

Assignment 3

GAME DESIGN PROJECT



Space Colonies

- Colonize space and wage interplanetary warfare

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1 Introduction

This section will give the reader an introduction to what this report is about and how it is supposed to be read. The unique selling point of the game is also included in this section.

1.1 Design Patterns & Game Mechanics

Within this paper, game design patterns will be written using CAPITAL LETTERS, and game mechanics will be written in *italics*.

By default, all referenced patterns are as defined in Björk, S. (2018). However, self-defined patterns will be accompanied by an '*' and can be found in Appendix A.1.

The term “mechanic” refers to both primary and secondary core mechanics as described in Sicart, M. (2002). These are all self-defined and can be found in Appendix A.2.

1.2 Introduction to Space Colonies

Space Colonies is a strategic two player game where the players *build* colonies on different planets to *expand* their empire in a space themed setting. The players use the planetary RESOURCES to *construct* Ports and Ships, in order to get the military upper hand and *destroy* the other player’s empire. The game revolves around *resource production* tied to STRATEGIC LOCATIONS on the game board. The main actions players take are *moving units* around the map, *building* more constructions, and *destroying* the opponent’s constructions.

The target audience is people interested in competing using their cognitive capabilities. More specifically, competitive players interested in digital real time strategy (RTS) games or board games such as Chess (Ultra Boardgames 2019?). The game’s core aesthetics include fighter-looking ships ready for battle, invoking a feeling of wanting to send them into battle against the opposing player. The physical board is intentionally large to match the aesthetics of how vast space is.

The game has been developed using methods and advice described in the book “Game Design Workshop” (Fullerton 2018), and its corresponding chapter written in paragraph header, if nothing else is referred to. Method names are underlined. We define the methods in the book as the blue header names, and names we think are methods, based on their description. For the playtesting we refer partly to an in-course guest lecture by Sivertsson (2019).

1.3 Unique Selling Point

Space Colonies is a two player game with a unique combination of TACTICAL PLANNING, RESOURCE MANAGEMENT dependent on AREA CONTROL, and MASS UNIT MOVEMENT*. These patterns combined makes this game more engaging than its competitors in different aspects. For example, in Chess (Ultra Boardgames 2019?) you can move game pieces but only one at a time, and there is no RESOURCE MANAGEMENT. In Warhammer: Mass Combat Fantasy Roleplaying Game (Games Workshop Ltd. & Descartes Editeur n.d.), one moves all of one's game pieces but due to it including RANDOMNESS, it lack the full strategic and deterministic gameplay of Chess (Ultra Boardgames 2019?). In Risk (Lamorisse & Levin 1959), players get income dependent on AREA CONTROL; however this game also depends heavily on random elements.

Arguably Space Colonies is the closest board game to the TACTICAL PLANNING experience of a digital real time strategy (Casteel 2017) game, such as the inspiration StarCraft (Blizzard Entertainment 2019), even if it is even closer to a turn based game such as Heroes of Might and Magic (Ubisoft 2016?) or Sid Meier's Civilization VI (2K 2016). Additionally, players have full control of the game by their intelligence, rather than relying on events of RANDOMNESS, as many of the previously mentioned titles does.

2 The Game Concept and Rules

A sidenote, but important to mention to show that we thought about it: when it comes to primary/core and secondary gameplay, there are different ways of defining what is what. One might think that the core gameplay is what players do most often during a session, this would exclude actions that must or might happen seldom. Another viewpoint is that core gameplay also is actions players want to do often in a session, like winning a sub-part of, or the entire, game; something an opponent would prevent you from doing. E.g. is taking the king in Chess (Ultra Boardgames 2019?) part of the core gameplay or not? We are of the mind that what players do and think of doing most during the majority of each session is part of the core gameplay, the rest is part of the secondary/non-core gameplay.

Space Colonies is a one versus one game where the players COMPETE* against each other to be the sole ruler of a space themed empire. The game board consists of an eight by eight hexagon matrix with nine planets to Colonize, as can be seen in Figure 1, the planets works as RESOURCE SOURCES. Both players have the same goal and must *defeat* the other to win, or get the opponent to *concede*. The game is solely based on the players decisions and STRATEGICAL PLANNING, and the only way to win is to outsmart the opponent.

To further spice up the gameplay, the players have to manage their RESOURCES well to achieve the EXPANSION of their empire. One RESOURCE can be used to *construct* either a Colony, a Ship, or a Port. The Colonies are used for *Resource production* and they are the only way for the players to gather enough RESOURCES to *build* the biggest fleet of Ships; however, to *build* a Ship the players also need to *construct* Ports since each Resource Round any one Port can only *construct* one Ship each.

The core gameplay is a game loop that consists of three MOVEMENT Rounds and one Resource Round. In every MOVEMENT Round, the players take turns to move all of their ships of choice, one hex in any direction. The players can *attack* each other by *moving* a Ship onto a hex where there is an opponent CONSTRUCTION:s; Colonies, Ports, or Ships, and immediately *destroy* that Construction. After the three MOVEMENT Rounds, it is time for the Resource Round. The first player starts by *constructing*, using all of their RESOURCES, any multitude and combination of the following CONSTRUCTION ACTIONS:

- A ship can *build* a Colony on an adjacent empty planet.
- A ship can *build* a Port on an adjacent empty hex.
- A Port can *build* a Ship on an adjacent empty hex.

To further allow the opponents to interact and block each other, a player can not *build* on a hex occupied or adjacent to the opponent's CONSTRUCTION. Any CON-

STRUCTION UNIT can be used for *constructing* once every Resource Round and newly built CONSTRUCTIONS can not be used in the same Resource Round. After the first player has done all of their possible *moves*, the second player takes their turn during this Resource Round.

One important aspect of the game is the POSITIVE FEEDBACK LOOP that helps move the game towards the ENDGAME. As the number of RESOURCES each player receives each round is directly correlated to the number of Colonies they CONTROL, a player that already has the upper hand will get to produce more RESOURCES, which in turn will strengthen their position. Similarly, a player who CONTROLS fewer Colonies will have a hard time bouncing back as they will get to *build* using fewer RESOURCES next Resource Round. The effect of these feedback loops is that the game will end rather quickly, given that one person has a good strategy. If this feedback loop is not in effect, for instance if both players have a similar strength in their strategies or if none of them have an effective strategy, the game might become slow.

2.1 Rules and Assets

The main rule book of the game is a two-page document referred to as the Comprehensive Rules, intended to detail each of the game's restrictions of interaction. Accompanying these rules are a Quick Guide, for reminding players of common rules, and a Strategy Guide, visually presenting examples of certain interactions. Furthermore there is a Turn Tracker that is optional to use, with the purpose of reducing the cognitive load of keeping in mind which phase the game is in.

The game board, consisting of an eight by eight matrix of hexagons, includes nine planets that are symmetrically arranged in such a way that the distance to the planets are equal for both players, and with one planet located in the middle to allow for more competitive gameplay. The game tokens consist of nine two-sided Colony tokens, one side for each of the two colors. Furthermore there are 12 two-sided tokens in each of the two colors that has Ports and Ships on either of their two sides.

2.1.1 Comprehensive Rules

The Comprehensive Rules feature the full rules list and should be complete. It features a "Quick Overview", most useful for beginner users in need of context and which is recommended to be the first thing one reads of the rules of the game. The first page also features a 'Glossary' for convenient look-up of words in italics mentioned anywhere within any of the three rules inserts. The flip side of the Comprehensive Rules feature how to set-up a game, the win conditions of the game, how the core game loop functions, and rules regarding what player actions are legal.

Notice the optional finite resources rule at the end of the second page. This was introduced as a possible solution for stalemates where games seem to never reach an end state. By making the resources of the map finite, one avoids these stalemates. Additionally, as the starting bases run out of resource, the players are also encouraged to fight over the planets still left untouched, further motivating interactive play. These are most often the planets in the middle of the map or otherwise hardest to control.

