An Agent-based Model of the Green Dot Violence Prevention Program on College Campuses

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What is the Green Dot Bystander Program?

An act of interpersonal violence ensues when one harms another through physical, psychological, emotional or sexual means. The act may occur in a variety of environments ranging from the workplace, the social scene, and, of particular interest to the authors, a hub of young adults: academic institutions such as colleges and universities. To some, the ramifications of interpersonal violence may be immeasurable, and its effects are more detrimental and noxious due to physical and psychological repercussions the survivor may face long after the incident has occurred.

Recently, the difficulty of addressing the issue of interpersonal violence on college campuses nationwide has come to light. It has been reported that an estimated 20% to 25% of women in higher education institutions will have been the target of interpersonal violence at least once during their four years at university (Fisher 2000). As such, many organizations across the country are working to find a solution to the issue.

Green Dot Etcetera (GDE) has made it its mission to tackle the problem of interpersonal violence by using techniques such as bystander training sessions and educational overview speeches designed to educate and empower students to take a stand against violence and intervene (perform what GDE terms a "green dot") when they recognize the early stages of a potentially violent act. According to GDE, their efforts have been able to effectively reduce the number of incidences of interpersonal violence (what GDE would call "red dots") on college campuses (Coker 2011).

Here we present an agent-based model (ABM) of the Green Dot program. ABMs are small scale models that imitate a larger environment and allow agents to interact with one another and their environment according to a set of user-defined rules. Since agents are autonomous, they have the capacity to adapt and alter their behavior throughout the course of a single simulation run. Particularly with adaptive behaviors, as the simulation progresses, peculiar patterns may emerge, allowing the observer to make key predictions about agent behaviors, and, in our case, make recommendations for improving violence prevention.

Key Model Components

To visualize the spread of nonviolence and to assist in model predictions, we are using the agent-based programmable Modeling environment NetLogo[4] (See Figure 1). The following are some of the model's key attributes:

Red agents are "red dotters," students that, if successfully coupled with a non-red dotter, will always seek to initiate a violent interaction.

Green agents are "green dotters," students that have taken the Green Dot training and have the ability to intervene in a potentially violent situation. **White** agents are students that are neither red dotters nor green dotters. User-controlled parameters: population size, percent green or red dotters, and tendencies to intervene, rest, and couple.

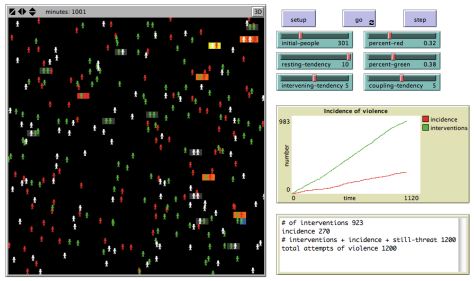

Figure 1. The Model's Interface

What's your green dot?
www.up.edu/greendot

Sensitivity Testing

Sensitivity testing allows the modeler to observe the influence of model parameters on specific model outputs of interest and can provide insight into which parameters most significantly affect the model output. Since we expect the number of interventions to depend on the number of couples, our output of interest is the ratio

$$\frac{\text{Total number of interventions}}{\text{Total number of coupling events}}$$

We were interested in observing changes in this ratio with respect to changes in the following parameters:

- Intervening tendency, ranging from 0-10 with default value of 5.
- Coupling tendency, ranging from 0-10 with default value of 5.
- Resting tendency, ranging from 0-10 with default value of 5.

We performed a one-at-a-time sensitivity analysis by varying each parameter of interest about its defined range, in unit increments, while keeping all other parameters fixed at their above default values. Each individual simulation was run for 1000 time steps, and every simulation was repeated 100 times due to inherent stochasticity in the model. For each simulation, the following parameters were kept fixed: percentage of red dotters: 7%, percentage of green dotters: 20%, and population size: 100. Results are shown in Figure 2.

