014). In 2008 alone, US organizations incurred over US$ 47 million in monetary expenses, and a total of 13,867 SH charges (Equal Employment Commission, 2008). However, despite increased efforts by both academicians and practitioners, progress in understanding and mitigating SH in the workplace has fallen short of expectations.

Many current studies seek to understand SH from an isolated factor approach. These studies investigate the isolated influence of one or two factors on SH experience (Lindgren, Parkhill, George, Hendershot, 2008; Ohse & Stockdale, 2008). Other studies are limited in their scope by their overuse of static data to examine a dynamic phenomenon (Lengnick-Hall, 1995), and by their exclusive focus on targets (Fitzgerald et al., 1997; Willness et al., 2007) at the cost of the insufficient study of perpetrators (Lucero, Allen, & Middleton, 2006). However, incidents of SH in the workplace usually result from the complex and simultaneous interaction among several variables (Hesson-Mcinnis & Fitzgerald, 1997). As such, understanding and mitigating SH require a model that simultaneously considers the effect over time of individual, situational, and organization factors on the interaction between targets and perpetrators of SH (Amick & Sorenson, 2004; Fitzgerald & Shullman, 1993).

Our investigation of SH employs a complex adaptive system (CAS) simulation to investigate the relative influence of multiple parameters that are known to impact the likelihood of SH. CASs are dynamic systems consisting of a network of interacting actors, such as, humans and processes, that adapt to constantly changing environments (Holland, 2006). Many economic and social systems are complex because (a) they involve a network of interacting actors (humans, processes, etc.), and (b) the interactions of these actors reveal a dynamic collective behavior (Wang, Gwebu, Shanker, & Troutt, 2009). A CAS approach facilitates the investigation of how actors adapt to their environment over time in order to achieve their goals (McCarthy, 2003).

SH occurs within a complex system of interacting components. Incidences of SH arise when employees (agents) interact in the workplace. The interaction among these agents leading to SH is influenced by the characteristics of the interacting agents (e.g., age, position), be it situational characteristics (e.g., the proportion of males and females in the workplace), or the organizational context (e.g., training and enforcement of the organization's SH policy). Further, the effect of each of these factors on SH incidence changes over time. Thus, from the CAS viewpoint, incidences of SH are affected differentially over time by characteristics of agents, situations, and organizational context.

In this article, we offer a CAS perspective on SH. For our CAS study, we developed an agent-based simulation model to understand better how individual, situational, and organizational factors affect the incidences of SH in the workplace over time. Our objective is twofold: First, to demonstrate the feasibility and importance of agent-based simulation for modeling incidences of SH and, second, to show that agent-based modeling combined with data-mining approaches can lead to further insights into SH. Our simulation model offers a tool for which parameters can be modified to match the characteristics of a particular organization (e.g., organizational size, gender mix, the average employee age, and the level of enforcement of SH policies) to provide context-based evidence that would guide proactive actions to deter SH and its negative outcomes. Because our model is based on previous research findings, it provides a generalizable approach to studying incidence of SH in the context of a complex interplay of varying parameters.

We begin with an overview of relevant literature summarizing the influence of selected factors on SH. This is followed by a brief description of agent-based modeling, after which we present our agent-based SH model and results. We conclude with a discussion of how CAS can inform both SH research and practice.

Theoretical Framework

Our model incorporates three categories of factors that previous research has shown to have an impact on SH: individual, situational, and organizational. Individual factors refer to characteristics of employees, such as, age, job position, and gender, that impact whether an individual becomes a target or perpetrator of SH (Baker, Terpstra, & Larntz, 1990). Situational factors describe conditions that affect the interaction among employees

(Langhout et al., 2005), such as, gender mix in the workplace (Gutek, 1985). Organizational factors refer to the organizational context that may affect SH. For example, SH training and enforcement of SH policy are two approaches commonly used by organizations to decrease the incidence of SH (Fitzgerald, Drasgow, Hulin, Gelfand, & Magley, 1997).

Individual Factors

Previous studies indicate that an individual's gender, age, sexually permissive attitudes (SPA), job position, and prior SH experience meaningfully impact the incidence of SH in the workplace.

Gender. Gender significantly affects one's likelihood of becoming involved in SH (Reese & Lindenberg, 2005; Uggen & Blackstone, 2004). In general, females experience a greater frequency and risk of SH than males (Magley, Waldo, Drasgow, & Fitzgerald, 1999; Merit Systems Protection Board, 1995). On the other hand, males more frequently perpetrate SH. Despite the increasing number of male–male and female–male SH cases, the majority of SH incidents are those of males harassing females (Ménard, Hall, Phung, Ghebrial, & Martin, 2003; Perry, Schmidtke, & Kulik, 1998). In 2009, women initiated 84 percent of SH charges filed with the EEOC and Fair Employment Practices Agencies (FEPA) (EEOC, 2010). Given the prevalence of male-on-female SH, we limit the scope of our study to this type of harassment.

Age. Lafontaine and Tredeau (1986) note that older workers report fewer incidents of SH than their younger counterparts. Lee, Gibson, and Near (2004) found that younger women are more vulnerable and likely to experience SH. Further, studies indicate that women younger than 35 have a greater chance of experiencing unwanted sexual attention than older women (Merit Systems Protection Board, 1981, 1995), with the likelihood of harassment decreasing with age (Fain & Anderton, 1987). Studies on the age of male perpetrators generally suggest that this group appears to permeate all age categories (Pina, Gannon, & Saunders, 2009). Such inconclusive results could be mainly attributed to the scarcity of research on SH perpetrators. However, the evidence regarding perpetrators in the workplace (rather than child perpetrators, street perpetrators, etc.) is more suggestive of perpetrators being 40 years and older (Collins, 2006; Uggen & Blackstone, 2004). These findings are guided by the assumption that older males often have greater work experience, and

therefore, higher positions and more power (Collins, 2006). In our study, we therefore adopt the latter viewpoint. Thus, the age of female targets is negatively associated with SH, while the age of male perpetrators is positively related to SH.

Job Position. The notion that SH is primarily driven by sexual desire was dispelled some time ago (Berdahl, 2007). Rather, evidence shows that an individual's job position and its associated power give rise to incidences of workplace SH (Berdahl, 2007; Paludi & Barickman, 1991). The increased percentage of working women has meaningfully changed long-standing expectations about the traditional roles of women (Berdahl, 2007). Women's ascent up the organizational ladder has also become more common (Diekman, Goodfriend, & Goodwin, 2004). Thus, while women may experience SH as a result of societal norms, they also occupy higher positions and tend to be more educated, assertive, and self-defensive (Berdahl, 2007; Diekman, Goodfriend, & Goodwin, 2004). However, younger women who occupy lower positions often lack the ability and power to respond properly to sexually harassing behaviors, putting them at greater risk of SH (Uggen & Blackstone, 2004).

