

Team Plot Twist



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Project Structure Document

1. Formal Game Proposal

1.1. Game Description

1.1.1. Game Idea

Fatal Tides is a three dimensional multiplayer battle arena game, taking place on sailboats caught in a huge maelstrom. It features exciting naval battles fought for survival, as the vortex is created by a hungry kraken, looking for its next meal, and only the last ship is spared by the monster.

The multiplayer is fully realised over Steam and steamworks and will feature thrilling battles between two and four teams fighting for survival. Each team, with up to two players, pilots a sailboat caught in the current and tries to attack the enemy vessels, in hopes that they will get destroyed by the kraken. A team wins as soon as all other ships were eaten by the monster. To achieve this, players have a selected amount of actions at their disposal, to distract and hinder the other boats from escaping the current and hopefully sending them to the depth, before they can do the same with you.

To create more variety and create more replayability, our game features power-ups, which can be acquired during the sea battle, as well as unlocking a variety of ships and characters with unique abilities.

The longer the battle in the maelstrom lasts, the hungrier the kraken will get and it will worsen the current, drawing the ships faster into the center. Also a storm will slowly form overhead, sending lightning into the maelstrom, which can hit your ship and light it on fire. You then have to extinguish the flames or go down in a burning wreck. The last stage will include the kraken helping with its huge tentacle arms, which will fling from the depth of the maelstrom to the boats overhead, trying to hit them and damage the vessels.

Also, to give people a tutorial and learning curve for our game, it will feature a small set of story inspired Coop scenarios with different ship layouts and crew members. These will teach the basic mechanics of the game and especially in the later scenarios, will feature certain puzzle elements, requiring the players to figure out the most effective strategy to survive the maelstrom. For example you could find yourself on a huge ship, which has already lost a great deal of its crew and you and your friends have to defeat the enemy ships. These scenarios are all played against an AI, which controls the other boats.

Another important aspect of our game, is the visual representation of the water, weather and wind. We will simulate the water flow of the maelstrom, the clouds forming overhead and the wind moving the cloth from the sails.

1.1.1.1. Relation to Course Theme

Our game takes the theme "Twister", interpreted as a tornado, and puts it into the water, creating a huge maelstrom. This vortex is literally the centerpiece of our game, as the core gameplay revolves around two to four ships caught in the deadly current, battling for

survival. The maelstrom is caused by a huge kraken in the center, craving after human flesh and trying to navigate the ships directly into its deadly fangs.

1.1.1.2. The Team

Each team in our game has the same structure. It consists of up to two human players, taking the roles of the captain and the first mate, and a few NPC crew members, which can be given orders by the players. Players and the crew can roam freely on deck and can carry out predefined actions on certain parts of the ship.

The commands to the crew members can be given with simple commands from a button press on your controller and directing it with the joystick towards the crew members that should follow it. Available commands are firing the cannons, repairing the ship, adjusting the sail to allow for more maneuverability, fishing power up items from the sea and boosting the moral for the rest of crew, by playing the war drums.

1.1.1.3. Actions

As with any historic naval battle, the primary weapon of choice is the cannon. This medieval war instrument can be aimed at the other ships (the camera perspective will change, allowing for a clean view towards the targets) with the joysticks, showing and approximated trajectory curve, which highlights the targeted impact location. Based on a few random and fixed variables, your shot will land near the targeted area, which will always leave a chance to miss the enemy ship entirely.

Of course these attacks will leave the ships damaged and might, if the cannoneer is lucky or very skilled, even hit crew members or the captain and send them overboard. To not leave the ship unattended for long, these lost souls will return to the deck after a few second to enact revenge. Also with building materials stored below deck, your crew or yourself can fix the broken parts of your ship. This is important, as damage to the ship's hull or masts causes a decrease in maneuverability and the health bar of the ship and fixing them will restore a certain amount back.

The main task for the human player (if only one is on the boat) is to command the crew to their posts and steer the vessel. The current of the maelstrom will always provide a certain base speed of the ship, but through smart maneuvering closer to the center of the maelstrom and back towards the outer edge, the ship can gain and lose speed. This is important to maybe move away from the enemies target path and position oneself in a more promising position. If a boat has two human players stationed on it, both players can alternate with steering, while also helping the crew shoot at the enemy or repair the ship.

Other actions are adjusting the sails of the boat, improving or decreasing the maneuverability, fishing crates from the sea for power-ups, building materials and ammunition. Also the moral of the crew can be boosted by playing the war drums. This results in better aiming and higher repair speeds of the crew mates and players.

1.1.1.4. Power-Ups

To allow for a more diverse player experience, the ammunition and building materials on the boat are limited. New materials have to be fished from the sea, where crates will be floating. These creates can contain normal cannon balls, wood planks and cloth for repairing, but can also contain special equipment that can either enhance your capabilities or have a negative

effect.

All consumables will spawn randomly on the map. When the ship goes through the power-up, it will be activated instantly. Other materials (cannon balls, planks etc.) will be picked up the same way. These consumables can give positive as well as negative attributes, depending on the context. Power-ups vary from speeding or slowing the ship, freezing or inverting the current, making the ship invulnerable or making it unaffected by the current.