SPACE COLONIES

- Colonize space and wage interplanetary warfare.
COMPREHENSIVE RULES

QUICK OVERVIEW

(*Italics* words are defined in the Glossary to the right.)

Space Colonies is a 1v1 game between two opponents played on a grid of hexagons. Both players start with a *Colony*, a *Port*, and two *Ship*:s each. *Colony*:s produce resources and can only be constructed on *Planet*:s. *Port*:s construct *Ship*:s and can be constructed anywhere. *Ship*:s can attack enemy *Constructions* and can construct both *Colony*:s and *Port*:s.

The core game loop consists of three *Movement Rounds*, where each player moves, all of their *Ship*:s up to one *Hex* each, potentially destroying enemy *Constructions* in the process. After every third *Movement Round*, there is a single *Resource Round*. During the *Resource Round*, *Colony*:s produce resources which can be used during the round to build more *Constructions*.

There is a delicate balance between long-term investments in the *Resource* producing *Colony*:s and military funding. If the opponent tries to expand too greedily, punish them with a superior fighting force. If you manage to maintain a larger income than your opponent, continuously trade away *Ship*:s for *Ship*:s as you will come out on top in the end. Also, by offensively trading *Ship*:s, you avoid the *Supply* cap of twelve *Ship*:s and/or *Port*:s. Furthermore, position your *Ship*:s in front of your *Colony*:s or *Port*:s, protecting them, and try to keep the *Ship*:s in formations one larger than your opponent's.

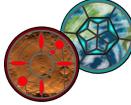
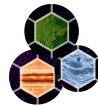
The game immediately ends if one player no longer controls any *Colony*:s. Secondary end conditions are: if a player concedes or if they control no *Ship*:s and no *Port*:s.

Good luck, Commander.

GLOSSARY

Note!: The GLOSSARY is not intended to be read through straight up. Use it as a look-up dictionary.

Italics words are defined here in alphabetical order. CAPS words are headers.

1. **Colony.** Produces *Resource*:s and can only be constructed on planets. *Colony* tokens have *Colony*:s on both sides, one of each color.

2. **Construction Actions.** The four actions players can take during a *Resource Round*. See UNIVERSAL CONSTRUCTION RULES and CONSTRUCTION ACTIONS.
3. **Constructions.** The collective noun for *Colony*:s, *Port*:s, and *Ship*:s.
4. **Hex.** Each hexagon, including *Planet*:s, building up the game board.
5. **Movement Round.** Each player moves all their *Ship*:s. See MOVEMENT ROUND.
6. **Planet.** Special *Hex*:es on the game board where players can construct *Colony*:s. Otherwise, there are no other rules or restrictions, such as movement of *Ship*:s or construction of *Constructions*, differentiating *Planet*:s from normal *Hex*:es. Starting *Planet*:s are marked with a star.

7. **Port.** Spends *Resource*:s to produce *Ship*:s. Can be decommissioned if no longer desired and permanently retrofitted to a *Ship*. Tokens for these have *Ship*:s and *Port*:s on each side, both of the same color. These also represent *Supply*. (Are not limited to being constructed next to *Colony*:s.)

8. **Resource.** During each *Resource Round*, each colonized planet produces one *Resource* point each. Building *Constructions* or retrofitting *Port*:s to *Ship*:s cost one resource point each. (There are no physical tokens for *Resource*:s.)
9. **Resource Round.** Players use the *Resource*:s produced by their *Colony*:s to take *Construction Actions*. Occurs after every third *Movement Round*. See RESOURCE ROUND.
10. **Ship.** Moves up to one *Hex* each *Movement Round*. Can destroy enemy *Constructions*. Also can spend *Resource*:s to build *Colony*:s and *Port*:s. Tokens for these have *Ship*:s and *Port*:s on each side, both of the same color. These also represent *Supply*.

11. **Supply.** The number of *Port/Ship* tokens a player can control, which is limited to twelve.

STARTING A GAME

12. **Starting Player.** If this is the first game of a match, the starting(red) player is chosen randomly. Otherwise, the loser of the last game chooses who starts.
13. **Colors.** The starting player controls the red game pieces and can take the red *Port/Ship* tokens. The non-starting player does the same with the blue ones. (Colony tokens have both colors, one on each side.)
14. **Starting Positions.** Beginning with the starting player, each player places a *Colony* on one of the starting *Planets* which are marked with a star.
15. **Starting Port.** Beginning with the starting player, each player places a *Port* on a *Hex* adjacent to their initial *Colony*. (Only the initial *Port* has the restriction of being adjacent to a *Colony*.)
16. **Starting Ship.** Beginning with the starting player, each player places two *Ship:s*, each on an unoccupied *Hex* adjacent to their initial *Port*.
17. **Start.** The game begins with the first *Movement Round*.

WINNING THE GAME

18. **Game End.** A player wins the game as soon as any of the three following criteria is fulfilled:
 - a. Their opponent controls no *Colony:s*.
 - b. Their opponent concedes.
 - c. Their opponent controls no *Ship:s* and no *Port:s*.

MOVEMENT ROUND

19. **Move.** Beginning with the starting player, each player moves each of their *Ship:s* up to one *Hex*.
 - a. **Attack.** If a player moves a *Ship* to a *Hex* occupied by an enemy *Construction*, then the enemy *Construction* is destroyed and returned to its owner for potential reconstruction later.
 - b. **Self Obstruction.** A player may not move a *Ship* to a *Hex* already occupied by a *Construction* they control.
20. **Core Game Loop.** After every third *Movement Round* there is a *Resource Round*.

RESOURCE ROUND

21. **Resource Production.** For each *Colony* a player control, they get one *Resource*. There are no physical tokens for these as they are not saved between *Resource Round:s*.
22. **Turn Order.** The starting player takes *Construction Actions* until they either run out of *Resource:s*, cannot perform any more allowed *Construction Actions*, or chooses to pass for the rest of the round. Then the other player does the same.
23. **Return to Movement Round:s.** After both players have finished taking their *Construction Actions*, the game returns to *Movement Round:s*.

UNIVERSAL CONSTRUCTION RULES

24. **Resource Cost.** Each *Construction Action* costs one *Resource*.
25. **Adjacent Construction.** *Ports* and *Ships* construct *Constructions* in adjacent *Hex:es*. (Not in the *Hex* where the *Port* or *Ship* is.)
26. **Newly Constructed.** A *Ship* or *Port* constructed this *Resource Round* cannot be used for taking other *Construction Action:s*.
27. **Monoconstruction.** A *Ship* or *Port* can only be used for taking *Construction Actions* once each *Resource Round*.
28. **Unoccupied Hex.** A *Construction* can only be constructed on an unoccupied *Hex*.
29. **Construction Threat.** A *Construction* cannot be constructed on, or transformed in, a *Hex* if there is an enemy *Construction* in an adjacent *Hex*.

CONSTRUCTION ACTIONS

See UNIVERSAL CONSTRUCTION RULES.

30. **Construct Colony.** A *Ship* can construct a *Colony* on an adjacent *Planet*.
31. **Construct Port.** A *Ship* can construct a *Port* if not at max *Supply*. (Does not have to be in proximity of a *Planet*.)
32. **Construct Ship.** A *Port* can construct a *Ship* if not at max *Supply*.
33. **Retrofit.** A *Port* can be transformed into a *Ship* by being flipped and not moved to another *Hex*.

FINITE RESOURCES (VARIANT RULE)

To enforce a maximum playtime, consider introducing this optional rule at the start of a game.

