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**UTC2721 Project**

Modelling the bystander effect

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# **Introduction**

In 1964, Kitty Genovese was murdered in a stairwell visible to thirty-eight of her neighbours who heard her screams and witnessed the murder. Over the span of 30 minutes from the beginning of the incident, none of the neighbours contacted the police, let alone attempted to help her (Rosenthal, 1999). This is the textbook example of the bystander effect which refers to the social-psychological phenomenon where people are less likely to offer help when there are more people present. There are several posited explanations for the bystander effect such as “apathy, habituation, and fear of reprisal” (Hudson et al., 2004, p. 168) and hence, this paper will attempt to investigate the relative significance of the various factors required for the exhibition of the bystander effect through a cellular automata model written in NetLogo.

# **Literature Review**

Latané and Darley (1968) found that participants reported the incoming smoke upon noticing it most of the time when they are alone. However, when 2 other individuals posing as participants that are tasked to not respond to the smoke are present, participants reported the smoke only 10% of the time. The “likelihood of the emergency victim receiving help at all decreases as the number of bystanders increases” (Hudson et al., 2004, p.169) and Latané and Darley (1970) attribute the phenomena to 4 mechanisms:

1. **Self-awareness:**

The individual “does not want to appear foolish or inappropriate in front of others” (Hudson et al., 2004, p.170) and hence, would be inhibited from acting.

1. **Social cues:**

The individual “actively look to one another for cues about how to behave in the situation” (Hudson et al., 2004, p. 170) and will be less likely to act if others do not act as well.

1. **Blocking:**

The individual is less likely to act when there are multiple bystanders already acting.

1. **Diffuse responsibility:**

The responsibility is diffused when “only a small percentage of the bystanders can take action” (Hudson et al., 2004, p. 170).

The NetLogo model will draw inspiration from these mechanisms to simulate the bystander effect.

# **Model Design**

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(Fig 3.1 The NetLogo model after setup has been done)

The bystander effect model comprises of tasks (represented by white squares) and individuals (represented by the coloured people) as seen in Fig 3.1. During a simulation run, the model will increment in steps until completion.

The model comprises 7 modifiable global fields that will determine the behaviour of the model:

|  |  |
| --- | --- |
| **Modifiable global fields** | **Description of modifiable global fields** |
| number-of-tasks | The number of tasks present in the space |
| number-of-people | The number of individuals present in space who can complete the tasks |
| vicinity-radius | The radius around an incomplete task that is considered its vicinity. Individuals will consider the number of other individuals within the vicinity of a task before deciding whether to act on and complete the task. |
| initial-patience | The number of steps in the simulation the individual will remain interested in a task before deciding to be interested in another random task. This new random task the individual decides on could be the same task. |
| willingness-to-help | A parameter ranging from 0 to 100 that describes how willing individuals are to complete a task. |
| self-conscious-coeff | A parameter with a positive value that describes how sensitive the individual is to the number of people in the vicinity of the task. |
| dependence-exponent | A parameter that describes how sensitive the individual is to a large number of other individuals in the vicinity of the task. |

The task would represent an emergency that requires an individual to help. Each individual will locate the closest task and become interested in the task. When the individual is interested in the task, the individual will approach the task and stop when they are in its vicinity. The individual will have limited patience and when its patience runs out, the individual will randomly choose another task to be interested in. While the individual is interested in a task and is within the vicinity of said task, the probability of the individual acting on the task is given below:

|  |  |  |
| --- | --- | --- |
|  |  | (1) |

where *W* = willingness-to-help,

*S* = self-conscious-coeff,

*D* = dependence-exponent,

*N* = Number of other individuals present within the vicinity of the task

As the probability of one lending help to a victim is observed to be negatively related to the number of people present in the vicinity (Hudson et al., 2004), the equation is designed so that the probability of an individual acting on a task is also negatively related to the number of other individuals in the vicinity with 3 degrees of variation possible. When a task is completed, all individuals previously interested in said task would look for the next closest task to be interested in, repeating the cycle until all tasks are completed.

A screenshot of a computer

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(Fig 3.2 The NetLogo model upon completion of all tasks)

# **Findings**

We have taken the following values to be the default values of the modifiable global fields:

|  |  |
| --- | --- |
| **Modifiable global fields** | **Default values** |
| number-of-tasks | 100 |
| vicinity-radius | 10 |
| initial-patience | 100 |
| willingness-to-help | 50 |
| self-conscious-coeff | 1.0 |
| dependence-exponent | 1.0 |

The analysis will involve understanding the relationship between the number of steps taken to complete 100 tasks and the number-of-people under different values of the modifiable global field to attain a better understanding of the role each parameter plays in contributing to the bystander effect.

If otherwise stated, the conditions in the following simulations are performed with the default values and 100 runs are performed for each unique set of conditions.

## Effect of vicinity-radius

Chart, histogram

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(Fig 4.1.1 Effect of vicinity-radius)

The data shows that as the vicinity-radius increases, the number of steps increases regardless of the number-of-people. We also find that the vicinity-radius had little effect on the shape of the curve and hence does not drastically alter the relationship between the number of steps taken and the number-of-people.