1.1.2. Concept Art and Sketches



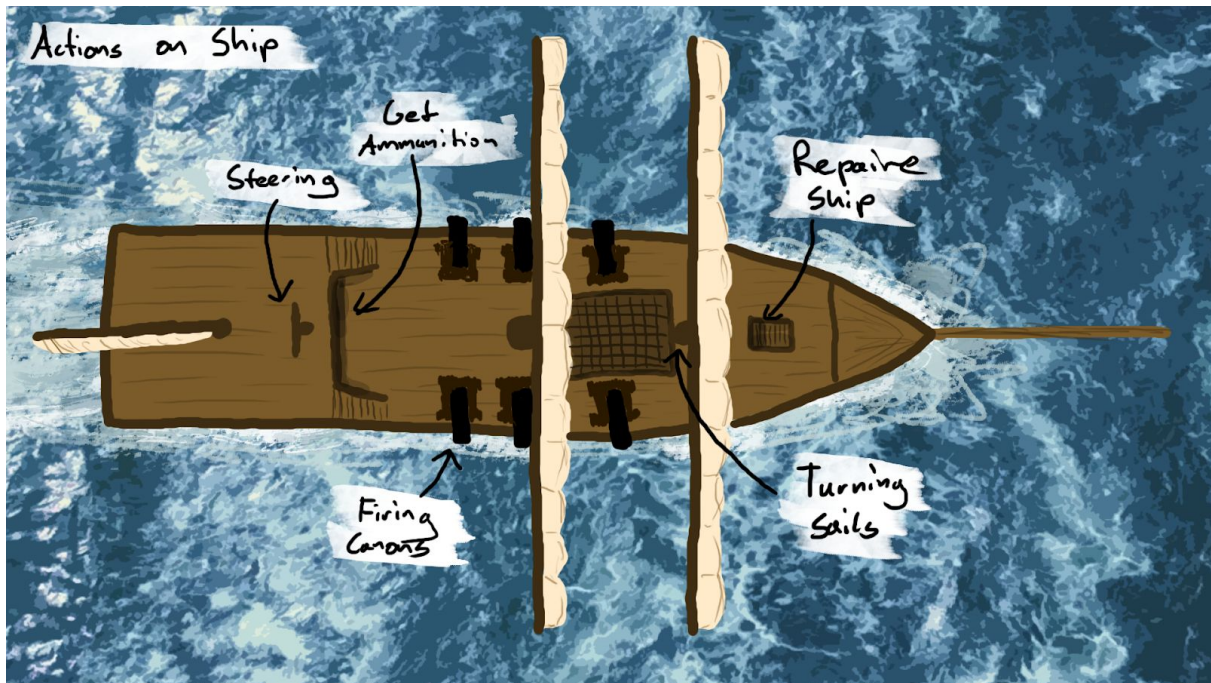
Concept art that conveys the general feel of the game. The ships are caught in the maelstrom and fire at each other with cannons, trying to sink the other enemy ship. Also in the background, a storm is slowly building up, ready to also release his wrath on the ships.



Concept art showing the action on the ship. The ship is already deep into the maelstrom, leaning heavily towards the center. The captain, controlled by the player, is steering the boat towards the outer banks of the current, while commanding the crew to adjust the sails (guy climbing up the masts).



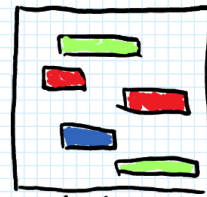
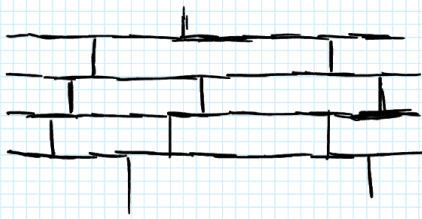
Concept art showing an overhead view of the naval battle. The two ships are firing cannon balls at each other, while caught in the current. The maelstrom slowly pulls them towards his deadly center



Sketch of the actions on the ship. As the players and the crew can move freely around the deck, this sketch shows a few action that can be performed. The steering of the vessel can be done on the higher deck, while below the storage for ammunition and building materials lies. Crew members will automatically go get the ammunition and building materials causing the ship feel alive with action. Cannons are stationary on the deck and can be fired into both directions (also one direction might not be as effective during battle). For repairing the hull of the ship, crewmates will disappear below deck with building materials. The sails can be repaired by climbing the mast. The sails can be turned at the mast.