34. **Initial Planetary Resources.** Before beginning with the first *Movement Round* of the game, place a d6 die, set on '6', on each planet. (These dice does not count as *Constructions* and does not obstruct movement or construction.)
35. **Finite Resource Harvesting.** Whenever a *Colony* produces a *Resource*, tick the corresponding die down one step. If the die was set to '1', remove it from the game board instead.
36. **Depleted Natural Resources.** *Colony:s* on *Planets* without a die does not produce any *Resource:s*.
37. **Lifeless planets (Optional).** The following criteria is added as a player's win condition:
 - a. Their opponent controls no *Colony:s* with dice.

2.1.2 Quick Guide

Space Colonies features a Quick Guide as a complement to the rules, intended for both beginners and intermediate players who might need minor reminders of the most common rules and interactions within the game. This guide is to be printed in a5 or a6 sized paper.

SPACE COLONIES

- Colonize space and wage interplanetary warfare.

~ QUICK GUIDE ~

Constructions:

Colony - Produces Resources and can only be constructed on planets.

Port - Spends Resources to produce Ships. Can be decommissioned if no longer desired and permanently retrofitted to a Ship.

Ship - Moves up to one Hex each Movement Round. Can destroy enemy Constructions. Can spend Resources to build Colonies and Ports.



Colony tokens have Colonies on both sides, one of each color.



Port/Ship tokens have Ports and Ships on each side, both of the same color. These also represent Supply.

Winning the Game:

The game immediately ends if one player no longer controls any Colonies. Secondary end conditions are if a player concedes or if they control no Ships and no Ports.

Movement Round:

Beginning with the starting player, each player moves each of their Ships up to one Hex. They cannot move Ships onto Hexes where they already control a Construction. If they move a Ship onto a Hex of an enemy Construction, then that Construction is destroyed.

After every third Movement Round there is a Resource Round before returning to Movement Rounds.

Resource Round

For each Colony a player control, they get one Resource they can use this round.

By taking Construction Actions, players spend their Resources. The starting player may spend any number of their Resources first before passing for the rest of the round.

Construction Actions

1. Construct Colony. A Ship can construct a Colony on an adjacent Planet.
2. Construct Port. A Ship can construct a Port if not at max Supply.
3. Construct Ship. A Port can construct a Ship if not at max Supply.
4. Retrofit. A Port can be transformed into a Ship by being flipped and not moved to another Hex.

Universal Construction Rules

1. Construction Action costs one Resource.
2. Ports and Ships construct Constructions in adjacent Hexes.
3. A Ship or Port constructed this Resource Round cannot be used for taking other Construction Actions.
4. A Ship or Port can only be used for taking Construction Actions once each Resource Round.
5. A Construction can only be constructed on an unoccupied Hex.
6. A Construction cannot be constructed on, or transformed in, a Hex if there is an enemy Construction in an adjacent Hex.

BEWARE - This Quick Guide simplifies many of the rules and omits certain details. When in doubt, always refer to the Comprehensive Rules.

2.1.3 Game Board

The game board is constructed with nine planets within an eight by eight matrix of hexagons. The hexagons with colored background are planets and the planets with a white star are the starting positions. Every planet is accompanied with flipable tiles that represent the Colonies, shown in figure 2, but note that these are not placed on the board until a player *construct:s* them.

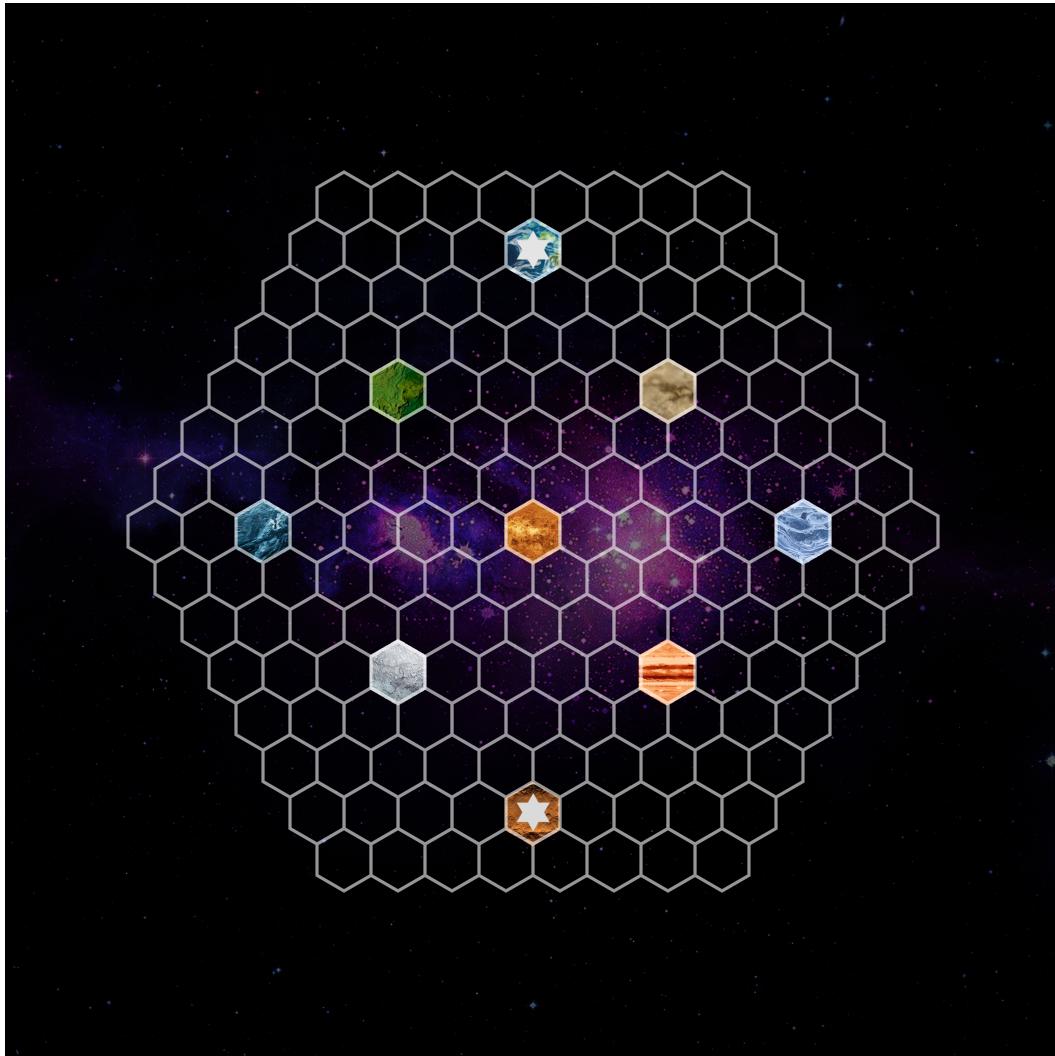


Figure 1: The game board

2.1.4 Constructions (Game Pieces)

The game pieces are divided into nine Colony pieces and 24 Ship/Port pieces. These are also collectively referred to as "Constructions" within the game. The Ship/Port pieces are divided among the two players by color, twelve pieces for each player. These also represent the maximum Supply a player may control.

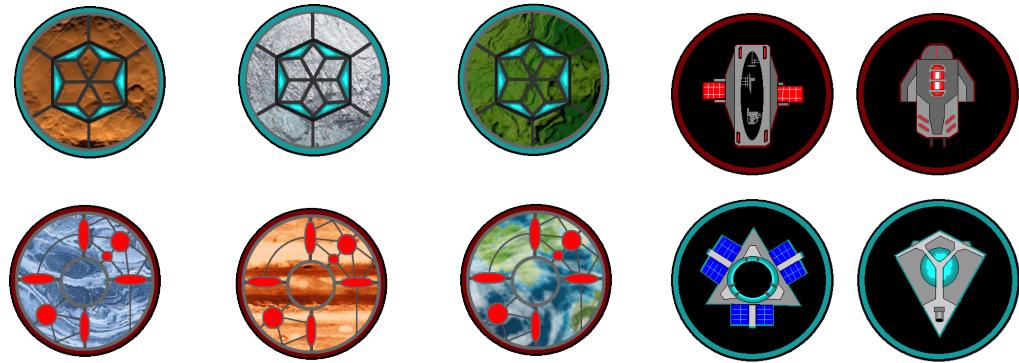


Figure 2: Colony pieces. Red on one side, blue on the other.