Existing studies on male perpetrators demonstrate that higher job positions are associated with increased proclivity to sexually harass. For males, higher positions are often viewed as an opportunity to assert and maintain dominance over women (Uggen & Blackstone, 2004). As Paludi and Barickman (1991) note, men's power engenders SH in two common patterns. Quid pro quo SH is primarily used to indulge and express power, whereas hostile environment SH is more often used by men as a defensive mechanism to protect their power (Paludi & Barickman, 1991). However, regardless of the justification, the possibility of becoming a harasser increases if the job position occupied by the male is higher than that held by the female, and thereby the male is perceived as more powerful and influential.

Sexually Permissive Attitudes. SPAs reflect an individual's belief regarding how open, free, and unrestrained expressions of sexuality should be, and one's comfort with casual sex (Feldman & Cauffman, 1999; Hendrick & Hendrick, 1986). Although research on sexual permissiveness is primarily limited to studies on how SPA may impact premarital sexual relations (Askun & Ataca, 2007; Ojedokun & Balogun, 2008), DuBois, Faley, and Knapp (2008) demonstrated that males hold SPA that are more permissive than those of females. Further, they showed that the probability of experiencing SH, as either a target or a perpetrator, increases for individuals who hold more SPAs.

Personal History of SH. A number of studies demonstrate that personal history of SH may be predictive of future SH experience (Chiodo, Wolfe, Crooks, Hughes, & Jaffe, 2009; Lucero et al., 2006). Women who have experienced sexually harassing behaviors are more likely to become a target of additional SH (Fitzgerald, Swan, & Fischer, 1995). Previous findings indicate that targets of SH may choose to simply tolerate SH out of fear, self-blame, or rationalization (Fitzgerald, Swan, & Fischer, 1995). An alternative reasoning can be framed using an affective adaptation theory, which proposes that an individual's psychological processes may cause an affective response to weaken after one or more exposure to a stimulus (Frederick & Loewenstein, 1999). From this perspective, prior experiences of SH could render perceptions of subsequent SH experiences as somewhat familiar, and consequently, less harmful or severe than the initial experience (DuBois, Faley, & Knapp, 2008).

Similarly, research on perpetrators demonstrates that they are likely to repeat harassing behaviors in the future, and even escalate the severity of their SH behaviors (Lucero et al., 2006). Perpetrators may want to satisfy their ego, express aggression, hostility, or power, or there may be "vulnerable perpetrators" who expect to build further relationships with a victim (Lucero, Middleton, Finch, & Valentine, 2003). Repeated offences often rest upon perpetrators' dysfunctional social perceptions and high likelihood of accepting rape myths and interpersonal violence (Lucero, Middleton, Finch, & Valentine, 2003).

Situational Factor

Gender Mix. Because context plays a powerful role in social life, the investigation of SH must include situational factors (Chamberlain, Crowley, Tope, & Hodson, 2008). Gender mix at work has been identified as a situational factor that considerably impacts the incidence of SH (O'Leary-Kelly, Duffy, & Griffin, 2000). Studies on the association between gender mix and the possibility of SH in the workplace have consistently demonstrated a higher number of SH incidents in a male-dominated organizational environment as compared to a female-dominated environment (Gruber, 2003; O'Leary-Kelly et al., 2000). Target proximity is one reason for these differences (O'Leary-Kelly et al., 2009), and fewer women may get more attention from many men. In addition, the prevalence of male norms in the male-dominated environment may

result in a more hostile workplace for women who are perceived by men as violators of the gender norms (Amick & Sorenson, 2004; Rosenberg, Perlstadt, & Phillips, 1993). Harassment often provides a means for men to defend their status and power and to discourage women from entering "a male territory" (Bandura, 2002; Berdahl, 2007; Schultz, 1998).

Organizational Factors

Training and enforcement are the two common organizational factors considered in the SH literature.

Training. Recent research on organizational factors has demonstrated that SH training is associated with decreased SH incidents in the workplace (O'Leary-Kelly et al., 2009). Other researchers have found that training increases sexual harassment awareness, reduces inappropriate behavior in men (Perry, Kulik, & Schmidtke, 1998), and increases the sensitivity of employees to SH issues (Antecol & Cobb-Clark, 2003). Further, training provides potential targets with a greater awareness of the behaviors that are considered inappropriate and the methods of recourse available to them, which enables these individuals to become proactive in discouraging SH (Gruber, 1998). Thus, the implementation of SH training programs may affect change in behavior as employees interact, thus allowing organizations to decrease SH incidents even in the absence of formal organizational policies (Perry, Kulik, & Schmidtke, 1998). In such circumstances, targets identify and take proactive steps to stop SH behaviors, and perpetrators develop greater sensitivity and reduce their own harassing behavior (Perry et al., 1998). However, studies indicate that the effect of SH training is unfortunately short term because it does not influence individuals' long-term attitudes associated with the propensity to harass (Perry et al., 1998). In essence, SH training postpones the occurrence of SH incidences; to have a long-term effect, SH training needs to be ongoing.

Enforcement. Enforcement of SH policies also decreases SH incidence (Gruber, 2003). Many companies have developed policies and procedures for dealing with SH in the workplace. By enforcing policies that prohibit and punish sexually harassing behaviors, organizations can reduce SH incidence considerably (Gruber, 2003; Hertzog, Wright, & Beat, 2008). Holding the gender mix ratio constant, organizations with visible anti-SH policies will exhibit fewer SH incidents (Gruber, 1998). The positive effect of enforcement policies is achieved not only through

Table 1. Effect of Factors on Female Targets and Male Perpetrators

Factors		Likelihood of Becoming a	
		Target (Female)	Perpetrator (Male)
Individual	Age	Lower with age	Higher with age
	Job position	Lower with higher position	Higher with higher position
	Sexually permissive attitudes (SPA)	Higher with greater SPAs	Higher with greater SPAs
	Prior sexual harassment experience	Higher with prior SH experience	Higher with prior SH experience
Situational	Gender mix	Higher with greater proportion of males	Higher with greater proportion of males
Organizational	Training	Lower with training	Lower with training
	Enforcement	Lower with enforcement	Lower with enforcement

Source: Authors' own.

a threat of punishment for the perpetrator but also through providing a supportive environment for targets who have confidence that their complaints will be taken seriously (Hulin, Fitzgerald, & Drasgow, 1996). Gruber (1998) notes the greater effectiveness of proactive enforcement policies over informational methods, such as, training. Although the epistemology of why these policies are more effective is yet to be determined, it might be related to the shorter-term impact of training on perpetrator behavior, as compared with a longer-term impact of consistently enforced policy.

