

## 6 Appendix

### 6.1 Instructions

## WELCOME

Thank you for taking the time to participate in my experiment.

In this study, human behavior is investigated in a **foraging game**. You will play a foraging game in a **galaxy** with **infinite planets**.

The study consists of an **instruction page**, a **foraging game** and a **questionnaire**. This experiment is going to take about **10 minutes**. Your full **attention** is needed for this period. Therefore, we would like to ask you to remove any distractions (e.g. phones) before starting to play the game.

At the end of the game you can fill in your email address if you'd like to participate in the lottery to win a prize. Out of the 5 best players, 1 will be randomly picked and paid according to their total score. This means that if the total score is for example 10000, the winner will receive 10 euros. The winner will be informed by email.

At the end of the game, we will ask a couple of **behavioral questions** and **demographic questions** for statistical purposes. Therefore, we would like to point out that your identity will remain completely **anonymous** and any information provided will remain completely **confidential**. The outcomes of this study may be used only for scientific purposes and will not be shared with any third parties.

This study is part of a Master's Thesis in **Neuroeconomics** at the University of Amsterdam (UvA). It has been designed and programmed by Moira Lampe with the supervision of Alejandro Hirmas Frisius. If you have any questions about this study or concerns about privacy, please feel free to contact me (moira.lampe@outlook.com).

Please conduct this experiment on a **laptop or computer** and **do not refresh** the page during the entire experiment!

By clicking the next button below, you agree to the terms and conditions, that your participation in this study is voluntary and you may terminate the participation at any time for any reason. By pressing the next button you will continue to the **instruction page**. Please read the instructions carefully.

Next

## Instructions

Imagine that you are on a **spaceship** in a **galaxy** with infinite **planets**. You left **Planet Earth** because its **resources** have been fully **depleted**. You are one of the lucky ones who made it to one of the **spaceships**. Your **survival** now depends on finding a **resourceful planet** in order for you and your people to start a new life.



This is a **foraging game** and it is about testing which **decisions** you would make in such an environment. In the **context** of this game, **foraging** means **gathering/collecting resources**.

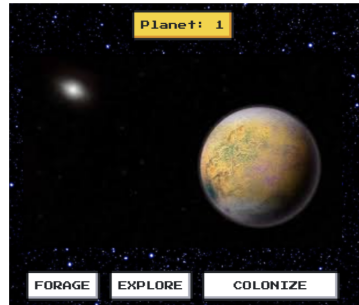
You will navigate through **space**, discover different **planets**, evaluate their **value** and decide whether you want to **stay** or **move**. The **goal** is to **forage planets**, which in turn will give you **resource points** and to ultimately find a **planet** that can provide you with the needed **resources** to **survive** and that you want to **conquer**.

## Decisions

In the beginning of the game, you do not know anything about the galaxy. You also have little information about the planets. The only thing you know is that planets' resources will be shown in terms of a payoff that can vary between [0, 100].

You have **5 levels** to complete. In each level you will play multiple rounds, where you can make **3 decisions**:

1. **Forage**
2. **Explore**
3. **Colonize**



## Forage

If you decide to **forage** on a given **planet**, you will get to know how rich this planet is in terms of **resources**. With **every time** you decide to **forage** on this **planet**, you are **already collecting resources** that will be added to your **total score** of this level. Remember, the resources will be shown in terms of a **payoff** that can go from **0 to 100**.



Every day the harvest can change a little bit. Every round, the value you receive can vary up to 10 points from the planet value (from -10 to 10).

**Example:** Let's say that planet 1 has a randomly specified value of 50. Every round that you decide to forage on this planet's resources, you will be given a random value that ranges between 40 and 60 [40, 60].

By **foraging** on a **planet**, you **learn** more and more about its **value**, which will give you a **better idea** about whether this **planet** will be **feasible** for you and your people (in the long run). If you **decide** to **exploit resources** on a **planet**, you gather **resources** in the form of a payoff.

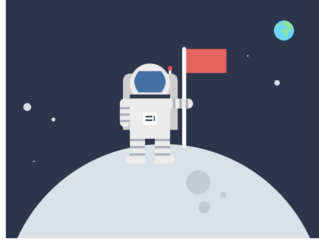
## Explore

If you do not wish to **stay** on the **current planet**, because you do **not like the payoff** of the **planet** or because you believe that there might be a better planet in the orbit, you can decide to keep **exploring** and thereby going to the next **planet**. **Travelling** from one planet to the next one also comes with a **cost** as you will have to use some of your **resources** to travel there. This is the **exploration cost**, that you will **learn** about **before** every level starts. If you decide to keep exploring, you **cannot** go back to the previous planet.



## Colonize

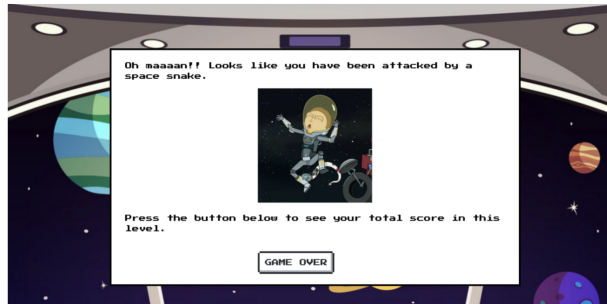
If you think that you have found a **planet** that gives you **enough resources**, you can decide to **stay** on this planet **forever**. In order to do this, you can just click the button **Colonize**. Your **payoffs** will then **automatically** be iterated through the rounds until the **game ends**. This means that for this level your **decision-making** is over.