Figure 3: Red and blue Ship/Port pieces. Ship on one side, Port on the other.

2.1.5 Turn Tracker

The Turn Tracker is a GAME STATE INDICATOR and is used by the player to keep track of what turn the game is on. After every round, the players move a marker between the different rounds, following the direction of the arrows.

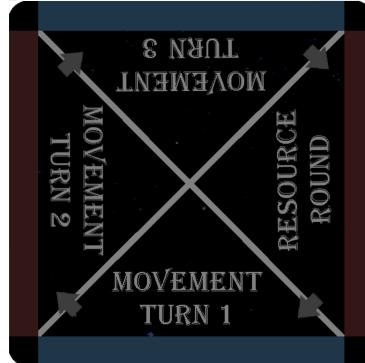


Figure 4: The Turn Tracker.

2.2 Strategy Guide

The Strategy Guide is comprised of pictures of certain interactions and tactics within the game accompanied with explanatory text. This concept is supposed to be printed out and given with the rest of the game. By showing how pieces could be moved in a suggested efficient way, novice players are assisted to quickly get into the game and play more aggressively towards winning. Note that this guide, as mentioned in 4.4.4, has not yet been used for external testing with beginners as this idea was conceived after the final playtesting session.

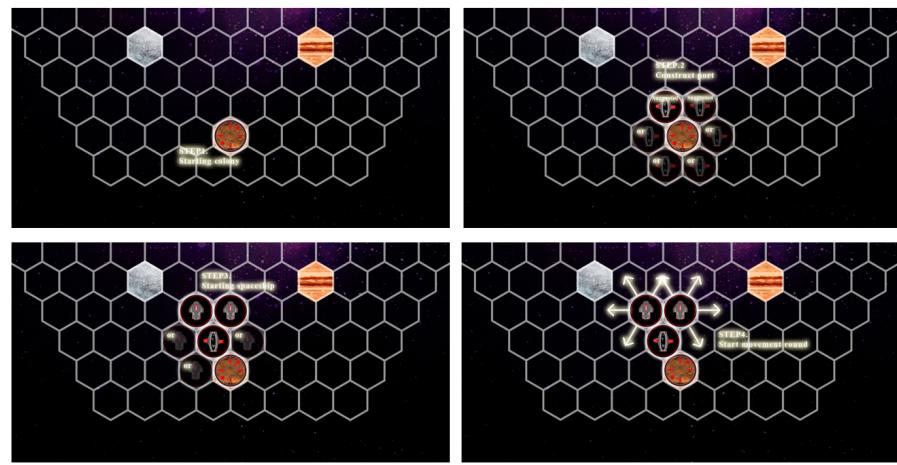


Figure 5: These four pictures illustrate how to perform the initial set-up.



Figure 6: Illustrations of how players can *construct* Ships, Ports, and Colonies during a Resource Round, showcasing some specific rules interactions.



Figure 7: Left image depicts a "1 for 1 trade", an action the player with the most resources would want to take as often as possible. Right picture shows a player taking the new Retrofit action.

2.3 Game Aesthetics

Space Colonies features a sci-fi premise of two empires battling over domination within a small section of space.

As mentioned earlier, the visual appearance of the Ship is to be combat ready, invoking a feeling within the players of wanting to send them into battle against their opponent. Additionally, the physical board is intentionally large and the visual elements consciously made few, e.g no visual doodads around the map, to match the aesthetics of how vast and empty space is.

However, an MDA game mechanic (Hunicke, LeBlanc & Zubek 2004) that clashes with the aesthetics of the game, at least according to some of the playtesters, was that the space station Ports were able to be constructed anywhere on the map; not just "in orbit" around a planet. This may have been a side-effect of the visual appearance of the Ports being similar to satellites which some people might be familiar with often being in orbit.

When it comes to diegetic (Andrews 2019) elements in our game, the hexagonal spaces can be diegetic when it comes to their relative size, being a certain distance in space, but their edges drawn on the map are something that does not actually exist in outer space. It could be compared with trying to find the letter 'A' in the Atlantic ocean after seeing it on a map. There are many components in the game that both exist visually and could conceivably exist in the setting: Ships - space crafts, Ports - space stations, Colonies - while not now, it is realistic in a future setting, space colonies. The Hexes combined with Movement Rounds could represent that both players have the same Ship speed, and a round is a fixed amount of time - the Hex size is how far a space craft can travel in that time. Resource Rounds however, are less diegetic, as in reality production is seldom in bursts and a planet would probably produce way more resources than is required to *build* a space craft. On the note of building, the amount of resources needed to *build* any construct being the same is definitely not realistic, not even considering costs such as moving said resources across space.

Following the mental model of space colonization, a Colony can only be constructed on a planet and needs to be done by a Ship. This is enforced by the requirement of settlers for the new planet, of which are travelling on the Ship.

As the name implies, there is a major focus on the Colony game pieces within the game. The main win-condition is to *destroy* the opponent's Colonies, also making Space Colonies a WINNER DETERMINED AFTER GAMEPLAY END game, and they are crucially the only source of resources. By *destroy*:ing the opponent's constructions and occupying the hex with colonies, the player gain a sense of achievement in regard of the aesthetic component in the MDA model (Hunicke, LeBlanc & Zubek 2004). Besides, winning with strategies is an intriguing experience to the target audience of this game.

2.4 Comparison to Competitors

Since Space Colonies is solely based on the players' decisions and TACTICAL PLANNING, the game can be compared to games such as Chess (Ultra Boardgames 2019?). However, Space Colonies stands out from Chess by including MASS UNIT CONTROL* and RESOURCE MANAGEMENT.

The RESOURCE MANAGEMENT based on AREA CONTROL in Space Colonies can be compared to games such as Catan (Ultra Boardgame 2019?), however there is no RANDOMNESS in the resource gathering in Space Colonies, it is all up to the players themselves to *construct* and defend their empire.

Space Colonies is a TURN-BASED strategy game and can therefore be compared to games such as Heroes of Might and Magic (Ubisoft 2016?) and Sid Meier's Civilization VI (2K 2016). Space Colonies however is a lot easier to get started with, there is no RANDOMNESS involved and pace of the game is a lot faster.

StarCraft (Blizzard Entertainment 2019), one of the primary inspirations for the base concept of Space Colonies, shares many gameplay aspects with the latter. In both game, the player starts with a small resource producing base on and is encouraged to *expand* one's production to other base locations on the map. Players may prioritize investing in either economy, offense, or defense. A mayor difference between the two is of course the real-time versus TURN-BASED aspects which, in StarCraft, introduces the aspect of execution. For an example, in Space Colonies and games such as Chess (Ultra Boardgames 2019?), there is no difference between an experienced player and a beginner player following the guidance of an experienced player for every move. Additionally, StarCraft and Space Colonies differ as the former features other avenues of investments in the form of: upgrades increasing the efficiency and strength of certain game pieces, and different combat units of various "tech levels" with various strengths and weaknesses. These options give another depth to the "economy, offense, defense" as what constitutes as an offensive

or defensive unit can be changed as a result of upgrades, and how the aspect of time can be a valuable resource waiting for upgrades to finish researching. Additionally, the various units available in StarCraft produces a rock-paper-scissors relationship not present in Space Colonies.