Results of Sensitivity Testing

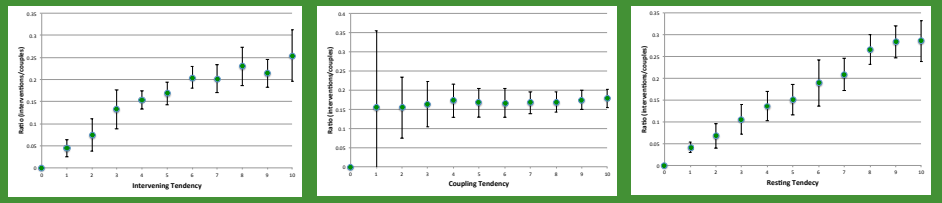

Figure 2. Changes in the ratio of number of green dot interventions to number of couples formed over a range of values of the intervening tendency of a green dotter (panel A), the coupling tendency of all turtles (panel B), and the resting tendency of a green dotter (panel C). Each parameter is varied from 0 to 10, and each data point is the average ratio over 100 simulation runs. Error bars represent one standard deviation above and below the mean ratio.

These results provide initial insight into the effectiveness of different bystander strategies in reducing the incidents of interpersonal violence (red dots) on college campuses. As seen from the Intervening Tendency plot (panel A), we see that the ratio of interventions to number of couples seems to exhibit logarithmic behavior, suggesting that at some point as we increase a person's tendency to intervene in a situation, we do not drastically increase violence prevention.

The Coupling Tendency plot (panel B) reveals linear behavior with a slope approximately equal to 0. At coupling tendency = 0 there are no couples and thus no opportunities for violence prevention. After coupling tendency of 1, the ratios do not increase or decrease in any sort of recognizable pattern, suggesting that an increase in tendency to couple results in an equal increase in number of interventions, as we would hope.

The Resting Tendency plot (panel C) reveals a linearly behavior with positive slope of approximately 0.025. As the ration of interventions to couples continues to increase, this suggests that a green dotters ability to notice a potentially violent situation could be the most important step in the violence prevention process.

Model Details and Assumptions

The primary goal of our modeling effort is to capture realistic social behaviors among all agents in order to make predictions about effective tools for violence prevention. The basic agents (referred to by Netlogo as *turtles*) in this model are college students, each of which is characterized by a single parameter we call "status" (green dotter, red dotter, and neutral), as defined in the Key Model Components section.

For simplicity, we make several key assumptions about the ways green dotters will interact with potentially violent situations as well as the ways in which all turtles interact with one another and with their environment: Unless coupled to another turtle, each turtle moves randomly throughout the environment. Each turtle that is a green dotter has an adjustable tendency to stay within a region when they observe a potentially violent situation (same tendency for all green dotters), and if they do stay, they also have an adjustable tendency to intervene, and this tendency is the same for all green dotters. At this point we assume that someone who is seeking to harm other individuals will never be a green dotter and that their status will always be the same, a red dotter. A red dotter is an individual that, if successfully coupled with another non-red dotter, will always seek to initiate a violent interaction. A neutral agent simply moves around the environment randomly and will neither intervene nor initiate any sort of violent coupling.

All turtles—red dotters, green dotters, and neutral—have an adjustable coupling tendency, which is the same for all turtles. This tendency controls the likelihood of two turtles entering into some form of close connection. When a red dotter is one of the turtles in the couple, the connection may escalate into a violent act if not stopped by a green dot intervention within a specified amount of time.

Future Work

As part of the reasoning behind the Green Dot Program curriculum is based upon the belief that there is great power in one individual's ability to influence others to intervene, one way in which we could improve our model is to allow green dot events to "convert" neutral and even red dotters to become green dotters. This adaptive behavior could provide great insight into the numerous complexities behind violence prevention. We also wish to incorporate a varied probability that someone who attends a Green Dot event will actually adhere to Green Dot's policies, as each individual necessarily acts and reacts in different ways depending upon their own education and comfort levels and on their particular environmental conditions.

Another attribute that we would like to add is the creation of different environments in the turtles' environment. For instance, for a model of a college campus, there could be a "Party Environment," a "School Day Environment," and a "Sleeping Environment." We also plan to take into consideration the effect of graduating and incoming students over the span of four years.

Each of these modification will allow for a more realistic model and in turn provide greater insight into how we may improve violence prevention on college campuses.

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