Table 1 summarizes our discussion on the effects of individual, situational, and organizational factors on the likelihood of becoming either a female target or a male perpetrator of an SH incident. We now describe how agent-based modeling can be used to better understand the CAS of SH in organizations.

Agent-based Modeling and Simulation

As noted earlier, traditional analytical techniques cannot capture the dynamic unfolding of complex and dynamic interactions within CASs, such as, workplace SH. Recent advances in agent-based simulation

offer new opportunities to study these complex systems (Wang et al., 2009).

Software agents within a computer program represent actors that exist in the same environment and who are capable of autonomous action to accomplish their objectives. Using intelligent agents as building blocks, an agent-based simulation can represent complex systems by modeling these actors as intelligent agents and the interactions between these agents through a wide-range of computer algorithms (Wang et al., 2009). Further, because agent-based simulation allows us to observe both micro- and macro-level effects on an organization (Kenjo, Yamada, & Terano, 2007), the behavior of individual agents and the interactions within the organizational system can be observed simultaneously throughout a specified period of time. Thus, by varying individual, situational, and organizational factors over multiple runs of the agent-based simulation, we can observe how behavior unfolds among individual agents, as well as within the overall system. This dynamic path view of the system can provide important insights into how SH unfolds and propagates through an organizational system.

Finally, agent-based simulation models provide some advantages over other computer-based simulations. First, agents are autonomous, proactive, socially interactive, adaptive, and intelligently cooperative (Jennings, Sycara, & Wooldridge, 1998). This allows for complex patterns of interaction. In addition, an agent-based system is well suited to situations with multiple goals or interactions. Moreover, agents can be modeled with different characteristics and objectives, ensuring that interactions among agents are represented accurately in the simulation. In the workplace, different agents (humans) have varying objectives, and in addition to personal characteristics, are influenced by social and organizational norms. As such, interactions among these agents can result in unexpected behaviors (Polhill, 2009). By capturing such unexpected behaviors, an agent-based model provides an attractive alternative to traditional approaches to studying SH.

Model Development

As outlined above, the interplay among organizational factors, individual employee factors, and situational factors results in the presence or absence of SH. These factors are represented in Figure 1, which presents the conceptual model that serves as the basis for our agent-based simulation model.

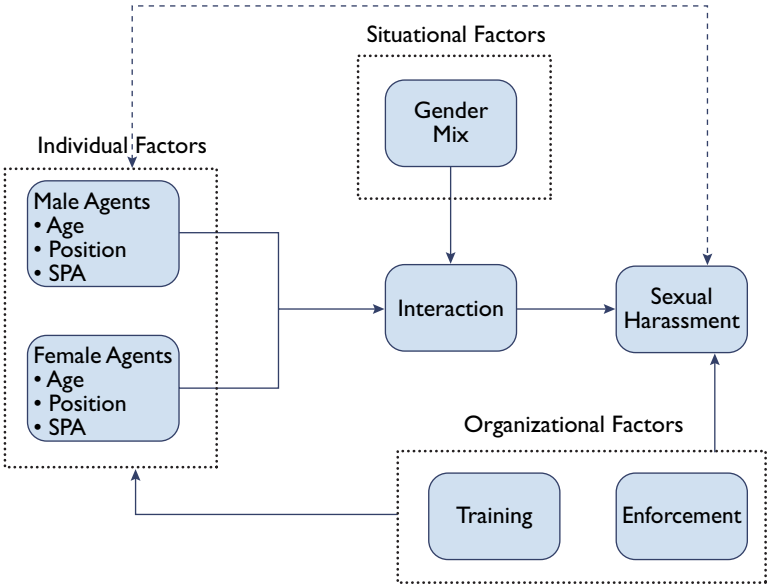

Figure 1. Conceptual Model

Source: Authors' own.

Model Description

Our model consists of two types of agents: males and females (Figure 1). Each agent is defined by individual characteristics of age, job position, and sexual permissiveness. Agents move freely in the system, and over time, interact with one other. Every interaction between a male agent *i* and a female agent *j* leads to a likelihood, however small, of SH. This likelihood of SH, denoted by P_{ij}, is affected by several factors, including the level of interaction. In our model, the level of interaction between male and female agents is measured along two dimensions: frequency and intensity. Frequency measures the number of times male agent *i* interacts with female agent *j*, while intensity refers to the proportion of time male agent *i* interacts with female agent *j* compared to his total interaction with all other female agents. In addition to individual characteristics, situational factors, such as, gender mix, also directly influence the level of interaction (Figure 1), and hence P_{ij}. Organizational factors too affect P_{ij}. Training provides greater sensitivity to each agent,

while enforcement penalizes each agent for sexual harassing behavior. Our conceptual model is given in Figure 1, and we specifically calculate P_{ij} as follows:

$$P_{ij} = f(\text{training level, enforcement level, } I_{ij})$$

$$I_{ij} = f(\text{female } j \{\text{age, position, SPA}\}, \text{ male } i \{\text{age, position, SPA}\}) + f(\text{level of interaction between male } i \text{ and female } j),$$

where P_{ij} = likelihood of SH by male i of female j, I_{ij} = net effect of individual factors when male i interacts with female j, and f = function.

Thus, the likelihood of SH occurring depends on organizational factors of training and policy enforcement levels, along with the effect of individual and situational factors. The effect of individual factors depends upon the characteristics of each interacting agent as well as the level of interaction, which is influenced by the situational factor of gender mix in the workplace. The net effect I_{ij} is then an aggregate function of these individual factors. A similar process is applied to the aggregate effect of training, enforcement, and individual factors to determine the likelihood of SH.

Agent-based Simulation Model for SH

Our agent-based simulation model is designed in NetLogo (Wilensky, 1999). NetLogo utilizes a simple programming language and provides a convenient user interface to construct and test agent-based models. Figure 2 shows the graphical user interface (GUI) that is used to set up parameters for interactions within our agent-based system. The simulation clock is measured in ticks, where each tick in our simulation corresponds to approximately one day in a real system. Initial conditions for our simulation include setting values for the simulation run length, MaxTicks; the number of employees in the organization, N; and factor levels for individual, situational, and organizational policies. For individual characteristics, such as, age, position, and SPA, the range of values can be set by moving sliders. The values of each agent are then generated randomly within the range of allowable values for that characteristic.