Risk (Lamorisso & Levin 1959) possesses similar features with Space Colonies as it includes performing *attack*:s between segmented areas of the map, RESOURCE MANAGEMENT, colonization, and AREA CONTROL in the gameplay. However, as mentioned before, Risk depends heavily on RANDOMNESS that in Space Colonies does not exist. The combat phase in Risk is decided by who rolls the highest, while in Space Colonies players follow fixed patterns to combat the opponent.

In Warhammer: The Mass Combat Fantasy Roleplaying Game (Games Workshop Ltd. & Descartes Editeur n.d.), the players do move multiple pieces at once, similarly to Space Colonies; however, there are at least three mayor differences between the games. Firstly, in Warhammer, the pieces are all movable and can be of different types with different abilities and attributes, while in Space Colonies there are immobile pieces, Ports and Colonies, and all movable ones are of the same type - the Ship. Secondly, in Warhammer many interactions rely on rolling dice, something that was intentionally avoided in Space Colonies to make the game less random. Thirdly, in Warhammer pieces are produced based on a fixed budget before the game, e.g. stronger pieces being more expensive, having no core way for players to produce more pieces during a game session. Compared to this, Space Colonies focuses primarily on gaining resources and increasing the amount of pieces during the game.

3 Gameplay Models

This section presents models that serve to give further understanding of how the game works.

3.1 Machinations Models

Following are three Machinations models that depict three different aspects of the game - Supply Cycle and Retrofit regarding the cognition model when the player is making decisions; how colonies accelerate the Supply Cycle regarding the construction round; losing Colonies and reaching end game states.

3.1.1 Supply Cycle & Retrofit

Figure 8 shows the internal cycle of the game element *Supply*, highlighting how the mechanic component forces players to manage finite resources and form strategies regarding what to *construct*. In red: a simplification of how a Ship may survive or be destroyed during a Movement Round, refilling Supply if destroyed. In green: the most common acts during Resource Rounds - *building* a Ship or a Port. In orange: the edge case where a player has no Ports to *build* Ships with, thus being forced to *build* a Port. In blue: Retrofit - the added game rule where a player may convert a Port into a Ship, allowing a player to increase the number of Ships they control, even if out of Supply.

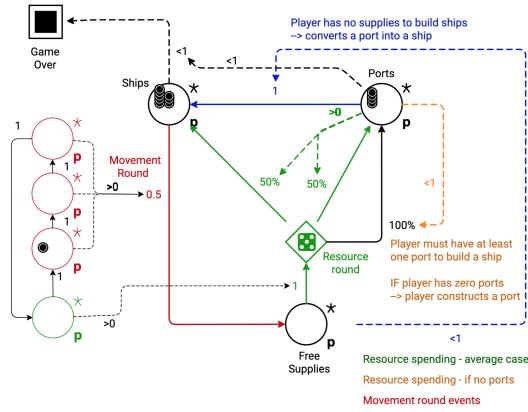


Figure 8: Model showing the Supply Cycle. The percentages chosen have no statistical connection.

3.1.2 How Colonies Accelerate the Supply Cycle

Figure 9 shows how the amount of Colonies affects the Supply Cycle (red), see also Figure 8, accelerating it the more Colonies a player controls. This means a player can afford to play more aggressively - losing and rebuilding Ships and Ports at a higher rate to *destroy* the opponents Constructs, something which is required to be able to win the game.

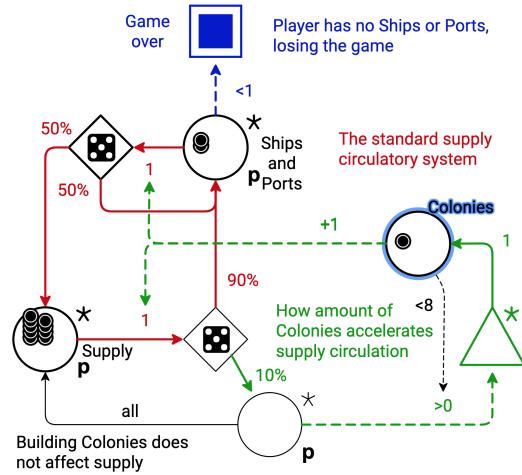


Figure 9: Model showing how the amount of Colonies affect the Supply Cycle. The percentages chosen have no statistical connection.

3.1.3 Losing Colonies & Reaching End Game States

Figure 10 shows how the number of Ships a player controls(orange), and how many its opponent controls(purple), during each Movement Round(black) affects the possibility of that player losing a Colony, see bottom left. Marked in green and yellow are the sub-models seen in figures 8 resp. 9. Combined with the sub-models this model shows that a player has to balance *building* resource-producing(Colonies) constructs and building resource-destroying(Ships) and resource-defending(Ships) constructs to win the game, much similar to games in the Real Time Strategy genre(Casteel 2017).

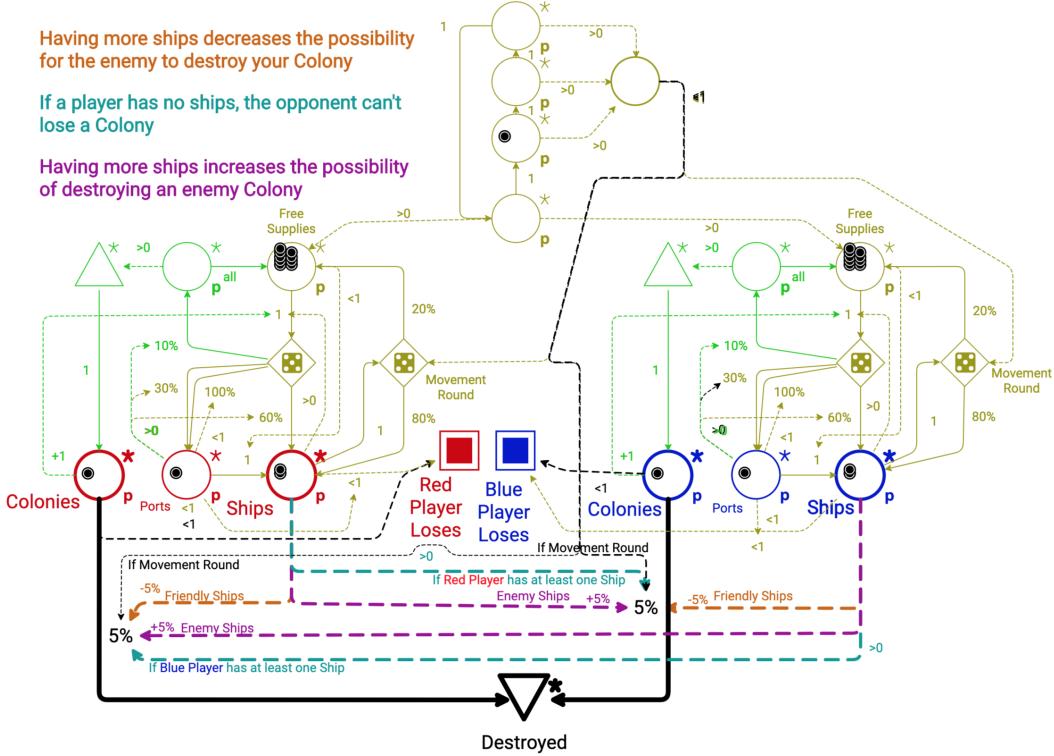


Figure 10: Model showing what affects the possibility of losing a Colony, something that leads to an end game state, in bottom left for blue player and right for red player. The percentages chosen have no statistical connection.

3.2 iStar Model

In the iStar model, see Figure 11, the focus is on simulating how the player's actions lead to the winning state. In Space Colonies, there are 2 players with five main actions, five soft goals, and one final goal. Within the model, the relationship between a player's action and both their own goals and their opponent's goals is symmetrical for the two players. Therefore, tasks of Player Blue has been omitted to reduce visual clutter. We indicated RESOURCE MANAGEMENT as an important factor of the game, as one's tasks is dependent on them, but we did not model the total production and flow of resources within this model for simplicities sake.

