Experiment Instructions for 'Investing in prevention or paying for recovery - attitudes to cyber risk'

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[We provide the instructions for the gain frame followed by those for the loss frame.]

Introduction

This is an experiment in decision making. If you follow the instructions and make appropriate decisions, you can earn a significant amount of money. You will receive your earnings for today's session in cash before you leave the laboratory

It is important that you remain silent and do not look at other people's work. If you have any questions, or need assistance of any kind, please raise your hand and an experimenter will come to you. If you talk, laugh, exclaim out loud, etc., you will be asked to leave and you will not be paid. We expect and appreciate your cooperation.

Everyone is the room is receiving exactly the same instructions.

The main part of the experiment will consist of **20** rounds which follow one after the other. Each round consists of 3 stages as we will explain below. Within each round you have the chance to earn Tokens. Each Token is worth 5 pence (20 tokens sum up to £1). As a reward for showing up at the experiment you start with an initial allocation of 100 Tokens (equivalent to £5).
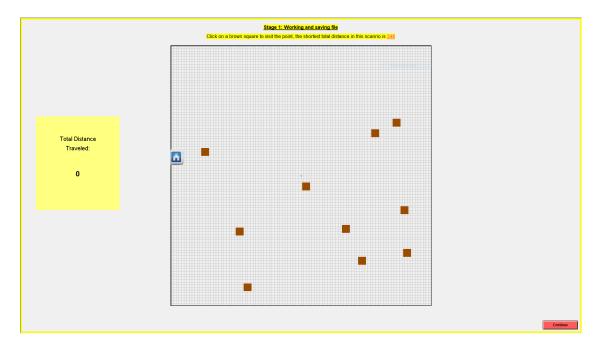
At the end of the experiment, two of the rounds will be randomly selected to determine your earnings for the experiment. Because you will not know which rounds will be selected until you have made decisions in all of them, **you should treat each round as if it will be a selected one**. Your total earnings for the session will be given by the total earnings from the selected rounds together with your initial 100 Tokens.

The Decision Task

The decision task in each round consists of 3 stages. The task will be framed in terms of writing computer files and then protecting those files from potential cyber attack.

Stage 1: Working and saving files

In Stage 1, you will complete a Traveling Salesman Problem (TSP), which is presented by a picture like this on your screen.

You will start from a home location, which will be indicated by a picture of a house. You need to move around the map, visit all the other 10 points, and then return to the home location.

The house and the 10 points are located on the map. The map is measured by 100 from top to bottom and 100 from left to right. As you move around the map visiting the 10 points, the computer will draw the path you take. The objective is to use as short a distance as possible. As a guide, at the top of the screen you will find the minimum possible distance.

After you complete the problem, your entries will be saved as a **computer file**. The **saved file is worth 100 Tokens**. You will then continue on to Stage 2.

Stage 2: Safeguard your files

In stage 2, the file you have saved in stage 1 has a chance of being lost because of a cyber attack.

- If you are attacked, you will lose access to the file saved in stage 1 and so it becomes worthless.

- If you are not attacked, you will not lose access to the file and so it is **still worth 100 Tokens**.

You have the opportunity to decrease the chance of being attacked at a cost. We will now explain how your chances of being attacked are determined and what you can do to decrease the chance of being attacked.

Your chances of being attacked if you do nothing

Imagine a box with 100 balls, 50 of them are red and 50 of them are blue. The computer will randomly select one ball from the box.

- If the selected ball is red, you will be attacked.

- If the selected ball is blue, you will not be attacked .

How to decrease the chance of being attacked?

You can spend Tokens to reduce the chance of attack. For each Token that you put in a cyber-security insurance account the experimenter will take one red ball away from the box. This means that the chance of getting attacked will be lower because there are fewer red balls in the box.

You can put any number of Tokens from 0 to 50 into the cyber-security account. Once you have made your decision the computer will randomly select 1 ball from the box.

- If the selected ball is red, you will be attacked and your file becomes worthless. Because your security failed you are not obliged to pay over the tokens put in your cyber-security account. So, overall you have 0 Tokens at this stage.

- If the selected ball is blue, your will not be attacked. Your **still have access to the file worth 100 Tokens**. In this case you do need to pay over the tokens put in your cyber-security account. So, overall the number of Tokens you have is $100 - Tokens\ in\ cyber\ security\ account$.