The impact of each of these individual characteristics on the likelihood of SH can also be controlled in the model. For example, in less hierarchical organizations, position may have minimal impact on SH.

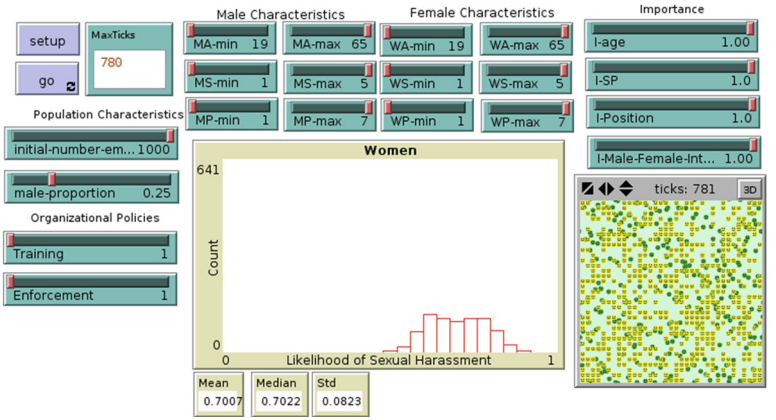

Figure 2. Simulation Model: GUI

Source: Authors' own.

To model this, the importance slider for the *position* variable can be moved so that the effect of *position* in determining P_{ij} is reduced. The situational factor, gender mix, controls the proportion of males in the organization. Organizational factors, training and enforcement, are similarly controlled through sliders. The middle area in Figure 2 presents the output of the simulation. During the simulation, the likelihood of SH for female agents is visually depicted, along with descriptive statistics. At the end of the simulation, the graph depicts the distribution of values for all female agents in our model.

These values represent the maximum likelihood of SH for each female in the organization during the simulation. A dynamic representation of the movements of the male and female agents can also be observed and monitored during the simulation.

Simulation Experiment

A simulation experiment was conducted to understand the effect of individual, situational, and organizational factors (Table 2) on the likelihood of males sexually harassing females. Because our primary purpose is to establish the feasibility of using an agent-based simulation to understand the effect of these factors on SH, the data for our simulation

Table 2. Factor Levels for the Simulation

Factors	Factor Levels
Individual characteristics	
Age	19–65
Job position	Low (1) to high (7)
Sexual permissiveness	Low (1) to high (5)
Situational	
Gender mix—proportion of males	25 percent, 50 percent, 75 percent
Organizational	
Training	Low, medium, high
Enforcement	Low, medium, high

Source: Authors' own.

are artificially generated, rather than collected from a specific organization. Our simulation experiment consisted of the following factors:

1. Initial conditions
   a. Population size (N)
   b. Run length (MaxTicks)
2. Individual characteristics (males and females)
   a. Age
   b. Job position
   c. SPA
3. Situational factors
   Gender mix
4. Organizational factors
   a. Training
   b. Enforcement

Factors 1a and 1b specify the initial conditions of the simulation. Here, we consider a medium-sized company consisting of $N = 1{,}000$ employees and fix this value for the entire simulation. To understand the effect of SH over time, we ran our simulation to mimic approximately three years of real time. Individual characteristics specify the range of values for each of the agents in the simulation. We set the age range as 19–65 for both men and women to reflect typical ages in the workforce; each individual agent's age is then generated uniformly within this range.

We apply this for all N agents in the simulation. A similar approach is taken to generate values for job position and SPA for each agent, where job position is defined on a scale of 1 (low) to 7 (high) and SPA from 1 (low) to 5 (high).

The situational factor specifies the gender mix, that is, the proportion of males in the organization, which we consider at three levels (25 percent, 50 percent, and 75 percent). Organizational factors that include training and enforcement are also considered at three levels (low, medium, high). Table 2 lists all factors and the levels for each that were used in our simulation.

Each simulation run consisted of generating individual characteristics for each of the $N = 1{,}000$ agents and was set to mimic three years of real time. The number of male and female agents in the simulation depended on the value of the gender mix variable. Our study employed a full-factorial experiment. We set each of the three variables (gender mix, training and enforcement) at three different levels, which created 27 treatments. We replicated each treatment five times, thereby generating a total of 135 simulation runs.

To facilitate the understanding of how different factors affect SH, our simulation model provides a detailed output during and after the simulation. During the simulation, our model displays a constantly updated histogram of the likelihood of SH of the female agents in the organization. In addition, descriptive statistics and the interactions between males and females are also displayed. At the simulation's end, detailed output on individual agent characteristics, the level of interactions between male and female agents, and the likelihood of SH for each female are also captured. Further, for each female, we also note the individual characteristics of the male who was the most likely to sexually harass that female. While this likelihood may be small, for the purposes of this article we label these males as perpetrators.

Results

The simulation output data were used to fit a linear regression model to predict the likelihood of SH (Table 3).

The simulation output includes data on the likelihood of SH observed for each female, gender mix in the organization, the level of training and enforcement, individual characteristics for all females, and individual characteristics for male perpetrators, but not for non-perpetrator males.

Table 3. Linear Model to Predict Sexual Harassment Likelihood

Term	Estimate	Std. Error	*t*-Ratio	Prob>|*t*|
Intercept	0.7651	0.001687	453.46	0.0000
Situational characteristics				
Male_Proportion [50 percent to 25 percent]	0.0056	0.000304	18.32	<0.0001
Male_Proportion [75 percent to 50 percent]	0.0036	0.000406	8.93	<0.0001
Organizational characteristics				
Training [medium–low]	–0.0109	0.000331	–32.98	<0.0001
Training [high–medium]	–0.0101	0.000331	–30.41	<0.0001
Enforcement [medium–low]	–0.4581	0.000331	–1,385.00	0.0000
Enforcement [high–medium]	–0.0916	0.000331	–277.00	0.0000
Individual characteristics				
Female age	–0.0023	1.017×10^{-5}	–229.60	0.0000
Female sexual permissiveness	0.0133	0.000117	113.58	0.0000
Female position	–0.0089	0.000078	–113.40	0.0000
Perpetrator age	–0.0000	0.000012	1.46	0.1449
Perpetrator sexual permissiveness	0.0045	0.000259	17.18	<0.0001
Perpetrator position	0.0018	0.000143	12.23	<0.0001

Source: Authors' own.
Notes: $R^2 = .9797$; F ratio = 271,481.7 (prob > F = 0.0000).

