// Introduction?

Project Stars is a simulation in which an organism has to overcome the destruction of their home planet. As their star reaches its final one-thousand years, the organism’s goal is to survive the catastrophes with which its civilisation is about to be hit and manage to escape towards a new, more distant and fertile planet.

**Vision**

// 1 page max with why and what //gui what we want to achieve with gui

**Concept**

The Project Stars simulation follows the progression of an organism in its race against time and destruction. Its main goal is to escape its home planet and find a new, more distant world where its civilisation can further improve itself and continue its space quest. The organism’s final one-thousand years of civilisation before catastrophe hits, symbolises the inevitable confrontation of a race with its annihilation.

At the start of each simulation, Project Stars offers the user a star system consisting of one star and a number of planets to choose from. These planets are generated on so called planet rings, which are possible locations for planets to exist at, each at a particular distance from the system’s star. It should be noted that the Goldilocks’ Zone or GZ contains the planet rings that spawn the most optimal and easiest planets for the organism to survive on. Similar to how Earth is a planet within the GZ, these planets come with very strong and positive attributes.

Each planet is equipped with an information panel where these attributes are listed, allowing the user to make an informed and optimal selection based on said information -- if they so choose to. The user’s planet of choice turns this planet into the Main Planet or home planet.

Initially, a planet has (1) a distance from its star, (2) a planet radius, (3) the percentage of landmass, (4) a value indicating the quality of the atmosphere, and (5) an average surface temperature. Finally, values (3) and (5) are combined into one attribute that indicates the overall quality of the planet, which can be seen as an overall score for that planet.

It is assumed that the planet’s organism commences its journey with the technology and wisdom of a humanlike civilisation during the era of Enlightenment (the 18th century).

As the simulation -- and therefore the organism -- progresses, a planet will also indicate what (6) the organism’s overall health (population health) is and what (7) the total amount of living organisms (total population) is. The simulation progresses through what are called turns. One turn equals ten years, so the simulation supports a grand total of one-hundred turns before the organism’s time runs out.

The organism has access to four technologies: agriculture, medicine, architecture and engineering. The user is allowed to spend a total of twelve points in the first three technologies to boost the initial values. These will further increase as the user’s organism progresses throughout the simulation to a cap of fifteen for the first three technologies and a cap of thirty for engineering.

Technologies play a major role in the survivability of the organism, as they will directly influence the susceptibility of the organism to disasters. The organism is allowed to research passively into one technology at a time, as such generating one point per five turns. Furthermore, they influence the quality of life, which is a grand total of the usable landmass, average surface temperature and population health.

Disasters are one of two, the other one being Breakthroughs, simulation mechanics that are part of the Events. An event is Project Stars approach to simulate reality by adding the randomness and unpredictability of daily life. Disasters have negative effects on the planet and organism, whilst Breakthroughs have positive effects. Both of them appear in wide variety and the frequency and gravity depend on how long your organism has been alive for. A full list of all disasters and all breakthroughs with their corresponding effects can be found at X.

The ultimate goal of the simulation is to escape the organism’s home planet within one-thousand years. This can be achieved by reaching a Progression of 1000. Progression is the simulation’s way of showing the user how advanced the organism has become. It is based on the amount of organisms alive -- and therefore the quality of life -- and the engineering technology.

**Functionality and simulation mechanics**

This chapter will go into the functional detail of every aspect and mechanic of the simulation. This includes the star system, the planets and their attributes, the organism and their attributes, events and the GUI. MORE TEXT HERE?

1. **Star System**

A star system is the environment in which the simulationtakes place. It contains a single, near-death *star* and a number of planetsbetween five and seven. These planets are generated on so-called planet rings. A planet ring is a possible location for a planet around its star. Project Stars has a set total of eleven rings that it chooses at random distances from the star, but allows for expandability for even more rings. The user is guaranteed to have at least three rings (or possible planet locations) in the so-called Goldilocks’ Zone.