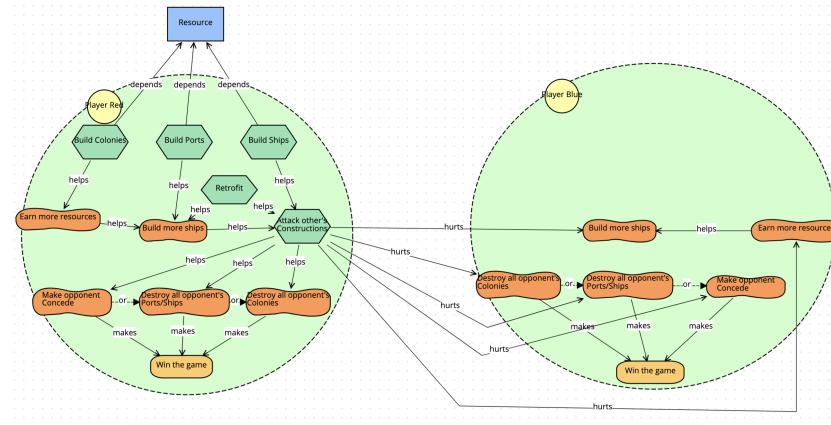


Figure 11: The main tasks and goals of Space Colonies.

3.3 Patterns and Mechanics

The mechanics in the list below is used to describe the core and secondary gameplay. All of these mechanics are used throughout the entirety of the gameplay experience.

- Mechanics
 - *attack*
 - *build/construct*
 - *concede*
 - *defeat*
 - *destroy*
 - *expand*
 - *moving units*

The patterns in the list below are used to describe the core and secondary gameplay. All of these patterns are used throughout the entire gameplay, except for the pattern RANDOMNESS that was mainly used during the process to be avoided.

- Patterns
 - AREA CONTROL
 - COMPETE*
 - COMPETITIVE GAMEPLAY*
 - CONSTRUCTION ACTIONS*
 - ENDGAME
 - EXPANSION
 - GAME STATE INDICATOR
 - MASS UNIT MOVEMENT*
 - MOVEMENT
 - POSITIVE FEEDBACK LOOP
 - RANDOMNESS
 - RESOURCES
 - RESOURCE MANAGEMENT
 - RESOURCE SOURCES
 - TACTICAL PLANNING
 - TURN-BASED
 - UNIT
 - FINITE RESOURCES*

4 Work Process

This section will describe how the game concept was developed, how the concept was changed between different prototypes, and what the results of the playtests were.

4.1 Methods

Editing and Refining. This stage of the creative process was about evaluating ideas and then refining them. Ideas from the ideation phase were evaluated about whether they were valuable and worth pursuing considering the aspects of technical feasibility, possibilities for development, etc.

Turning ideas into a game. After choosing a single idea, we started defining the core gameplay mechanics and designing the physical tokens and the physical parts of the first prototype.

Taking notes. It is imperative to keep notes of playtests. During the conducted playtests, all feedback and observation notes were documented for the later analysis.

Basic usability techniques. We followed the basic usability techniques according to Fullerton (2018) during playtests. For instance, 'do not lead', we didn't interfere the testers or explain rules during observation. Instead, we let players discuss themselves, and asked questions after the game ended.

Data gathering. Data were gathered as detailed qualitative feedback, such as recording the time it took players to read the rules. Data that affected the gameplay were mostly emphasized in data gathering.

Bottom-up design(Lopes & Kuhnen 2007). We used bottom-up design during the whole game design process as we firstly decided on game design components such as mechanics and patterns we liked, and later added flavour and theme.

4.2 Initial Concept Pitches

Some of us had brought concepts of various fidelity to the first group meeting.

We discussed the ideas, which included a LEGO™ building game, a dice based collection game, and a construction game featuring cranes ideated during the most recent exercise session. However, we settled on the "E.F.U" concept, inspired by digital RTS games such as StarCraft (Blizzard Entertainment 2019) and SimWars (Adams & Dormans 2012, p.187), which would later become Space Colonies. The concept at the time already featured a playable foundation of the core gameplay but lacked a theme or setting and can be seen in Figure 12.

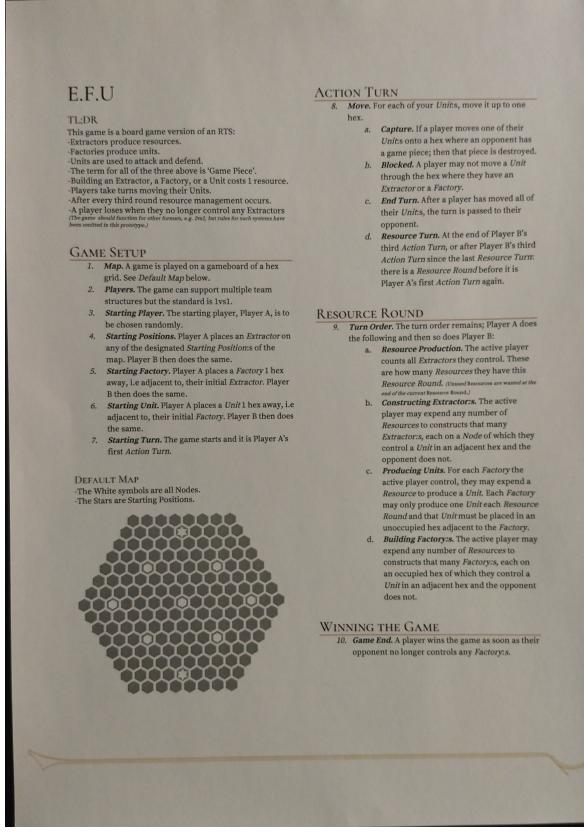


Figure 12: Initial E.F.U concept pitch. Predecessor of Space Colonies.

We discussed what would be a fitting target audience; the choice was between the current chess-like competitive players or a more casual audience. Both of these alternatives would possibly lead to playable games and the choice was settled with a group vote. This casual version of the game was discussed to be able to feature random or surprise elements, such as:

- Resource Rounds occur randomly, not always after every third Movement Round using a d4 for the same 25% distribution.
- Hexes on certain parts of the map are tiles flipped face down. *Moving units* adjacent to these hexes would flip the tiles face up, revealing the terrain with some effect (E.g. rough terrain makes it harder to pass through, etc.) inspired by what is called *Fog of War* in other games.
- Possibly introduce die rolling for MOVEMENT or *attack:ing*.

Additionally, there were different ideas of what the premise of the game should be. The final two ideas was either Space Colonies; space themed, with colonies, ports, and ships, or Peasant Wars; medieval themed, with farms, tents, and peasants. The peasant idea seemed to fit better with the more casual design choice which was already omitted.

4.3 Internal Playtesting

In the internal play testing we had created a physical prototype that more resembles the look and feel of the game that we were targeting. This higher fidelity prototype also allowed for two-sided tokens, as in the case of the Port/Ship tokens. This introduced the convenient ability of having Supply being conjoint by both Ports and Ships, compared with the the initial design where these were separate as a player could have a maximum of ten Ports and ten Ships. However, after testing it was decided that the new change of having a maximum of ten of either Ports and/or Ships was too restrictive as players too often hit the maximum limit, even when not playing passively. As a result, this limit was increased to twelve towards the end of the internal playtesting.

We also noticed in the tests how the game can progress very slowly in the beginning and both players were waiting for the Resource Rounds to *construct* new Colonies and Ship. To counteract this, the choice of starting with two Ships instead was introduced. This allowed for a much earlier map presence and made it less obvious from which of the two Ships one were going to *build* one's next construction. Additionally, by starting with two Ships, one player could keep their formation together and punish the opponent if they were spread too thinly across the board.