Results indicate that all factors, with the exception of age differences among perpetrators, are significant in predicting the likelihood of SH. Specifically, results for women indicate that younger women, in lower positions, and with higher SPA, experience the greatest likelihood of SH. In addition, among male perpetrators, increased the likelihood of SH is associated with holding higher positions and SPA. However, age differences within the group of male perpetrators have no effect on the likelihood of SH.

To explore these relationships further, Table 4 shows the individual characteristics of our agents and the frequency of interaction between them. Note that Table 4 displays means for the entire group of males in the simulation as well as means for the group of male perpetrators.

Table 4. Mean Levels for Individual Characteristics

Agent	Age	Position	Sexual Permissiveness	Interactions
Females	44.98	4.00	3.00	
Males (all)	44.95	4.00	3.00	6.17 (max)
Males (perpetrators)	48.72	5.63	4.31	2.87

Source: Authors' own.
Note: All mean-level differences between males (all) and males (perpetrators) are significant at $p < 0.001$.

Clearly, the group of male perpetrators differs significantly from the average male population; they are older, hold higher organizational positions, and have higher SPA. Table 4 also shows that male perpetrators interact with females less frequently in comparison to the maximum interaction that a female might have with a male from the full population of males.

We also see the influence of the situational factor and gender mix in these results. Table 5 shows the proportion of all males in the population who are perpetrators. In our model, organizational, along with individual and situational factors, affect the likelihood of SH. Specifically, as the proportion of males increases, the interaction between a male and a female employee is likely to change.

This affects both the frequency and intensity of interaction, which on average, becomes smaller for *each* male, leading to fewer perpetrators. When the percentage of males is 25 percent, there are 250 males in the population; on average, 35 percent of them are perpetrators. Similarly, for a gender mix of 50 percent, there are 500 males in the population; however, the percentage of perpetrators drops to 23 percent (Table 5). Tables 4 and 5 also indicate that a small number of all males tend to be perpetrators, but as the population of males grows, the average likelihood of harassment increases. For example, when the gender mix is at 50 percent, the average likelihood of SH is 0.3537 (Table 6), which is caused

Table 5. Percentage (Number) of Males/Perpetrators

Gender Mix	Perpetrators
25 percent (250)	35 percent (88)
50 percent (500)	23 percent (116)
75 percent (750)	14 percent (106)

Source: Authors' own.

Table 6. Average Likelihood of Sexual Harassment

Factor	Level	Average
Training	Low	0.3623*
	Medium	0.3506*
	High	0.3405*
Enforcement	Low	0.6871*
	Medium	0.2290*
	High	0.1373*
Gender mix	25%	0.3471*
	50%	0.3537*
	75%	0.3580*

Source: Authors' own.
Note: *$p < 0.001$.

by 23 percent of males (Table 5). When the gender mix is at 75 percent, the likelihood of SH increases to 0.3580, yet this increase in SH is perpetrated by a smaller percentage, 14 percent of males (Table 5).

As such, while age differences among perpetrators do not contribute significantly to the likelihood of SH, as a group, perpetrators are significantly different in individual characteristics from the overall male population. Together, Tables 3–6 clarify that the differences between perpetrator males and the overall male population arise primarily from individual characteristics rather than increased interaction between males and females.

Simulation results for the influence of organizational factors demonstrate that training and enforcement both reduce the likelihood of SH. Increase in training has a minor effect on reducing SH. Increasing training from low to medium and high reduces the average likelihood of SH from 36 percent to 35 percent, and 34 percent (Table 6). Results indicate that enforcement has a much stronger effect in reducing SH than training, for even moderate levels of enforcement produce significant reductions in the likelihood of SH, from 68 percent to 23 percent (Table 6). Further, increasing enforcement from medium to high reduces the average likelihood of SH from 23 percent to 14 percent (Table 6).

Our simulation experiment demonstrates how agent-based simulation can be used to explore and understand a CAS, such as, SH, in organizations. Our model was based upon existing theories and knowledge.

Moreover, it accounts for complex interactions between individual, situational, and organizational factors, and their impacts on the likelihood of SH incidence. Our results support previous studies and validate our model's assumptions. This agent-based simulation provides value in that it offers a tool to understand the effect of specific factors selected for inclusion in our model. Selected factors and factor levels can be adjusted to appropriately reflect a given workplace environment or even country culture. Agent-based modeling thus allows us to simulate different workplace environments to study the effect of a variety of factors on SH. As expected, our results are consistent with general findings in existing research. However, the simulation provides insights on interaction effects among factors, rather than single-item results.

Organizations can use agent-based simulation to determine their vulnerability to SH and their plans for how to minimize it. For example, an organization might want to know whether conducting additional training or spending effort in workspace reorganization to minimize interactions would have a greater impact on decreasing SH. To answer such a question, we can apply data-mining techniques to our simulation results. Specifically, we apply partitioning, also known as decision or regression trees, to our simulation output (Gehrke, Ramakrishnan, & Ganti, 2000; Murthy, 1998). Partitioning is a powerful, yet conceptually simple, method of nonparametric regression, which allows us to systematically analyze our output for unknown relationships and creates a successive tree of partitions between the dependent and independent variables (Kutner, Nachtsheim, Neter, & Li, 2005; Murthy, 1998). For our case, the dependent variable is the likelihood of SH; the independent variables are those listed in Table 2 and the interactions between male and female agents. A partitioning algorithm seeks to predict the dependent variable by repeatedly partitioning the X (predictor) space into rectangular regions, and then fitting a regression response surface to predict the mean likelihood of SH for each region. To find the best partition, the algorithm first examines all independent variables and determines the optimal predictor and *split* point so that the error sums of squares for the resulting partitions are minimized. The process then continues for each partition by determining a new optimal predictor and split point from the remaining predictors so that the error sums of squares are minimized. The resulting partition tree, the number of partitions and splits usually determined by a holdout or validation sample, provides organizations with a simple, yet powerful, approach to determine the steps needed to reduce SH.