The star system can be divided into three main zones: the near-star zone, the Goldilocks’ Zone or GZ, and the distant-star zone. The Goldilocks’ Zone is the most optimised region for a planet to live at. It is a zone at a set distance from its star that has optimised planet attributes for an organism’s survival, thus providing the user with a higher chance to successfully complete the simulation.

Project Stars’ GZ starts at 135 million km and ends at 180 million km. The predefined centre of the GZ is set at 150 million km, which is the real-life definition of one AU or Astronomical Unit. The near-star zone spans from 10% to 90% of the GZ centre – in others words 15 million km through 135 million km. The distant-star zone spans from 120% to 240% or the GZ centre – in other words 180 million km through 360 million km.

The star system is acted upon by the operator turn. The turn mechanic is a key functionality that allows the user to progress throughout the timeline, with each turn being ten years out of a total of 1000 years. The simulation ends when 100 turns have been completed.

1. **Planets**

Initial planet attributes are randomly generated, whilst still taking some predefined limitations into consideration. A planet has four initial characteristics that define what it is like: its (1) planet name, (2) distance, (3) atmosphere and its (4) landmass. A planet also has two calculated attributes that are determined through three out of four of its initial attributes (planet name is merely an aesthetic function). These two calculated attributes are (5) the (average surface) temperature and the (6) the planet quality. Planet attributes are displayed in the information panel (cfr. x) together with the organism attributes.

A planet has a seventh attribute, its radius, which is determined through the distance of the planet to its star, but it is only used in the GUI to draw the planets. It holds no value elsewhere in terms of calculations.

**Determining the six planet attributes**

1. Planet name

A planet’s name is randomly fetched from a csv file that contains a wide array of available, existing planet names (cfr. x to view all planet names).

1. Distance

A planet’s distance, from its star, is calculated in the star system and can range anywhere between 15 million km and 360 million km (cfr. x to view the formulas that generate the distances).

1. Atmosphere

A planet’s atmosphere is a randomly generated integer between 80 and 100 for planets in the GZ, and a randomly generated integer between 1 and 40 for planets outside of the GZ, i.e. the near-star zone or distant-star zone.

1. Landmass

A planet’s landmass is a randomly generated integer between 10 and 100 that determines the total amount of landmass that is available to a planet.

1. (Average surface) Temperature

A planet’s average surface temperature is calculated through its distance and atmosphere. Planets that are further away from their star are generally colder and vice versa. A planet that is generated inside the GZ has a temperature ranging from -25 °C to 50 °C, whereas a planet outside this zone has a temperature of -250 °C to 500 °C (cfr. x to view the formulas that calculate the temperature).

1. Planet Quality

Planet quality is Project Stars’ way of showing the user an average score between 0 and 100 and covers all of the above planet attributes. It is initially presented to the user and indicates how well-suited a planet is to be inhabited by an organism, in an effort to guide them in their selection of a main planet (cfr. x to view the formulas that calculate the planet quality).

1. **The Main Planet**

A main planet is the user’s planet of choice to harbour life for its organism. It keeps all planet attributes it had prior to being selected as a main planet, but gains one planet attribute and a number of extra attributes that belong to the organism that lives on it. These organism attributes are: (1) the total population of the organism, (2) four technologies, (3) population health, (4) life quality, (5) a research focus and (6) progression. The planet attribute that is gained, is (1) usable landmass and is unique to the main planet.

**Determining the additional planet attribute**

1. Usable landmass

A main planet’s usable landmass is the planet’s landmass that is fit for building and farming. It therefore depends on agriculture and architecture and is calculated through these two technologies along with the total landmass (cfr. x) a planet has (cfr. x to view the formula that calculates the usable landmass).

**Determining the six organism attributes**

1. Total population

The total population of the organism is set to 100.000 at the start of Project Stars’ simulation, but can easily be altered. The main planet also keeps track of the total population in the system’s previous turn, i.e. the previous population, and uses their difference to determine the approach to the calculation of the progression (cfr. x to view the formulas that calculate the total population).