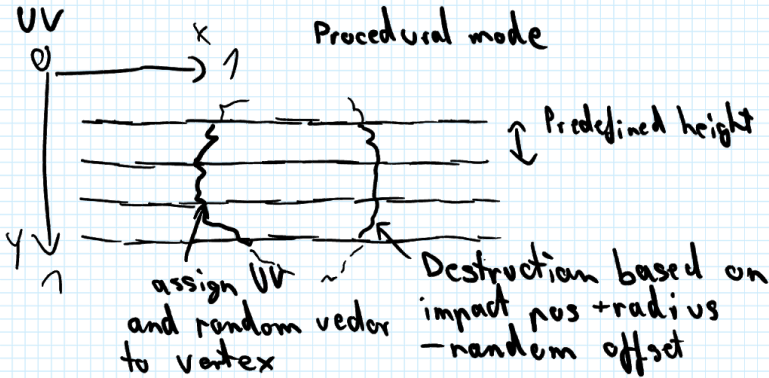
Ship destruction

Baked mode



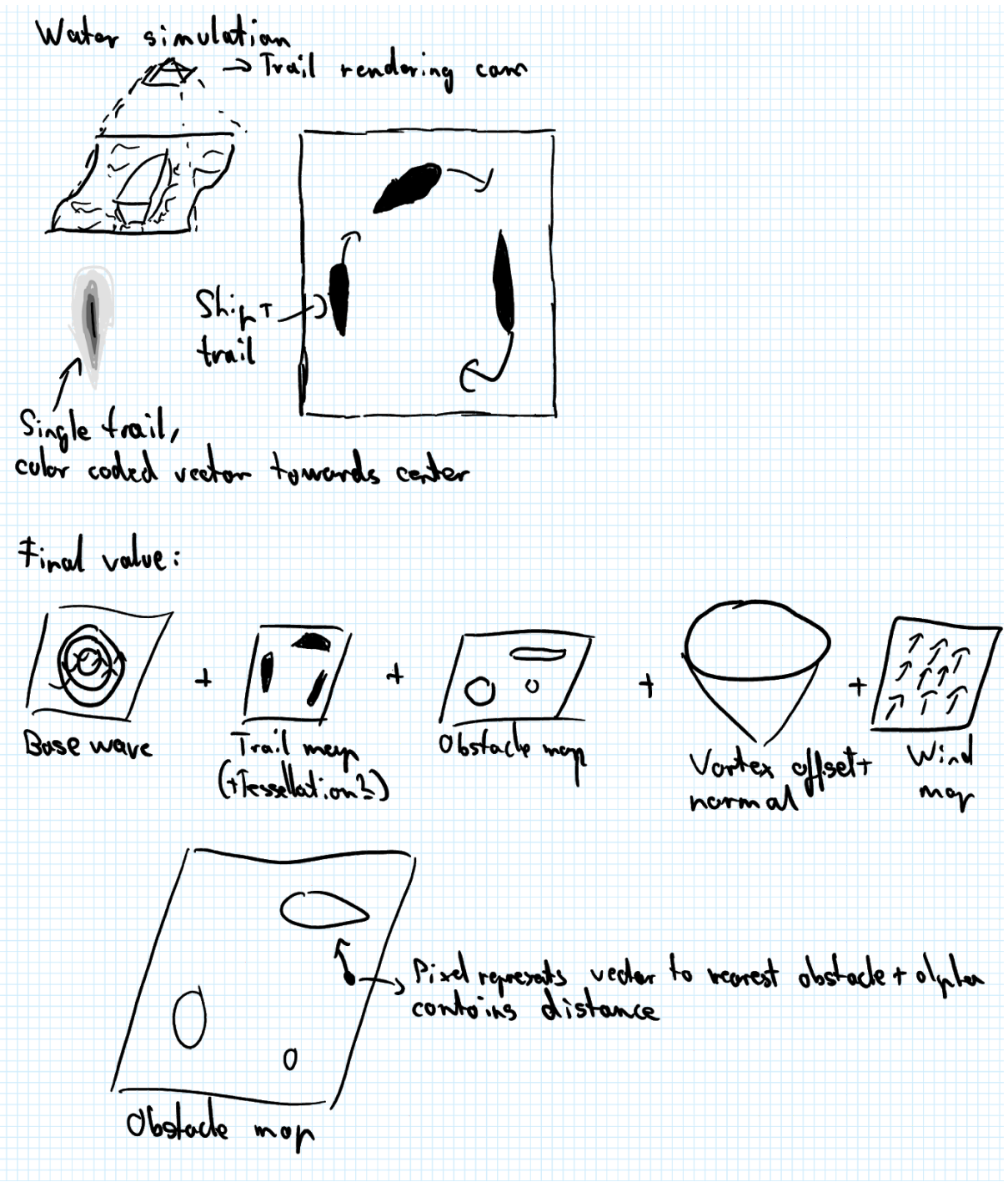
Material Id or Baked normal
⇒ Vertex color if available

UV Procedural mode



→ One UV per ship side

Technical sketches to the ship destruction. The sketches show two different implementation methods for having destruction show on the ship. One is the baked mode, where the destruction will be predefined and the second is the procedural mode, which will base the destruction on impact position and radius.



Technical sketches to the water simulation. These sketches show different components of the water rendering maps. It consist of the base wave, trail map, obstacle map, vortex offset and normal and the wind map.

1.2. Technical Achievement

There are 2 main technical achievements in this project, Steamworks support p2p networking and a complete water and weather simulation for the level running on the GPU.

1.2.1. Steamworks P2P networking

<https://partner.steamgames.com/doc/home>

<https://steamworks.github.io/>

In addition to interfaces for accessing different kinds of user data from Steam, the steamworks API provides a p2p networking interface. By providing optional relay servers, the interface assures a connection between host and client without any NAT issues. After setting up a lobby containing all the players, network packets can be sent to other players in it using the corresponding SteamId. The Unity plugin TNet will be used for object serialization, remote procedure calls (RPCs) and remote creation calls (RCCs). The existing udp/tcp backend of TNet will be replaced by the Steamworks API.

In order to access Steamworks C++ API, the Steamworks.NET wrapper will be used.

The Steamworks API enables additional, optional features like online leaderboards, cloud saves and community services to be added to the game.

1.2.2. Water simulation

<https://docs.unity3d.com/2018.1/Documentation/ScriptReference/Experimental.Rendering.AsyncGPUReadback.Request.html>

A compute shader supported simulation of the water will be used to create unique water behaviour every game. To get data like ship positions back to the CPU code, Unity's async GPU readback functionality will be used. A GPU based solution allows for a more complex wave simulation, as well as proper interaction between ships and water. Tessellation will be used to improve the visual quality around the ships.



Concept art for the final vortex structure. It shows how the structures of the waves could look in the final game representation.

1.2.3. Weather simulation

The core of the weather simulation is the GPU based wind simulation. The wind affects the water simulation, the gameplay behaviour of the ships (as well as the visual behaviour of the sails) and visual indicators on the map like trees on islands. A PhysX based cloth system in combination with simple C# logic will be used to enable proper interaction with the sails.

Advanced weather effects like volumetric clouds might be added to the game if there is enough time left.

1.3. “Big Idea” Bullseye



1.4. Development Schedule

For high resolution image, see the Wiki page of our project.

<https://wiki.tum.de/display/gameslab1819/Plot+Twist>

| PHASE | | REV | | DETAILS | | Q4 - 2018 | | | | | | | |
|---------------|--------------|--|--|---------|----|-----------|----|---|---|---|-----|----|---|
| PROJECT WEEK: | | | | OCT | | | | | | | NOV | | |
| | | | | 5 | 12 | 19 | 26 | 2 | 9 | 16 | 23 | 30 | 7 |
| 1 | Game Design | Everyone - Playtest - Report | Everyone - Playtest - Report | | | | | | Game Concept Game Idea Technical Achievements | | | | |
| 2 | Modelling | Domenik - Static objects Jan | Domenik - Dynamic objects Domenik | | | | | | Control Basic Global Events Game Duration | Report Paper Prototype | | | |
| 3 | Scripting | Jan, Kagan | Jan, Kagan - Gameplay - Systems | | | | | | Simple ship movement Cannon (Autonomous) Player movement | Game Input System | | | |
| 4 | Rendering | Alex - Tech art Alex | Alex - Shader - Render backend | | | | | | Add basic debug tool Add remote input Setup CI | Setup SIP | | | |
| 5 | Networking | Alex - Steam | Alex - Gameplay | | | | | | Async/CFI/Feedback functionality | Add Steamworks.NET Update AppID Add Serialization backend | | | |
| 6 | UI | Kagan Alex, Jan, Kagan | Kagan - Menus Alex, Jan, Kagan | | | | | | Start Game / End Game | Begin Debug UI | | | |
| 7 | Level Design | Everyone - Level design | Everyone - Level design | | | | | | Cannon fire Hull damage Ship Movement | Core UI design | | | |
| 8 | Sound | Kagan - Effects Kagan - Music | Kagan - Effects Kagan - Music | | | | | | Reloading Expanding Expanding Sandbox Main Theme In-game Music | | | | |