Other things that we found as not working very well was how complicated the construction rules were; both players regularly checked the rules to remind themselves of how the constructing worked. This problem was solved by introducing a Quick Guide that serves to remind the players of how the most common rules work. The rules were also rewritten to further clarify how the game is intended to be played. Furthermore, the cognitive load of the players was perceived as possibly too heavy, even with the assistance of the Quick Guide. These memory issues were mainly in terms of keeping track of the three Movement Rounds that take place before the Resource Round and which game pieces had already moved or been used. To solve the prior problem, we introduced a Turn Tracker where the players can visually keep track of which the current phase of the game is.

Additionally, during this phase we ideated changes to the games, such as being able to stack Ships on top of each other into an armada, and adding more board game elements such as wormholes that can teleport Ships across the map. However, it was decided to not add these ideas as to keep the base rules as simple as possible. The intention of the game is to have few pieces which interact with each other in a

simple way, but how the entire board state develops, and will develop over the rest of the game, is where the cognitive load should lie.

4.4 External Playtesting

The playtesters were considered to be confidants as fellow gameplay design students, in favour of the target audience as many of the testers were not experienced within the genre of similar games. Therefore, the primary focus was put on Structure and Formal Details, as described in Fullerton (2018, p. 57).

As such, the main issue the playtesting sessions were going to evaluate was whether the written rules were comprehensive enough for the participants to play the game unaided. To test this, the participants were instructed to cooperatively set up and play the game, while using the Think Aloud method, as described in (Preece, J. Sharp, H. Rogers, Y. 2015), so that the observer would know what they were thinking, following the written instructions with no aid from the facilitators, unless required. In addition, there were a few aspects of the gravity of mental excise queried.

The structure of the playtesting sessions was as follows (*1.5-2h*):

- (*2min*) - Introduce the participants to the playtest.
- (*10min*) - Have the participants read through the printed page of rules in silence.
- (*5min*) - Have the participants think aloud and cooperate to set-up the game.
- (*15min*) - Have the participants think aloud and cooperate to perform the core game loop.
- (*60min*) - Have the participants play the game once or twice. When they stumbled upon questions they were asked where in the rules they would expect that information to be explained. Ex: Some participants were unsure what happened to destroyed tokens and were expecting that information to be found under the "ATTACK" rules. If their issue would not be resolved by the written rules, potentially by the designers not having thought of that particular interaction, their question was answered directly.
- (*15min*) - Have the participants discuss their experiences and answer a few questions.

During the playtesting session, the observers were looking for:

- Were the players ever stumbling upon issues not explained in the rules?

- Are players aware of when conceding is appropriate or do they continue losing slowly? I.e. do they always play until a player is eliminated?
- Did the players ever have trouble keeping track of which Ships they had moved or what Constructions they had already used for construction?
- Did the players appear to alternate between moving Ships and thinking of what Ship to move next or did they wait and think until they had mentally moved all of them before physically touching the tokens?

After the playtest session, there was a discussion regarding the following, in addition to the above four questions:

- How much was the perceived focus on the middle planet?
- Were the players mentally aware that conceding was an option and did they ever consider it?
- What would the players think about flipping tokens to show that they have moved/been used?
- What was the participants opinion of the structure of the rules?
- Do the participants perceive any unfair advantage in going first or going second?
- General thoughts or interesting discussion points emerging during the session.

4.4.1 External Playtesting 1

During the initial playtesting session, many rules details were identified to be in need of further clarification. Some of these included:

- Which of the physical tokens were representing what game piece? (There was no image of the physical tokens in the rules list.)
- Players expected that "resources" were able to be saved between Resource Rounds and were represented by physical tokens or cards; similar to in "Catan" (Ultra Boardgame 2019?).
- The rule that stated that one's initial Port had to be placed adjacent to one's Colony made players assume that that was the case for additional ones.
- Players assumed that Ships needed to be positioned on top of the Planet hex to *build* a Colony there.

The participants played two games, both with a playtime of about 20 minutes. The game was not perceived as slow or sluggish, and memory issues were minimal. However, that could be a result of the aggressive play style of the participants.

Before the second playtesting session, all identified rules misconceptions were clarified on a small separate rules add-on piece of paper.

4.4.2 External Playtesting 2

As a positive effect of the game being played by two players, two games running in parallel were able to be conducted.

Even though the remaining loopholes of the rules had been fixed up until this point, there were still some details needing further clarification to avoid having the participants needing to cross-reference rules to understand interactions.

One of the games went on for a much longer time than the intended playtime. This was a result of beginners playing passively and defensively, focusing on self-improvement in the form of investment in future resource production. This meant that the board state quickly got cluttered and, as a result of the action space greatly increased, made each turn pass excruciatingly slow.

To counter-act the issue of slow play, two changes were introduced: First, the “Retrofit” CONSTRUCTION ACTION* was introduced, allowing players to move up Ports far away from the frontlines which meant that the player in the lead could push their advantage more in the later stages of the game.

We contemplated simply increasing the maximum number of tokens, or Supply, a player were allowed to have. But we consciously wanted to keep the limit as low as possible as the concept of a maximum sized army is important to make players engage with each other and trade units to avoid reaching the limit. If there was a very high, or even no, Supply limit, then the player currently in the position of having the largest economy would want to start playing passively as to be able to accrue as much resources as possible. This reduces the tempo of the game heavily as the player who most likely has the strongest army actively attempts to prolong the game, at least until they reach the Supply limit.

By having a relatively low max Supply limit, one encourages the player with the largest income to actively engage in combat and trade away their units as to avoid reaching the Supply limit and waste a resource cycle. This is also an important factor to why saving resources between Resource Rounds is not possible.

The second change to avoid slow gameplay was to have players take all of their CONSTRUCTION ACTION* at once during Resource Rounds instead of one at a time; instead of ABABAB, it is now AAABBB, where A and B represents the starting player and the non-starting player respectivly, taking an action respectively. This

should help with both the time Resource Rounds takes and with memory issues by removing the need of keeping track of what you built this round between priority passes. This change, however, has the risk of offsetting the balance during the Resource Round as the non-starting player has the advantage of seeing exactly what the other player does with all of their resources before having to make a decision. On the contrary, the starting player might be considered to have an advantage in being the first to place down all of their new Constructions, possibly removing certain options from the opponent as the new tokens threaten adjacent hexes. This needed to be examined during the upcoming playtest sessions.

4.4.3 External Playtesting 3

Similar to the second playtesting session, two games were able to be run in parallel. The participants comments on the new "Retrofit" action was matching our intentions; it was not an action desired to be taken unless when one is nearing maximum Supply where it was much appreciated. The new turn order structure of the Resource Round was appreciated and was deemed leading to an unfair advantage to any of the two players.

However, as in the case of the second playtest, one of the games featured two beginners playing passively, resulting in an exhaustively long game.

Additionally, the beginners had insightful feedback regarding the Comprehensive Rules. During the testing, these rules were limited to one page, immediately beginning with the Glossary followed by the rest of the rules. The participants felt that being instructed to read through a Glossary lead to difficulties understanding what they read as they lacked context. They suggested having an introductory text summarizing the overall game structure so that while reading through the rules, one has a foundation to anchor to. The introductory text suggested for the Comprehensive Rules became the Quick Overview, which is discussed in Section 2.1.1.

4.4.4 External Playtesting Conclusion

The playtesting sessions fulfilled the goals we set out for it; players new to the game were able to give constructive feedback of the structure, and the understandability, of the Comprehensive Rules which was iteratively updated.

Secondly, the playtesting session gave us insight of issues arising when complete beginners pick up the game. The largest of the issues was the seemingly infinite playtime between passive players. One possible solution to this, which was approved as useful by the participants of the third playtest, was having a Strategy Guide accompanying the game. By teaching beginners the importance of not playing passively and pushing one's advantage, one could possibly avoid stalemates.