Figure 3 shows a tree of decision rules that were obtained by applying partitioning to our simulation results. The top node indicates that, in the

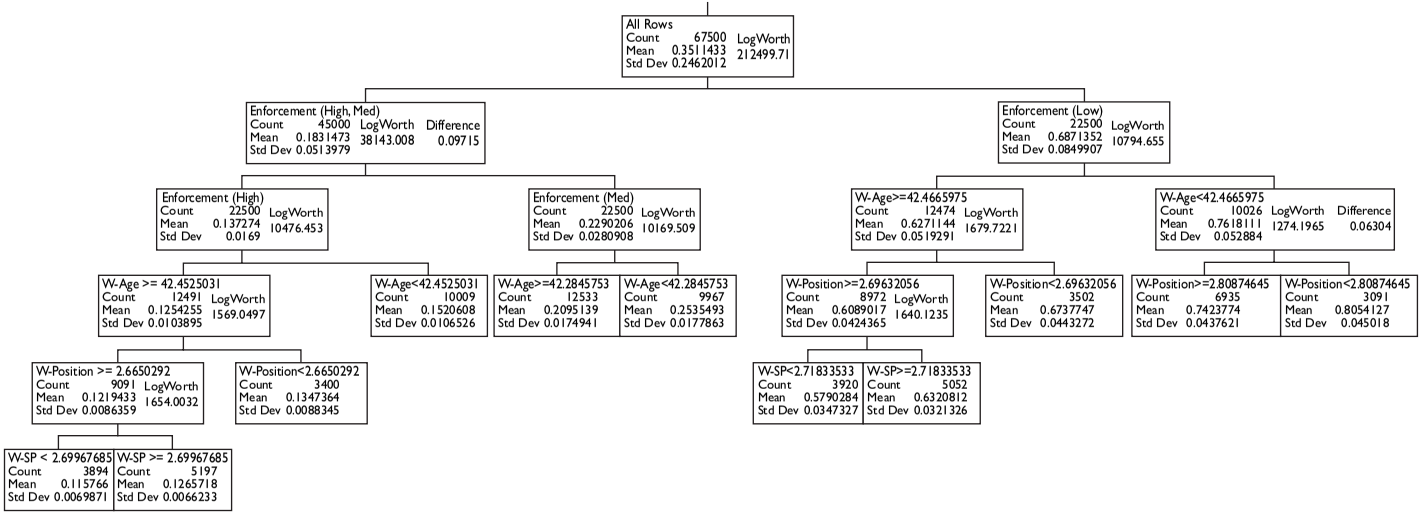

Figure 3. Decision Tree with All Factors

Source: Authors' own.

whole sample, the average likelihood of SH was 35.11 percent. Recall that the coefficients for all factors listed in Table 3 were all quite small, with the exception of that for enforcement. Similarly, Figure 3 indicates that enforcement is the factor with the greatest impact on SH. A medium level of enforcement reduces the likelihood of SH on average to 18.31 percent and a high level of enforcement reduces it to 13.7 percent. This is quite a steep decline considering that the likelihood of SH at a low level of enforcement is 68.71 percent. The next best set of predictors for SH is the individual characteristics of women.

For example, when enforcement is low and women are younger than 42.47 years, the likelihood of SH is 76.18 percent, compared to women older than 42.47 years, where the likelihood is only 62.71 percent on average. Next, in order of importance is women's position, followed by their SPA. Thus, the lowest likelihood of SH occurs when the level of enforcement is high and women are older than 42.45 years. The greatest likelihood of SH occurs when the enforcement level is low, women are younger than 42.46 years, they occupy a position lower than 2.8, and have higher levels of SPA. These women risk a likelihood of SH of nearly 82.48 percent compared to just 12.19 percent for the women experiencing the lowest likelihood of SH. The set of decision rules in Figure 3 explains nearly 98.8 percent of the variation in the likelihood of SH.

While the decision rules in Figure 3 provide insight into how different factors affect SH, the factors themselves may not be useful for an organization trying to understand where it should concentrate its efforts to reduce SH. For example, organizations cannot necessarily influence individual characteristics like age, but it might be possible to redesign workspace layout to decrease opportunities for interaction between males and females in enclosed spaces. To investigate this, we reran our partitioning algorithm by restricting the dependent variables to factors and policies within an organization's influence. Specifically, we considered enforcement, training, and the level of interaction as the dependent variables. The results in Figure 4 reflect that to achieve the greatest reduction in SH, an organization should concentrate on increasing the enforcement of SH policies. This is followed by low to moderate levels of training for all employees. Further effort should also be directed to understanding the level of interaction between males and females, rather than on more extensive training. These results, along with our above results on interactions (Table 6), suggest that while perpetrators in general do not necessarily interact the most with a given female, the level of interaction does play a role in affecting SH. As such, organizations should pay attention to their policies and workspaces that influence such interactions.

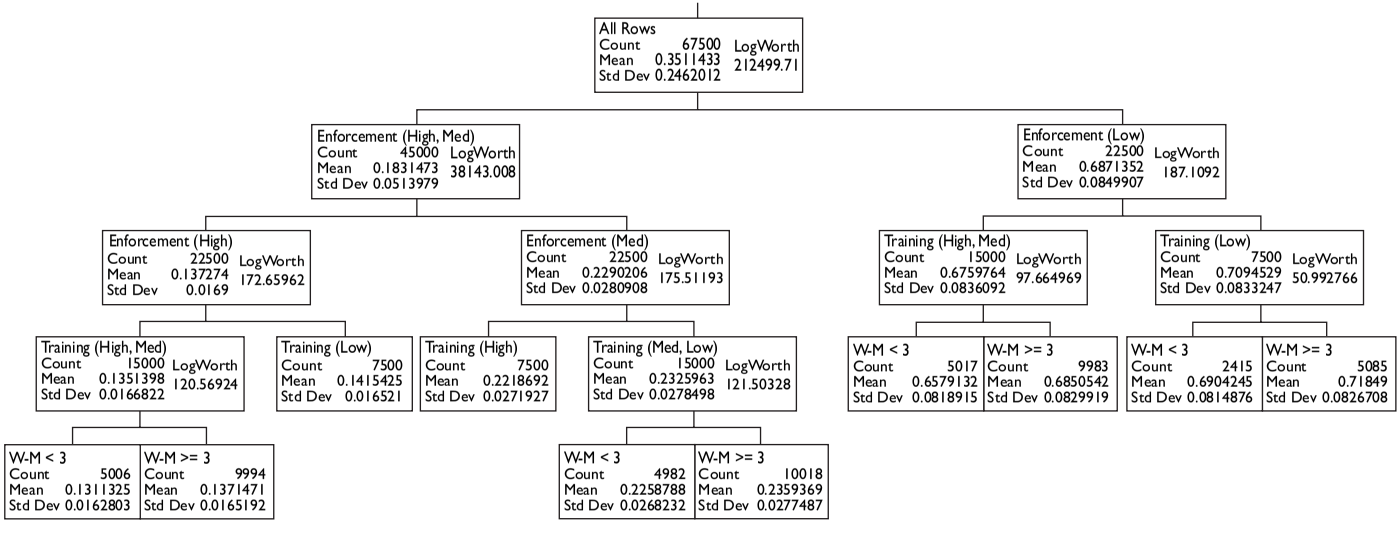

Figure 4. Decision Tree with Selected Factors

Source: Authors' own.