Funktional Minimum
 Low Target
 Desirable Target
 High Target
 Extras



| PHASE | | DEV | | DETAILS | | | | | | | | | | | | |
|----------------|--|--|----|---------|--|-----------------------|--|---|-----------------------|-----------------------------|-----------------------|-----------------|--|----------|--|--|
| PROJECT WEEK: | | | | | | | | | | | | | | | | |
| | | DEC | | | | JAN | | | | Q1 - 2019 | | | | | | |
| | | 14 | 21 | 28 | 4 | 11 | 18 | 25 | 1 | 8 | 15 | 22 | | | | |
| 1 Game Design | | Power-Ups Other Ships Playtesting | | | Tutorial Coop story scenarios | | | | Progressing Report | | Progressing Report | | | | | |
| 2 Modelling | | Reels Ship destruction Kracken model | | | | | Ship variations (Follower Crew (with arms or so)) | | Progressing | | Ship variations | | | | | |
| 3 Scripting | | Power-Ups Arms + Material => Spawn + Usage Ship repair actions Ship destruction | | | Moral boost actions | | | Tutorial Coop story scenarios | | Achievements Leaderboard | | | | | | |
| 4 Rendering | | Water & wind simulation optimization Ship obstruction Viewer shading Terrestrial support World event sync'ng | | | Weather simulation Shader improvements Post-processing UI shaders | | | Volumetric clouds Shader optimization Weather effects | | Performance optimization | | | | | | |
| 5 Networking | | Alex - Render lock'end | | | Alex - Tech art | | | Alex - Shaders | | Alex - Gameplay | | Alex - Steam | | | | |
| 6 UI | | Kagan Alex, Jan, Kagan | | | Menus - InGame | | | Kagan Alex, Jan, Kagan | | Menus - InGame | | | | | | |
| 7 Level Design | | Everyone - Level design | | | UI implementation | | | Settings Mechanics & Main menu | | UI polishing | | Tutorial | | Missions | | |
| 8 Sound | | Kagan - Effects Kagan - Music | | | UI Sounds & Effects Crew Sounds In-game music Powerful / Belle | | | World Events Time Ticks Power-up sounds End game music | | | | | | | | |
| | | Alpha Version Milestone | | | | Playtesting Milestone | | | | Release Milestone | | | | | | |

1.5. Assessment

Fatal Tides will feature a smooth multiplayer experience with fancy, simulated water and weather effects.

The gameplay consists of navigating your ship through a giant maelstrom, while trying to sink your foes and surviving their attacks. To be successful at this task, you will have to delegate your crew according to the situation and your tactic.

Since the the gameplay is fast and action-packed battle arena, people who like a replayable and fun multiplayer experience with their friends will also like Fatal Tides.

2. Game Prototype

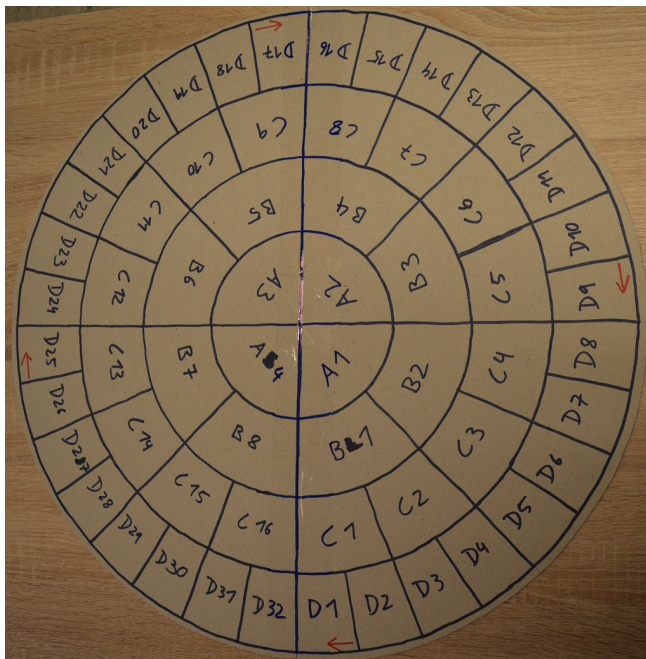
2.1. Overview

To visualize our game, we created a paper prototype that covers the main aspects of our game: Multiplayer battles supported by interesting maelstrom mechanics. The paper prototype is a four person board-game where each player commands his ship, assigns orders to their crew and tries to avoid getting consumed by the kraken nesting in the center of the vortex.

2.2. Rules and Gameplay

2.2.1. The Prototype Components

The board game consists of four parts: A map of the maelstrom, four paper boats, four ship cards and 11 figures for each ship card, representing the crew members.



Map

The map is a circular cardboard divided into four rings. Players will use their paper boats to simulate the ship. Each paper boat can be placed on a region marked in the map. The number of regions double on each outer ring. The rings are named from A to D while the regions in each ring takes a number as a suffix. Each additional outer ring has twice as many fields as the preceding inner ring.