For example, suppose you choose to put 10 Tokens in your cyber-security account. Then there will be 40 red balls and 50 blue balls in the box. If the computer selects a red ball, then you will be attacked and have 0 Tokens. If the computer selects a blue ball, then you will not be attacked, keep the file, and you have 90 Tokens, $100 - 10$.

Stage 3: Recover your files after attack

If you are attacked in Stage 2, then in Stage 3 you have the chance to recover the file you lost, at a cost. Note that we will ask you to make choices in this stage before determining whether or not you are attacked. Hence, you should presume for the purposes of this stage that you have been attacked.

We will now explain how you can potentially recover your files.

Your chances of recovering the files if you do nothing

Since access to your file was lost at Stage 2, if you don't do anything in this stage, your files will be lost for ever. This means you end up with 0 Tokens.

How to potentially recover your files?

Imagine again a box with 100 balls. This time all of the balls are brown. You can spend Tokens trying to recover access to your file. If successful you **regain the 100 Tokens**. For each Token that you put in a recovery account the experimenter will replace one brown ball with one green ball. You can put up to 50 Tokens in the recovery account. After you have made your choice the computer will randomly select a ball.

- If the selected ball is brown, you do not recover your file. Also any Tokens you put in the recovery account are spent. So, overall you have $0 - Tokens\ in\ recovery\ account$. This will be taken from your show-up fee.

- If the selected ball is green, your files are recovered. **You regain the 100 Tokens**. So, the overall number of Tokens you have is $100 - Tokens\ in\ recovery\ account$.

For example, if you put 10 Tokens in the recovery account, the experimenter will replace 10 brown balls with green balls. This means there will be 10 green balls and 90 brown balls in the box. If the computer selects a brown ball from the box, your files are not recovered. Your earnings are $0 - 10 = -10$ Tokens. If the computer selects a green ball from the box, your files are recovered. Your earnings are $100 - 10 = 90$ Tokens.

Your earnings

You earnings for a scenario will be determined by chance and the amounts you put in cyber-security account and recovery account.

1. If you are not attacked in Stage 2. You will receive:

$$100 - Tokens\ in\ cyber\ security\ account.$$

2. If you are attacked in Stage 2. You do not need to pay over Tokens put in your cyber-security account.

   In addition:

   (a) If you recovered your files in Stage 3, you will receive:

   $$100 - Tokens\ in\ recovery\ account.$$

   (b) If you did not recover your files in Stage 3, you will receive:

   $$0 - Tokens\ in\ recovery\ account.$$

Your final earnings

We will select randomly 2 out of the 20 rounds. Your final earnings will be the sum of your earnings in these 2 rounds plus 100 Tokens from initial allocation (the participation payment). Each Token is worth 5 pence.

Stage 2: Safeguard your files

In stage 2, the file you have saved in stage 1 has a chance of being lost because of a cyber attack.

- If you are attacked, you will lose access to the file saved in stage 1 and so it becomes worthless. You, therefore, **lose the 100 Tokens**.

- If you are not attacked, you will not lose access to the file and it is still worth 100 Tokens. You do not lose anything.

You have the opportunity to decrease the chance of being attacked at a cost. We will now explain how your chances of being attacked are determined and what you can do to decrease the chance of being attacked.

Your chances of being attacked if you do nothing

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- If the selected ball is red, your will be attacked and your file becomes worthless. **You lose 100 Tokens**. Because your security failed you are not obliged to pay over the tokens put in your cyber-security account. So, overall you have 0 Tokens at this stage.

- If the selected ball is blue, your will not be attacked. In this case you do **need to pay over the tokens put in your cyber-security account**. So, overall the number of Tokens you have is $100 - Tokens\ in\ cyber\ security\ account$.

For example, suppose you choose to put 10 Tokens in your cyber-security account. Then there will be 40 red balls and 50 blue balls in the box. If the computer selects a red ball, then you will be attacked, you lose 100 tokens, and have 0 Tokens. If the computer selects a blue ball, then you will not be attacked, and you have 90 Tokens, $100 - 10$.

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Since access to your file was lost at Stage 2, if you don't do anything in this stage, your files will be lost for ever. This means **you lose the 100 Tokens**.

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- If the selected ball is brown, you do not recover your file. The **100 Tokens are lost**. Also any Tokens you put in the recovery account are spent. So, overall you have $0 - Tokens\ in\ recovery\ account$. This will be taken from your show-up fee.

- If the selected ball is green, your files are recovered. You do not lose the 100 Tokens. So, the overall number of Tokens you have is $100 - Tokens\ in\ recovery\ account$.

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