Discussion

Our analysis of the results indicates that the organizational factors, enforcement and training, have the greatest effect on the incidence of SH. All organizational efforts incur costs. SH incidences impact organizational costs associated with legal charges, productivity, turnover, and grievance procedures (Husbands, 1992; USMSPB, 1987, 1995). In a study of SH, costs done in the US Army, administrative costs were estimated, which included employee separation, replacement, transfer, and training, to be approximately US$ 185 million, and the cost of grievance procedures, which include medical and counseling services for targets, to be approximately US$ 120 million. Clearly, SH costs an organization a great deal of money and reputation. However, preventing SH also incurs costs in terms of training and enforcement. Most administrative costs associated with SH can be avoided by eliminating SH incidents; what remains is the time and money spent on preventing SH. Our simulation reinforces the notion that simply having an organizational zero-tolerance SH policy does little to impact SH incidents unless the policy is consistently enforced. Preventive enforcement requires a constellation of actions that together generate considerable cost. These include, but are not limited to, ensuring that supervisors understand the organization's SH policy and are capable of enforcing it; ensuring that supervisors spend time familiarizing employees with SH policies and periodically hold proactive discussions to remind them of these policies, as well as the separation and replacement of perpetrators, who might be highly skilled at their work and not easily replaced. Although we cannot put a number to the cost of preventive enforcement, we might expect that it is considerable. We have better information for training costs, which can vary significantly based on training approach. For example, SH training sessions for 1,000 employees annually might cost between US$ 3,000 and US$ 6,000 per employee, resulting in annual training costs of more than US$ 3 million (Corporate Campus Online, 2009). Further, evidence suggests that the costly endeavor of training is effective only if it is ongoing, provided at least semi-annually, and on employees' paid time (Husbands, 1992).

The set of rules provided by the decision trees above, along with our simulation results of the previous section, clearly indicates that enforcement is significant in reducing SH, which supports results from the previous studies (Gruber, 2003; Hertzog, Wright, & Beat, 2008). The set of decision rules in Figures 3 and 4 allows an organization to focus their efforts and resources on effective implementation of organizational

policies to reduce SH. For example, assuming that the costs are bearable, an organization might first consider moderate enforcement of policies (Figure 4). According to the simulation, this immediately reduces the average likelihood of SH from 69 percent (at low enforcement) to 23 percent (at moderate enforcement; Figure 4). Next, if the cost of training is not affordable, an organization can determine whether the level of interactions could be impacted by other means, such as, workspace alteration. Thus, by judiciously matching resources and goals to the effectiveness of different SH policies, an organization can be effective in reducing SH in the workplace.

Theoretical and Managerial Implications

Our study employs an agent-based simulation as a decision-making tool to analyze SH in the workplace. We believe that the results of this study could benefit researchers and managers in several ways. First and most importantly, the application of an agent-based simulation to study SH facilitates a holistic approach that employs a multifactor rather than an individual factor perspective. Such an approach will help to clarify the interwoven nature of the factors which impact SH incidents. This, in turn, will help to view the natural phenomenon in the close-to-natural setting where all impacting factors coexist and their relationships may oftentimes be difficult to predict by means of traditional methods. Unlike previous SH research that mostly examined multiple predictors of SH independently from each other (as simultaneous predictors in the regression model), our model facilitates tests of various models of SH in which a combination of multiple variables can be examined. The choice of such combinations should be driven by the characteristics of a particular organizational environment (e.g., organizational size, gender mix, the average employee age, and the level of enforcement of SH policies). Tailored to the characteristics of a particular organization, our model will therefore provide a "contextualized" test of the SH predictors and would allow the examination of the interaction effects that are particularly relevant for the organizational environment in question.

Additionally, the application of agent-based simulation to study the complex SH system may help organizations reduce time and cost incurred through reactive measures to reduce SH, as agent-based simulation may be used proactively to test an idea without actually implementing it. We have noted how, given certain individual, situational, and organizational

Table 7. Means for Sexual Harassment at Different Levels of Sexually Permissive Attitudes

I-SPA	Mean	Standard Deviation	Upper 95 Percent Mean	Lower 95 Percent Mean
0	0.5237	0.0726	0.5249	0.5224
0.5	0.6144	0.0744	0.6156	0.6131
1	0.7090	0.0783	0.7103	0.7076

Source: Authors' own.
Note: *N* for each mean is 13,500.

characteristics, organizations may apply agent-based simulation to obtain possible rates of SH incidents in the workplace as well as to find ways to reduce them by targeting the factors which have the maximum impact.

Second, simulation allows for the examination of the importance of different levels of each factor on the likelihood of SH. For example, if an organization wanted to understand more clearly the impact that varying levels of SPA might have on SH incidence, our model could be used to test different levels. For example, Table 7 shows the results of a simulation run where we vary the importance of sexual permissiveness toward the likelihood of SH. For this example, we fix the proportion of males at 50 percent, and training and enforcement at low levels, while varying the importance of age, position, and interactions at three levels, for each level of SPA that we consider. This results in 27 treatments for each level of SPA, where each treatment consists of 500 women, resulting in 13,500 observations for each mean value shown in Table 7. The results show that as individual levels of SPA decline (smaller values of I-SPA), the overall likelihood of SH drops, specifically from an average of about 71 percent for SPA = 1 to about 52 percent for SPA = 0.

Third, as Chattoe (1996) notes, simulations offer more comprehensible descriptions of systems, which make a model accessible even to non-specialists. Parameters in agent-based models are more likely to relate to observed phenomenon, which, in turn, makes simulation models more descriptively representative (Polhill, 2009). Hence, we believe that agent-based simulation can be easily implemented by organizations as a decision-making tool through which they can integratively assess and analyze the diffusion of SH in their workplaces.

Fourth, we believe that agent-based simulation may provide a unique potential for cross-fertilization between SH theories and organizational reality. The combination of the knowledge accumulated in the SH literature together with the characteristics that are specific to a particular

organization allows for a "real-life" application of natural phenomena. This is particularly important in an area, such as, SH, where actual data are difficult to collect. This synergy between theory and practice should result in a better understanding of SH, and consequently, of SH measures taken by organizations.