Paper Boats

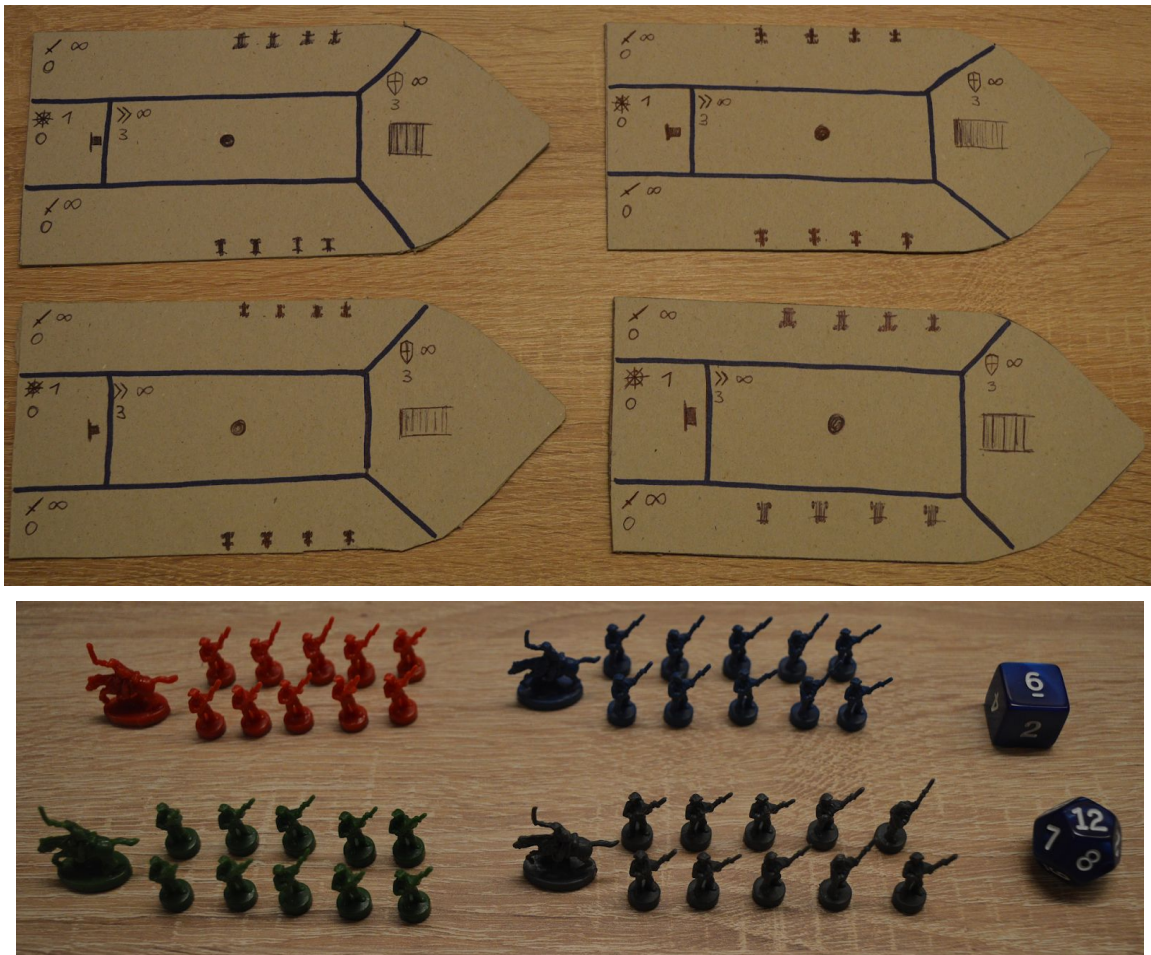
Each player has his own paper boat that is numbered. These boats will represent the actual ships and interactions with other players are realized through them. Your ship has **25 hitpoints** and if you

lose them all, you are defeated and is eliminated from the game.



Ship Cards and Figures

As it will be on our game, the players have 11 figures at their disposal. These are divided into 10 crew members and 1 captain. These figures can be placed on the ship cards to assign them to different tasks. The captain counts as three crew members when put on another task aside from steering. Many different combinations are possible and bring a variety to the game. Assignment is done via placing crew members on different parts of the ship card. A 12-sided dice and a 6-sided dice will also be used for combat and kraken mechanics.

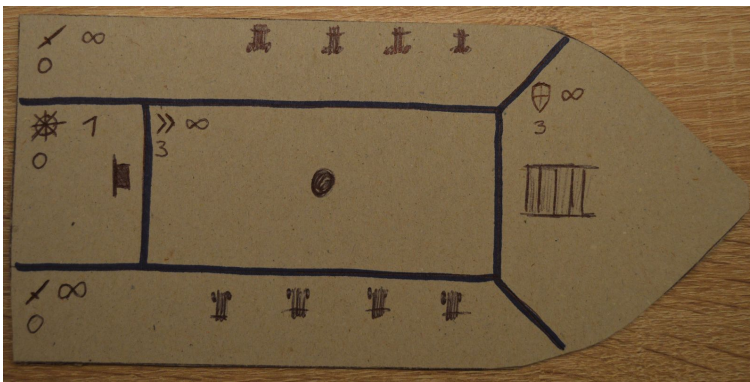
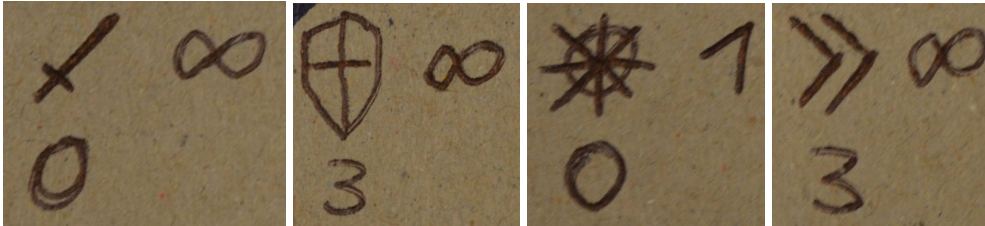


2.2.2. Boat Tile Crew Positions

The player can distribute the crew on 4 different abilities:

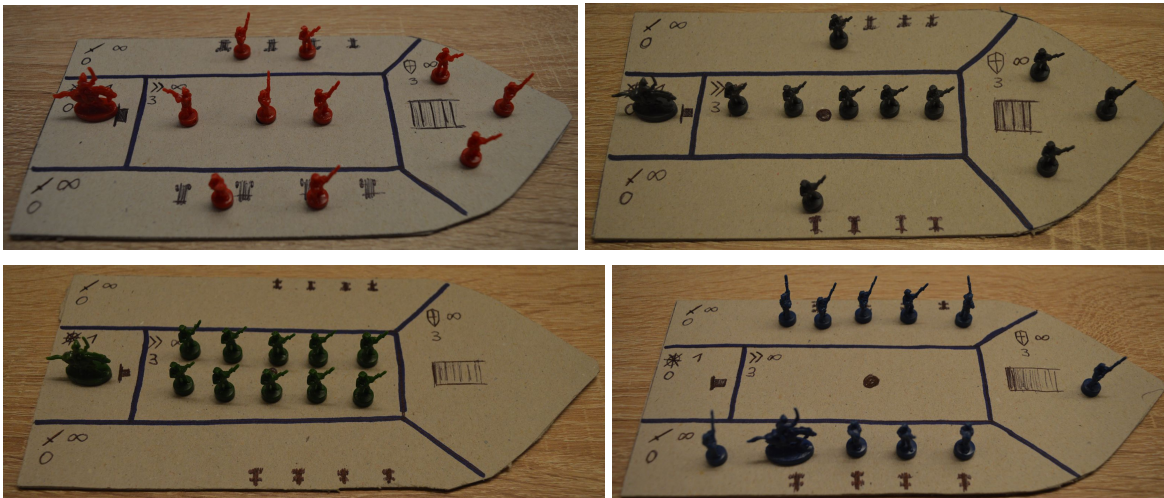
- **Offense:** Symbolized with a sword. Placement is on the sides of the ship, where the cannons are placed. Your offense points indicate how much damage you can deal with your cannons. The base value is zero and the number of units that can be placed here is unlimited.
- **Defense:** Symbolized with a shield. Placement is on the bow(front) of the ship, which has a stair leading to the basement. There the crew makes repairs and prevents the ship from taking additional damage. A base value of 3 is present on every ship. Your defense value indicated how much you can shield yourself from enemies' cannon barrage. The number of units that can be placed here is unlimited.

- Steering: Symbolized with a ship wheel. Placement is on the back of the ship. Only one person (the captain) is needed here. Steering allows your ship to navigate to an outer ring. The base value is zero.
- Movement: Symbolized with two angle brackets, implying motion. Placement is on the center of the ship so that the crew can adjust the sails. Each ship has a base value of 3. Your movement points determine how much you can traverse the map in a single round. The number of units that can be placed here is unlimited.



2.2.3. Crew Variations

Your game strategy may change on each round depending on the situation, so the player will usually shift the crew members to other parts of the ship and adapt to different situations in the maelstrom. Some of the possible assignments are presented below:

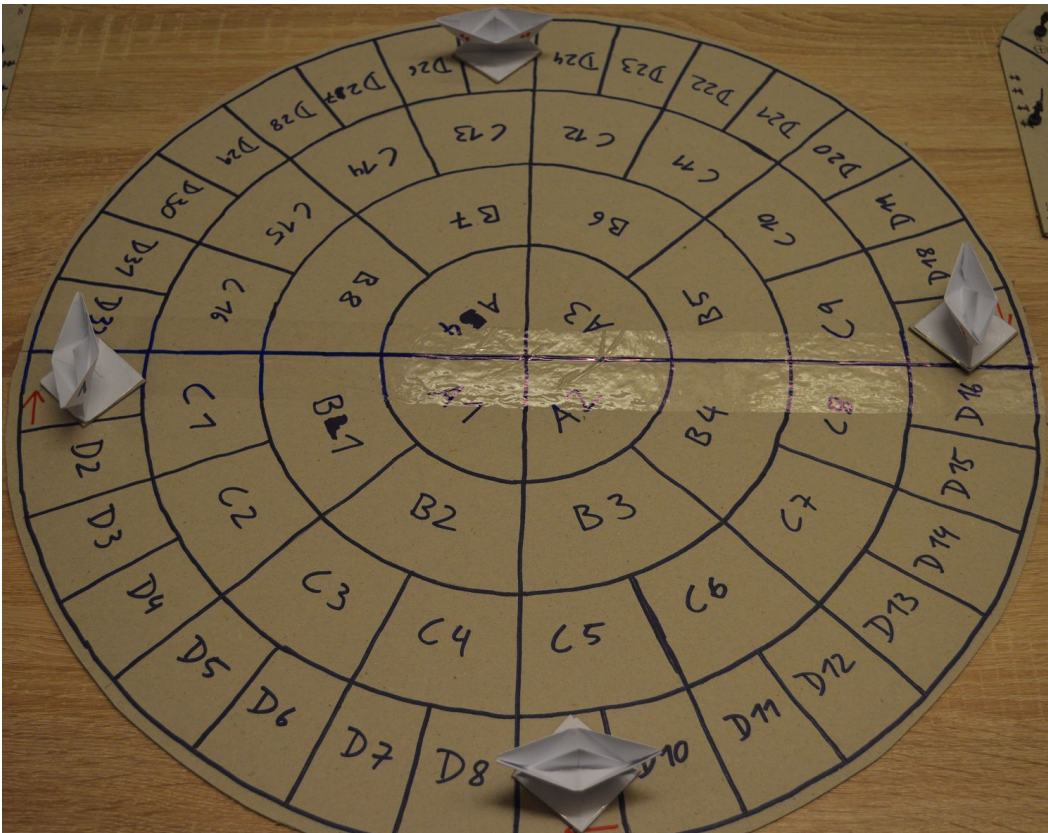


- Top left: A standard placement. 4 men on offense, 3 on defense, 3 on movement and the captain on steering.
- Top right: Similar to top right but 2 men are shifted from offense to movement, enabling one additional outer ring traversal.

- Bottom left: All crew members are placed on movement to be able to move rapidly, either out of harm's way or to reposition for a deadly attack on the next round.
- Bottom right: All crew members apart from one is positioned on the cannons. With this, the player has an offense value of 12, a defense value of 4 but no movement and steering: An all-out attack strategy.

2.2.4. Start Positions

Each player starts at the outer ring and as far as they can from others. Below: Players start on D1, D9, D17 and D25 (marked by a red arrow).