Examples of what a Strategy Guide could contain can be seen in Section 2.2.

However, an even more aggressive way of avoiding long playtime is to force the game to progress towards an end state through FINITE RESOURCES*. This component is a core mechanic component in many similar games, such as StarCraft, which not only avoids stalemates but also encourages players to *expand* to the few remaining resources nodes not yet depleted, often the one's hardest to defend. To read more about the possible introduction of FINITE RESOURCES in Space Colonies, see Section 2.1.1.

The memory issue was discussed with all participants, who were affected by it at varying levels. The proposed solution of having a flip side of each ship token, representing a used state, was disapproved by almost every playtesting participant as it would introduce the constant physical excise of flipping dozens or even hundreds of tokens during the playthrough of a single game.

Conclusively, the game should now be formally complete and what remains is transitioning from testing with confidants to testing with the target audience. Hopefully, these testers would be familiar with similar games to the extent that they would more accurately be able to test the balance of the game in the form of:

- Is there a starting player advantage?
- Is there a starting player disadvantage?
- Is there one clearly superior strategy?
- Is there the strategic space too narrow?
- Is there a sense of replayability to the game?

5 The Future of Space Colonies

Space Colonies has at this state not been tested on the target audience, neither have any extensive playtests been carried out. Therefore the game concept needs to go through more testing as possibly some aspects of the game concept might be in need of tweaking. It is possible for a clearly best strategy to exist, similar to First to Twelve (Koswara. I, Matijasevick. M, Boo. C, Lin. C, Khim. J, Kau. A 2019?), which would render the game unplayable. In contrast, there might exist multiple unanimously agreed upon best openers which still could lead to a wide board game space and rich strategies, similar to Chess (Ultra Boardgames 2019?) or StarCraft (Blizzard Entertainment 2019).

Furthermore Space Colonies could benefit from playtests using different game boards. With the inclusion of a new, and perhaps, bigger game board, the game concept could be adapted in such a way that there could be more players than only two as of now. With more players the game could either be played in free-for-all or, preferably, in two teams, as to maintain the head-to-head style of the game. Additionally, having multiple maps or formats could allow for a broader game experience increasing the replayability of the core concept.

Neither alternate game layouts nor team play have been explored as of this report but may lead to interesting discoveries.

Additionally, there are some concepts or issues still remaining within the game in need of further playtesting. For example, what are the concrete results of introducing the new, see 2.1.1, finite resources rule? Does it solve the remaining memory issues of beginners as the complexity of the board state does not grow exponentially indefinitely? One participant suggested having more doodads on the map to visually anchor which units one has moved, however they also stated that that would take away from the current appealing aesthetics.

References

- 2K (2016). *Civilization IV*. URL: <https://www.civilization.com/> (visited on 12/12/2019).
- Adams, E. & J. Dormans (2012). *Game Mechanics: Advanced Game Design*. Voices That Matter. New Riders. ISBN: 9780321820273. URL: https://books.google.se/books?id=%5C_Azio0txIdAC.
- Andrews, M. (2019). *Game UI Discoveries: What Players Want*. URL: https://www.gamasutra.com/view/feature/4286/game_ui_discoveries_what_players_.php?print=1 (visited on 12/12/2019).
- Björk, S. (2018). *Patterns*. Accessed on 18 November 2019. URL: <http://virt10.itu.chalmers.se/index.php/Category:Patterns>.
- Blizzard Entertainment (2019). *StarCraft II Official Game Site*. URL: <https://starcraft2.com/en-us/> (visited on 12/12/2019).
- Casteel, B. (2017). “The Balance of Power: Progression and Equilibrium in Real-Time Strategy Games”. In: URL: <https://waywardstrategy.com/2017/03/03/the-balance-of-power-progression-and-equilibrium-in-real-time-strategy-games/> (visited on 12/12/2019).
- Fullerton, T. (2018). *Game Design Workshop - A Playcentric Approach to Creating Innovative Games*. 4th. CRC Press. ISBN: 9781138098770.
- Games Workshop Ltd. & Descartes Editeur (n.d.). *Warhammer: Mass Combat Fantasy Roleplaying Game*.
- Hunicke, R., M. LeBlanc & R. Zubek (2004). “MDA: A Formal Approach to Game Design and Game Research”. In: URL: <https://users.cs.northwestern.edu/~hunicke/pubs/MDA.pdf> (visited on 11/18/2019).
- Koswara. I, Matijasevick. M, Boo. C, Lin. C, Khim. J, Kau. A (2019?). *Nim*. URL: <https://brilliant.org/wiki/nim/> (visited on 12/12/2019).
- Lamorisse, A. & M. Levin (1959). *Risk*. URL: <https://boardgamegeek.com/boardgame/181/risk> (visited on 12/12/2019).
- Lopes, G. & R. Kuhnen (2007). *Game Design Cognition: The Bottom-Up And Top-Down Approaches*. URL: https://www.gamasutra.com/view/feature/130542/game_design_cognition_the_.php (visited on 12/12/2019).

- Preece, J. Sharp, H. Rogers, Y. (2015). *Interaction design: beyond human-computer interaction*. 4th. John Wiley & Sons. ISBN: 9781119020752.
- Sicart, M. (2002). *Defining Game Mechanics*. Accessed on 18 November 2019. URL: <http://gamestudies.org/0802/articles/sicart>.
- Sivertsson, A. (2019). *Fail your Way to Success: On Playtesting*. URL: <https://chalmers.instructure.com/courses/7568/files/folder/Guest%5C20Lectures?preview=273841>.
- Ubisoft (2016?). *Heroes of Might And Magic VII*. URL: <https://www.ubisoft.com/sv-se/game/might-and-magic-heroes-7/> (visited on 12/12/2019).
- Ultra Boardgame (2019?). *Catan Fan Site*. URL: <https://www.ultraboardgames.com/catan/> (visited on 12/12/2019).
- Ultra Boardgames (2019?). *Chess Fan Site*. URL: <https://www.ultraboardgames.com/chess/> (visited on 12/12/2019).

A Appendix

A.1 Self-defined Game Design Patterns

Here are the self-defined game design patterns. As mentioned in Section 1.1, patterns are written in CAPITAL LETTERS and are as defined in Björk, S. (2018) unless followed by an '*'. In the latter case, they are defined here.

*COMPETE – Players try to defeat each other in order to win the game. Other games using this pattern include: Chess.

*COMPETITIVE GAMEPLAY – A game has COMPETITIVE GAMEPLAY when it is possible for a player to either win or lose, either over other players or over a game environment. Other games using this pattern include: Chess, Rock-Paper-Scissors, StarCraft, Unreal Tournament, 3Buttons, Donkey Kong, I Wanna Be The Guy.

*CONSTRUCTION ACTIONS – Different things that can be constructed with individual rules. Other games using this pattern includes: Catan.

*MASS UNIT MOVEMENT – Instead of moving only one unit each turn, the players can move any number of their units that they choose to. Other games using this pattern include: Warhammer, Sid Meier's Civilization.

A.2 Self-defined Game Mechanics

Here are the self-defined game mechanics, following the definition of mechanics as defined in Sicart, M. (2002). As mentioned in Section introduction-patterns, mechanics are written in *Italics* and are defined here.

attack: Move a Ship to a Hex occupied by an opponent construction and this construction is destroyed.

build/construct: Put a new construction token to an unoccupied Hex.

concede: End the game by committing themselves as a loser.

defeat: By *attack*:ing, their opponent controls no Colonies or no Ships and Ports.

destroy: *Attack* one opponent construction and this construction is removed from the Hex to its owner for potential reconstruction later.

expand: Occupy Hex:es.

moving units: Move Ships up to one Hex adjacent.