## Rounds and Levels

The game consists of **5 levels**. In each level, you will be navigating through a galaxy with an **infinite amount of planets**. With every time you **forage**, you go up one round, which is equivalent to **1 day**. With every time you **explore**, you lose **resources** (**exploration cost**).

**BE AWARE:** the galaxy does **not** come **without danger**. It is long known that there are **space snakes** around, and there is a **5% chance** that they **attack** you and your people. The level will go on until you are attacked by **space snakes**. This can either happen while you are still **foraging** or during the days on the planet which you decided to **colonize**. If you get **attacked by space snakes** while you are still actively **foraging**, you will see a **GAME OVER** page.



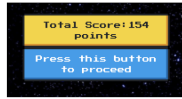
If you get **attacked** while you are already settled down on a **planet**(colonized), you will be informed on the **final results page** of this level.

When the **game ends** in this **level**, you will be sent to the **next level**. This will be a **different galaxy**, with **different planets**. It is important to note that each level is **independent** of each other.

After you have **finished the game**, you will be sent to the follow-up **behavioral** and **demographic questions**.

## Payoff and Main Goal

Your **payoff** depends on the score you receive with each day you are **foraging** on a **planet**, the **payoff** you receive on the **planet** you decided to **settle** down on and the **exploration cost**.



**EXAMPLE:** suppose on "**Planet 1**" on the first day you receive a **payoff** of **60** after you decided to **forage**. The second day **51**, after you decided to **forage** again on the same **planet**. Then you decide to keep **exploring** to find a **better planet**, and **forage** on "**Planet 2**" on day 3 and receive a **payoff** of 80. Now suppose you want to **stay** on this **planet** and press **colonize**.

Then your **TOTAL SCORE** in that **level** will be:  
 $60 + 51 - (\text{exploration cost}) + 80 + \text{'sum of all the upcoming values on that planet until the game ends'}$

If you want to know your total score and want to know how well you did compared to other players, please provide your email address in the demographic questionnaire. You will receive an email within the next 2 weeks. The same email will also announce the winner. Below you can also select a nickname you would like to use throughout the game. This nickname will then also be shown on the score page that will be sent to you by email.

**TO SUM UP:** Your **goal** is to try to have the **highest score** possible in each level while facing the constraint of having **exploration cost**, no way of **recalling** the **previous planet** and the possibility of the **game ending at random**. **GOOD LUCK!!!**

## ATTENTION

Please **do not refresh** the **page** at any time **during the experiment**. If you wish to **re-start the experiment**, please **contact me** and I'll send you a **new link**. **Thank you!**

By **clicking** the **next button** below, you agree that you **carefully** read the **instructions**, and are now ready to **start the game**.

Next

## 6.2 Big Five Personality Test

Please indicate how much the following statement applies to you. With 1 being least applicable and 4 being most applicable.

"I am a fearful person."



### 6.3 Holt-Laury List

The Holt-Laury Task measures risk aversion. In this task, participants are given a set of paired lottery choices. These pairs are structured so that the lesser payoff in choice "A" is always worth more than the lesser payoff in choice "B" (e.g., the high payoff in "A" is \$2.00 and the low payoff is \$1.60, whereas the high payoff in "B" is \$3.85 and the low payoff is \$.10). Initially, the chance of the high payoff is 1/10 and the low payoff 9/10. With each step, the probability of the high payoff steadily increases by 1/10 (e.g., the second pair has a 2/10 probability for the high payoff and 8/10 for the low payoff). When the probability of the high payoff is low, choosing the "B" lottery is seen as the risky decision. As the probabilities change, the expected value of "B" over "A" increases. When this occurs, continuing to choose the "A" lottery indicates risk aversion.

Option A: 10% chance of 100 euros 90% chance of 80 euros.

Option B: 10% chance of 190 euros 90% chance of 5 euros.



### 6.4 Bellman Equation

$$V(stay, V) = V + \beta * V(stay, V) \quad (1)$$

$$\Leftrightarrow V(stay, V) = \frac{V}{1 - \beta}$$

$$V(moving, V) = -c + \beta \int_V^0 * v(move) \frac{du}{100} + \beta * \int_V^0 * v(stay, v) \frac{du}{100} \quad (2)$$

$$\Leftrightarrow V(moving, V) = \frac{1}{1 - \beta * \frac{v}{100}} * (-c + \beta * \frac{100^2 - v^2}{2 * 100 * (1 - \beta)})$$

$$\frac{v}{1 - \beta} = \frac{1}{1 - \beta * \frac{v}{100}} * (-c + \beta * \frac{100^2 - v^2}{2 * 100 * (1 - \beta)}) \quad (3)$$

$$\frac{v}{1 - 0.95} = \frac{1}{1 - 0.95 * \frac{v}{100}} * (-5 + 0.95 * \frac{100^2 - v^2}{2 * 100 * (1 - 0.95)}) \quad (4)$$

$$v = 72 \text{ if } c = 5$$

$$v = 66 \text{ if } c = 50$$