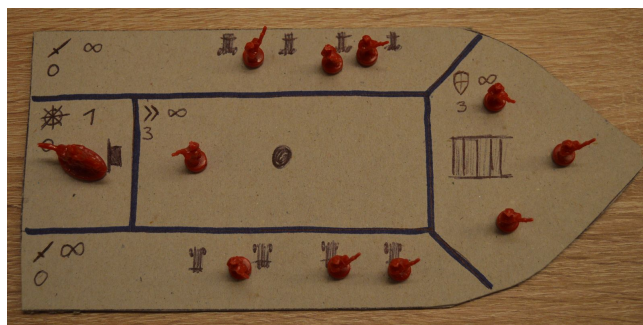


2.2.5. Actions per Turn

The game consists of rounds, while rounds consist of four turns. The game continues until one ship is remaining. In the first three turns players can participate while on the last step the kraken makes its move.

2.2.5.1. Reposition Crew

The players assign their crew to new positions in the first turn. The assignments are not revealed to players until turn three so that their actions are not influenced. The captain counts as



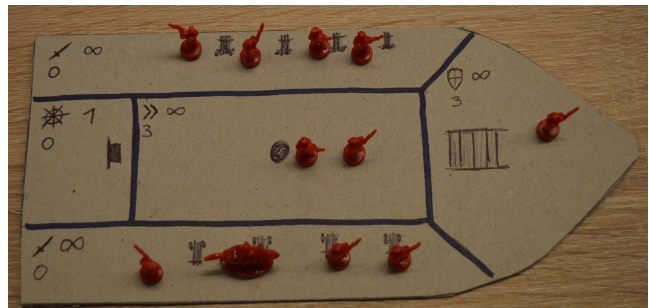
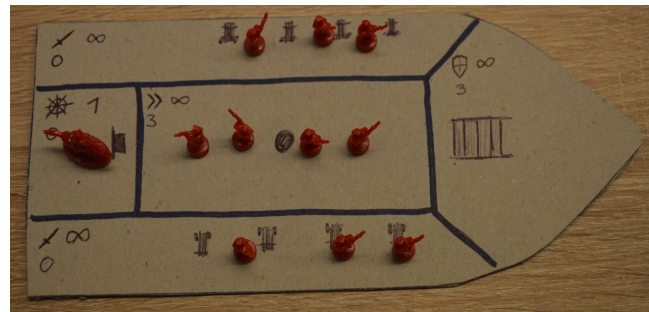
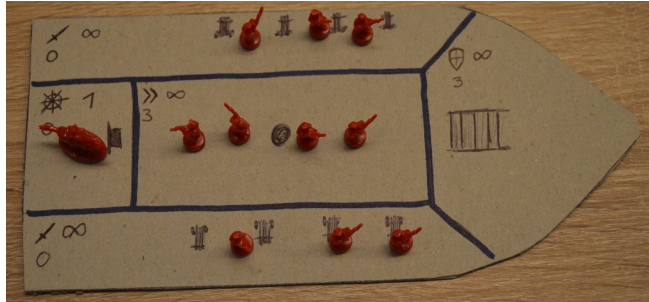
three members while he is not on steering duty.

2.2.5.2. Move Boat

In this turn players move their ships according to their movement points. The movement is in the direction of the maelstrom (clockwise) and players cannot move against the current. Moving to a region within the same ring and moving into an inner ring costs one movement while moving to an outer ring costs two movement points. Keep in mind that your captain needs to be steering in order to move to an outer ring. If you have five people on movement, you can travel two outer rings. If you have 10 people you can travel three outer rings. Since the current is also moving the ship forward, every ship gains a base 3 movement speed. Since the current is faster in the center, moving through the inner rings is also faster for the ships and this is also realized in our map.

Calculating where to go

Every player calculates his movement and decides on which field he wants to go. This decision is stored somewhere (on paper). After everyone is ready, the everyone shows their trajectory to others and moves their ship.

