We investigated the number of steps taken to complete 100 tasks under different combinations of the 7 modifiable global variables. Under any combination of the parameters, 100 independent simulations are made and the number of steps for each are taken.

## Effect of dependence-exponent

Chart

Description automatically generated

Fig 4.1.1 Relationship between dependence-exponent and the number of steps taken

The number of steps taken for 50 individuals to complete 100 tasks increases at an increasing rate as dependence-exponent increases.

## Effect of self-conscious-coeff

Chart, histogram

Description automatically generated

Fig 4.2.1 Relationship between self-conscious-coeff and the log(steps taken) at different dependence-exponent

The number of steps taken for 50 individuals to complete 100 tasks increases as self-conscious-coeff increases regardless of the value of dependence-exponent. However, the degree of influence the self-conscious-coeff have on the steps taken is positively related to the dependence-exponent.

## Effect of vicinity-radius

Chart, bar chart, histogram

Description automatically generated

Fig 4.3.1 Relationship between vicinity-radius and log(steps taken) at different dependence-exponent

The number of steps taken for 50 individuals to complete 100 tasks increases as vicinity-radius increases regardless of the dependence-exponent. However, like self-conscious-coefficient, the degree of influence vicinity-radius has on the steps taken is positively related to the dependence-exponent.

## Effect of initial-patience

Chart, bar chart

Description automatically generated

Fig 4.4.1 Relationship between initial-patience and log(steps taken) at different dependence-exponent

The number of steps taken for 50 individuals to complete 100 tasks increases as initial-patience decreases regardless of the dependence-exponent when the initial patience is small. However, there is a threshold where once the initial-patience is above said threshold, initial-patience have negligible effect on steps taken.

## Effect of willingness-to-help

Chart, bar chart

Description automatically generated

Fig 4.5.1 Relationship between willingness-to-help and log(steps taken) at different dependence-exponent

The number of steps required for 50 individuals to complete 100 tasks decreases as the willingness-to-help increases regardless of the dependence-exponent.

## Effect of number-of-people

Chart

Description automatically generatedChart

Description automatically generated

Fig 4.6.1 Relationship between number-of-people and the number of steps taken

(dependence-exponent = 2.0 and self-conscious-coeff = 0.5 [left], 1.5 [right])

In Fig 4.6.1, the bystander effect can be clearly observed when dependence-exponent = 2.0 regardless of the value of self-conscious-coeff. When there is a small number of individuals doing 100 tasks, the number of steps taken to complete all tasks decreases as the number-of-people increases. Intuitively, this makes sense as there are more individuals completing the same number of tasks. However, the number of steps taken increases with the number-of-people when there is a larger number of individuals like what is observed in the bystander effect.

Chart, histogram

Description automatically generatedChart, histogram

Description automatically generated

Fig 4.6.2 Relationship between number-of-people and the number of steps taken

(dependence-exponent = 1.0 and self-conscious-coeff = 0.5 [left], 1.5 [right])

In Fig 4.6.2, by reducing the dependence-exponent from 2.0 to 1.0, we find that the bystander effect can no longer be observed. When the dependence-exponent is 1.0, the number of steps decreases as the number-of-people increases regardless to the number-of-people.

Chart, histogram

Description automatically generatedChart

Description automatically generated

Fig 4.6.3 Relationship between number-of-people and the number of steps taken

(dependence-exponent = 0.5 [left], 1.5 [right] and self-conscious-coeff = 1.5)

In Fig 4.6.3, we investigate other dependence-exponent values that are above and below 1.0. The plot on the left with a dependence-exponent = 0.5 < 1.0 does not display the bystander effect while the plot on the right with a dependence-exponent = 1.5 > 1.0 can be observed to display subtle signs of the bystander effect as seen in the slight increasing trend in the number of steps taken when the number-of-people is large. This suggest that that for the bystander effect to exhibit, it is necessary for dependence-exponent > 1.0, with the effect amplified by higher values of dependence-exponent and self-conscious-coeff.