1. Technologies

An organism’s technologies shields it from disaster and functionally influence a whole array of other attributes that belong to the organism. The four available technologies are (1) medicine, (2) agriculture, (3) architecture and (4) engineering. The user is allowed to spend a total of twelve points to their heart’s content in the first three technologies. The higher a technology is, the more effective it will protect the organism from disaster and the more it will positively influence other organism attributes.

1. Medicine aids the organism in their combat against disasters such as diseases. Medicine directly influences the regeneration of the population health of an organism and indirectly influences the quality of life of said organism.
2. Agriculture aids the organism in their combat against disasters such as diseases and famine. Agriculture indirectly influences the quality of life of an organism.
3. Architecture aids the organism in their combat against disasters such as natural disasters. Architecture indirectly influences the quality of life of an organism.
4. Engineering aids the organism in their combat against disasters. Engineering directly influences the quality of life of an organism and is a major component of the progression mechanic.

Technologies have a built-in cap, which means they cannot increase indefinitely. The first three technologies have a cap of 15, whereas Engineering has a cap of 30 (cfr. x to view the formulas that update the technologies). Functionally, engineering is allowed a higher cap, because it has a significant weight factor in the calculation of the progression. Overall, this higher cap has a positive effect on the progression mechanic.

1. Population health

The population health (0-100) of an organism is an indicator for its well-being and its regeneration is dependent on the technology level in medicine. It is possibly negatively affected by the health multiplier as a result of disasters (cfr. x). Population health is visually represented by a keyword that is determined as followed: 100-70: Healthy, 70-40: Average health, <40: Bad health.

1. Life Quality

The quality of life (also referred to as life quality) is the combination of the usable landmass, average surface temperature, population health and the technology level in engineering. Its functionality can be viewed as similar to planet quality: a simple percentage that indicates the how good the overall state of the organism is (cfr. x to view the formulas that calculate the life quality). This life quality is a factor that is used to calculate the total population for the organism.

1. Research focus

Research focus or technology focus is the organism’s way to passively gain a point in a particular technology every five turns. The user has a choice to alter the organism’s technology focus every turn, but that will reset and nullify the previous turns that had been spent towards a technology point (cfr. x to view the methods that determine the research focus).

1. Progression

The progression mechanic is what indicates the organism’s level of sophistication on a scale of 0 to 1000 and is what ultimately leads to the organism’s escape from its home planet -- in other words the successful finalisation of the simulation.

If the population is not on the decline, the progression is dependent on the technology level in medicine, architecture, engineering, life quality and the total population.

However, in a scenario where population has decreased in relation to the previous turn, progression is no longer dependent on the before-mentioned technologies, but solely dependent on life quality and the difference in population between this turn and the previous (cfr. x to view the formulas that calculate the progression).

Progression is visualised as a progression bar that tells the user what the total progression is and how much progression will be gained or lost upon ending the current turn. (MOVE ME)

1. **Events**

An event is Project Stars approach to simulate reality by adding the randomness and unpredictability of daily life. Events can occur as being beneficial or harmful to the planet and organism, the former being a breakthrough and latter being a disaster.

Disasters are based on a multiplier-effect approach, which means that they change the current value of an attribute by multiplying it with the multiplier. These multiplier will always be less than 1 but higher than 0, and as such effect it negatively. Breakthroughs, on the other hands, are not based on a multiplier-effect approach and as such they will always add one point to one of your technologies. The technology that is increased is determined by the breakthrough. A full list of all disasters and all breakthroughs with their corresponding effects can be found at x.

1. **Visualising Project Stars (GUI)**

//todo: add text explaining why we wanted visualisation and what we got out of it

//todo: add in images of the GUI with explanation

**Implementation**

//class diagrams, diagrams, code, methods, gui, formulas with corresponding methods