The proposed model is built on the premises of transferability and universality and thus can be effectively applied to other organizational contexts, including those across cultures. Empirical evidence indicates that SH is not limited to the US but is rather "a widespread universal problem" (Wasti, Bergman, Glomb, & Drasgow, 2000, p. 766). Yet, our understanding of the influence of culture on SH remains limited (Wasti et al., 2000). Considering the growing importance of multinational organizations and the increasing diversity within US organizations, understanding the influence of cultural values and norms on SH behavior becomes critical (Wasti et al., 2000).

Because of considerable cross-cultural variation in values as well as norms regarding women's sexuality and chastity, aggression, and sexual conduct (L'Armand et al., 1981), manifestations and outcomes of SH may vary across cultures. For example, the relation of SH to job satisfaction and job withdrawal is weaker in Turkey than in the US (L'Armand et al., 1981). This may be due to higher conformity and agreeableness values that are characteristics of the Turkish culture. Another cross-cultural study (Menon & Kanekar, 1992) found that men put more blame on the woman in a hypothetical incident of SH in the workplace than did women, and this finding was more pronounced in masculine societies which have a more distinct division of gender roles. In masculine societies, women in the workplace are perceived as the violators of their traditional "stay-at-home" roles (Brescoll & Uhlmann, 2005) and may be more prone to disrespectful treatment.

Our simulation model can be effectively used for comparative analyses of SH across cultures. To account for cultural influences, future researchers can incorporate cultural factors into the model. For example, masculinity can be introduced as an additional variable, with the levels of masculinity controlled by the slider. Researchers can therefore compare the model outcomes in countries high in masculinity (e.g., Russia) to countries low in masculinity (i.e., the Netherlands) (Hofstede & Hofstede, 2005). The hypothesized relationships may, for example, include higher likelihood of SH in the masculine than in feminine cultures.

In addition to differences in values and norms, organizational influences may also vary cross-culturally. While training is an indispensable

part of the US organizational environment (Brown & Sitzmann, 2011), the specifics of Russian and Chinese environments considerably limit training opportunities. Financial cutbacks and limited resources result in insufficient workplace training in Russia and China (Puffer & McCarthy, 2011). To examine the negative outcomes of the lack of training on SH frequency and severity in the workplace, future research can apply the proposed model by adjusting "training" to the required levels by using the slider. A similar approach can be used when considering economic differences among countries, such as, gross domestic product or unemployment level. These variables may be of particular importance when examining SH coping styles (L'Armand et al., 1981).

In sum, the above discussion and our results establish the importance and advantages of agent-based simulation for modeling complex systems. Specifically, compared to traditional modeling techniques, agent-based simulation modeling is flexible and well-suited to modeling complex systems while retaining the precision and power of the mathematical modeling techniques.

Research Limitations and Future Directions

This study has several limitations. According to Kleijnen (1995), simulation models require both verification and validation. Once the simulation model has been programmed, the researchers must verify it, that is, check if the computer code contains any programming errors ("bugs"). Then, model validation should be performed. As Knepell and Arangno (1993) note, the validation of simulation models should be both conceptual and operational. Conceptual validation establishes a match between the theoretical framework and the model outcomes, whereas operational validation examines the model performance over the range of model inputs expected for the intended use. In our study, we performed the verification of the model by checking intermediate simulation outputs through tracing and statistical testing, one of the verification methods identified by Kleijnen (1995). Furthermore, the comparison of the simulation outcomes with prior theoretical findings in the SH literature revealed an expected congruence. For example, the prevalence of SH in the male-dominated work environments (O'Leary-Kelly et al., 2000) was well supported by the simulation results. Similarly, the simulation outcomes demonstrated negative association between the female age and the propensity of being sexually harassed

at work, a finding which also aligns with prior studies (Lee et al. 2004). With both verification and conceptual validation of the model in place, the next step is operational validation, which is performed by using real-world data (Kleijnen, 1995). We suggest that future research include operational validation of our model by using input as well as output data collected in an organization (i.e., the actual number of employees, male–female proportion, and positions).

Another limitation of this study is related to the scope of the sexually harassing behaviors described by the simulation model. Although the model incorporates individual, situational, and organizational factors that impact SH, it does not distinguish between the range of possible SH behaviors. Therefore, another avenue for future research would be to use the proposed simulation model to examine different types of SH behaviors, and how they are influenced by various individual, situational, and organizational factors.

In addition, our model incorporates a limited set of individual, situational, and organizational factors and is not intended to be a comprehensive model of SH antecedents. As such, it represents a starting point to illustrate how agent-based simulation can be used to model and better understand SH. Future models might include additional antecedents, such as, organizational history of SH and SH litigation, supervisory experience in dealing with SH, and relevant elements of organizational culture. Further, models could also incorporate outcomes of SH, which may include, but are not limited to reduced productivity, increased stress levels and employee turnover (Fitzgerald et al., 1997; O'Leary-Kelly et al., 2009). The inclusion of the SH outcomes together with the antecedents would provide a more comprehensive model of workplace SH.

Finally, our investigation highlights the need for information regarding the costs associated with the enforcement of organizational SH policies. As noted earlier, research has investigated the costs associated with managing SH that has occurred. But we have little information on the costs associated with low to high levels of preventive enforcement of organizational SH policies. Because agent-based simulation allows organizations to weigh the relative costs and effectiveness of various actions to mitigate SH, it is essential to get a clear idea of preventive enforcement costs. Training costs are relatively easy to ascertain, but preventive enforcement cost estimates are needed to provide the key information upon which an organization can base its decisions regarding preventive actions.

Conclusion

In this article, we examine SH from a CAS viewpoint and model SH as an agent-based simulation. We consider the case of predicting the likelihood of male-to-female SH and constructed a simple model to illustrate the feasibility and potential benefits of the agent-based simulation approach. Due to privacy and legal concerns, SH research is notoriously difficult to conduct. Compared to traditional modeling techniques, agent-based simulation modeling offers several unique advantages. It is flexible and well suited to modeling complex systems and yet retains the precision and power of mathematical modeling techniques. In addition, it allows for a dynamic representation and modeling of a system so that scenario-based situations as well as nonlinear and adaptive interactions can be easily observed and analyzed. Agent-based simulation can provide data-based insights to guide effective organizational actions, which is the need of the hour.

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