## Effect of initial-patience

Chart, histogram

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(Fig 4.2.1 Effect of initial-patience)

The data shows that as the initial-patience increases, the number of steps decreases regardless of the number-of-people. However, this is only applicable when initial-patience is small in value as beyond a certain threshold, the effect of initial-patience is negligible. We also find that the initial-patience had little effect on the shape of the curve and hence does not drastically alter the relationship between the number of steps taken and the number-of-people.

## Effect of willingness-to-help

Graphical user interface, chart, histogram

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(Fig 4.3.1 Effect of willingness-to-help)

The data shows that as the willingness-to-help increases, the number of steps decreases regardless of the number-of-people. We also find that the willingness-to-help had little effect on shape of the curve and hence does not drastically alter the relationship between the number of steps taken and the number-of-people.

## Effect of self-conscious-coeff

Graphical user interface, chart

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(Fig 4.4.1 Effect of self-conscious-coeff)

The data shows that as the self-conscious-coeff increases, the number of steps increases regardless of the number-of-people. We also find that the self-conscious-coeff had little effect on shape of the curve and hence does not drastically alter the relationship between the number of steps taken and the number-of-people.

* 1. Effect of dependence-exponent

Graphical user interface, chart

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(Fig 4.1.1 Effect of dependence-exponent)

The data shows that as the dependence-exponent increases, the number of steps increases regardless of the number-of-people. However, unlike the other fields, dependence-exponent drastically alters the shape of the graph. When dependence-exponent <= 1.0, the graph is monotonic decreasing which means that number of steps taken decreases when the number-of-people increases. However, when the dependence-exponent > 1, the system exhibits the bystander effect where the number of steps taken decreases when the number-of-people increases and is small, but the number of steps taken increases when the number-of-people increases and is large.

## Summary of effects

The analysis shows that the modifiable fields (vicinity-radius, initial-patience, willingness-to-help, self-conscious-coefficient) alter the number of steps taken to complete one hundred tasks but preserve the monotonic relationship between the number of steps taken and the number-of-people. Hence, these fields are not able to induce the bystander effect in the system. However, only dependence-exponent appear to alter and break the monotonic relationship between the number of steps taken and the number-of-people. When the dependence-exponent > 1.0, we find that the monotonic relationship between number-of-people and the number of steps taken breaks and the bystander effect is exhibited.

# **Discussions**

## Diffuse responsibility

Based on our findings, we find that dependence-exponent is the key determining factor of whether the bystander effect is exhibited in the system.

Let us define responsibility as a quantity where the responsibility perceived by an individual is inversely proportional to the number of bystanders in the vicinity due to diffuse responsibility.

From this definition, we can form the relationship:

|  |  |  |
| --- | --- | --- |
|  |  | (2) |

where R = responsibility perceived by an individual,

n = number of bystanders in the vicinity not including himself,

k is some arbitrary constant.

Suppose that the probability of an individual acting is directly proportional to the responsibility they perceive.

|  |  |  |
| --- | --- | --- |
|  | for some arbitrary constant k’ | (3) |

Note that equation (3) above shares the same form as equation (1) defined earlier where dependence-exponent = 1 which we found to not exhibit the bystander effect. Hence, to exhibit the bystander effect, the supposition made is not correct and the probability of acting is not directly proportional to the responsibility they perceive. This could suggest that diffuse responsibility alone is not sufficient to explain the bystander effect if the definition of responsibility as a quantity is accurate. Hence, it is likely that the other 3 mechanisms proposed by Latané and Darley (1970) are necessary to create the bystander effect namely self-awareness, social cues, and blocking.

## Self-awareness

Hudson et al. (2004) stated that “self-awareness is an individual’s conscious awareness of others making judgments about that individual” and there is nothing about “whether or not others actually make judgments but rather refers to the perception of the individual” (Hudson et al, 2004, p. 185). We will assume that a more self-aware individual will pay attention to the possible judgement of individuals from a larger vicinity. Hence, we will define self-awareness to be positively correlated with vicinity-radius in the NetLogo model. Based on our findings, we saw that vicinity-radius do not induce the bystander effect but merely amplifies the effect if the phenomena are already present. This could suggest that self-awareness is also not sufficient to explain the bystander effect if our assumption of self-awareness is accurate.

# **Limitations**

Our simple model is unable to capture and study the other 2 mechanisms namely social cues and blocking. Hence, the model does not provide insights into the significance of social cues and blocking in the exhibition of the bystander effect. We have also made assumptions on what diffuse responsibility and self-awareness refer to evaluate their importance with the model. Future research might seek to extend this model to better understand the significance of the other 2 mechanisms in the exhibition of the bystander effect.

# **Conclusion**

Our simple NetLogo model demonstrates that the dependence-exponent parameter is the key determining factor for the exhibition of the bystander effect with other factors merely amplifying or dampening the phenomena. If we were to define responsibility as a quantity that is inversely proportional to the number of people present in the vicinity, we found that diffuse responsibility was not sufficient to create the bystander effect. If we were to take self-awareness as the size of the vicinity where the individual perceives judgement from others, we found that self-awareness was also not sufficient to create the bystander effect. This suggests that the bystander effect could be attributed to other reasons that could include but may not be limited to the other 2 mechanisms proposed by Latané and Darley (1970) namely (1) social cues and (2) blocking.

# **NetLogo Model**

Access the NetLogo model and the data generated here:

<https://github.com/StanleyNeoh/Bystander-Effect-Model>

(1957 words excluding cover page, table of contents and references)

# **References**

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