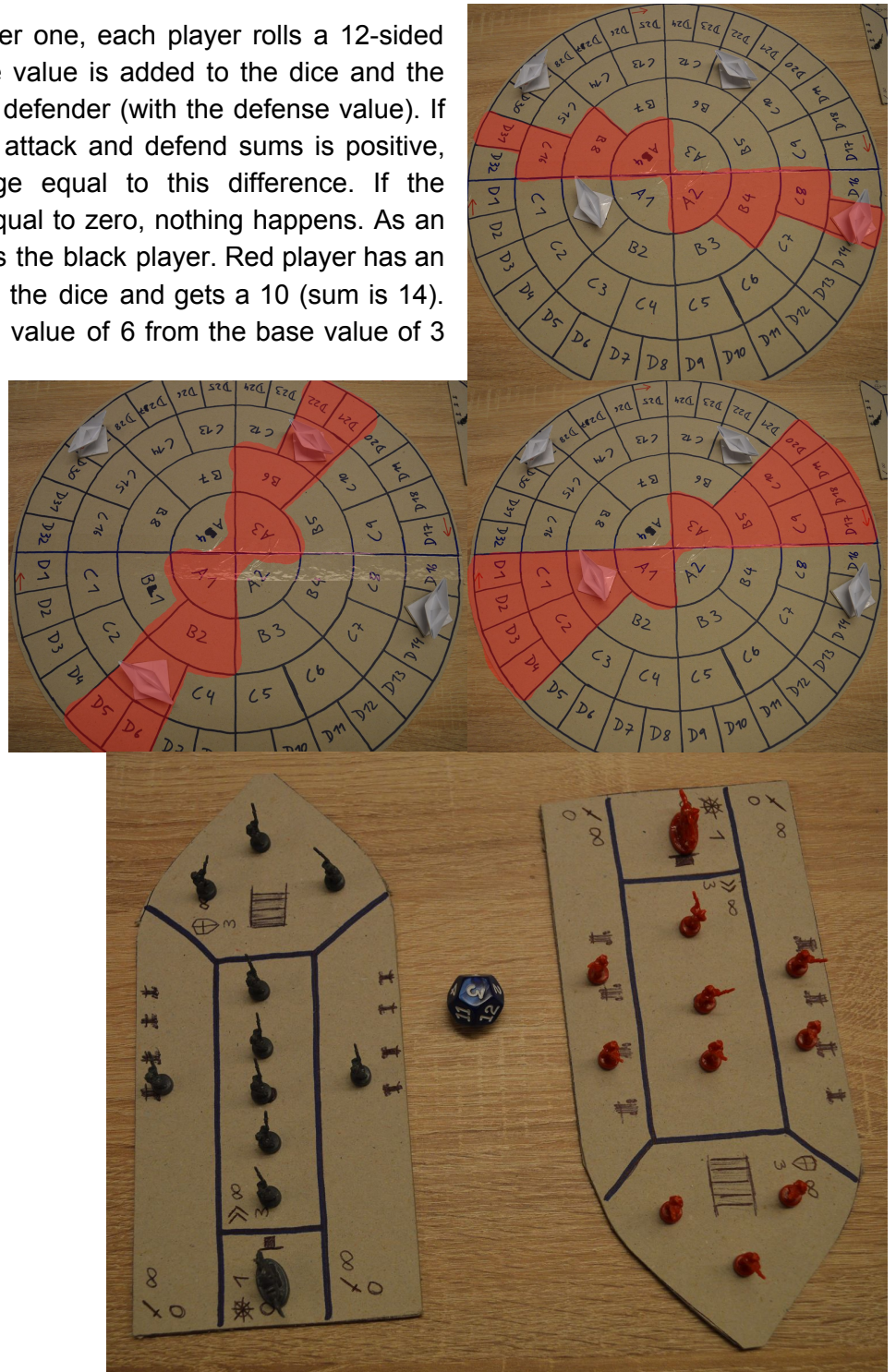


2.2.5.3. Attack

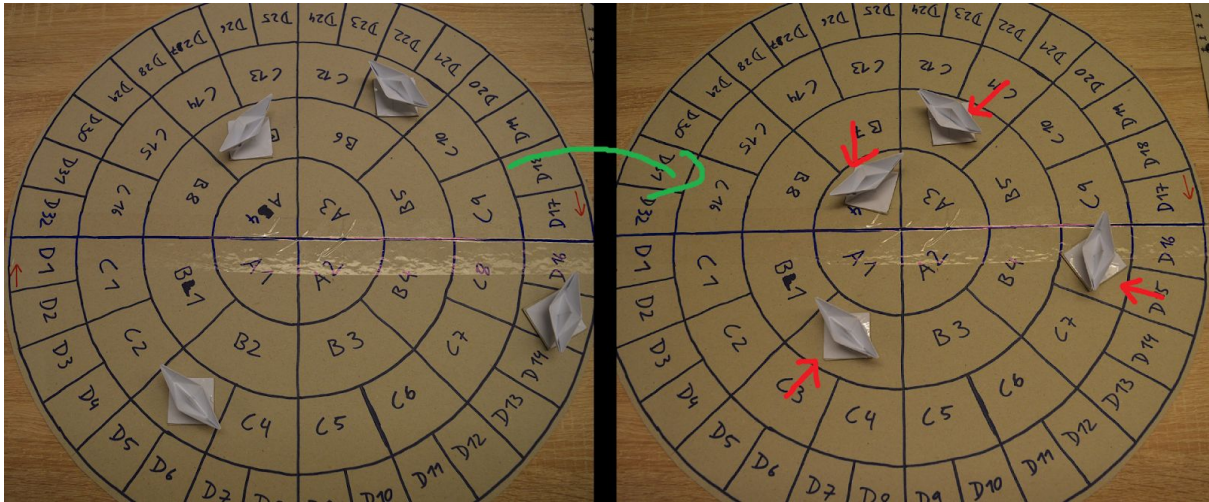
After the movement turn comes the battle turn. If two ships face each other on the maelstrom, they can fire at each other. If there are multiple ships in range, the player chooses which one to attack. The firing width of the ship depends on the ring the ship is in,

as can be seen on the images below: A player can find more targets, if his ship is closer to the center.

When a ship fires at another one, each player rolls a 12-sided dice. The attacker's offense value is added to the dice and the same things is done for the defender (with the defense value). If the difference between the attack and defend sums is positive, the defender takes damage equal to this difference. If the difference is less than or equal to zero, nothing happens. As an example: Red player attacks the black player. Red player has an offense value of 4. He rolls the dice and gets a 10 (sum is 14). Black player has a defense value of 6 from the base value of 3 and 3 men assigned. He rolls a 7. The sum is 13. The difference is $14 - 13 = 1$, so the red player inflicts 1 damage to the black player.



2.2.5.4. Moving Pieces Towards Center



After the battle is done, the maelstrom pulls every player to the center. Every ship moves one ring inward. If a ship is in the center of the maelstrom the kraken comes hunting for him (see 2.2.6.2).

2.2.6. Special Cases

2.2.6.1. Two Players on Same Field



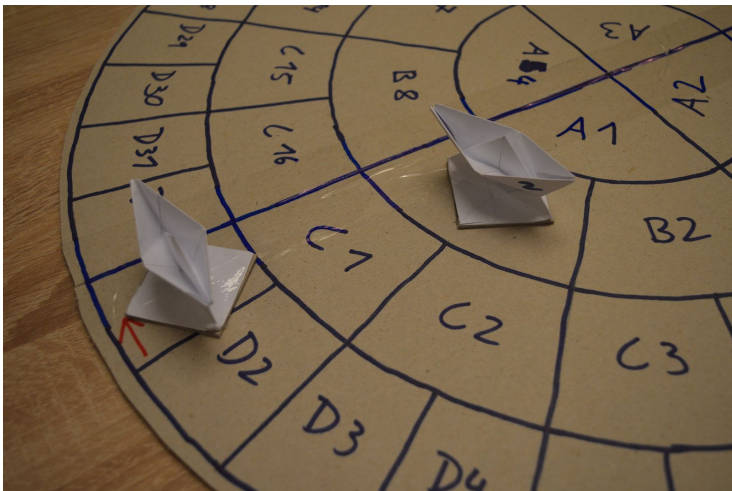
If two player land on the same field after a movement turn or at the end, when the maelstrom pulls the boats towards the center, each player rolls a 6-sided dice and the loser is rammed to the inner ring.

2.2.6.2. Player on Center Ring



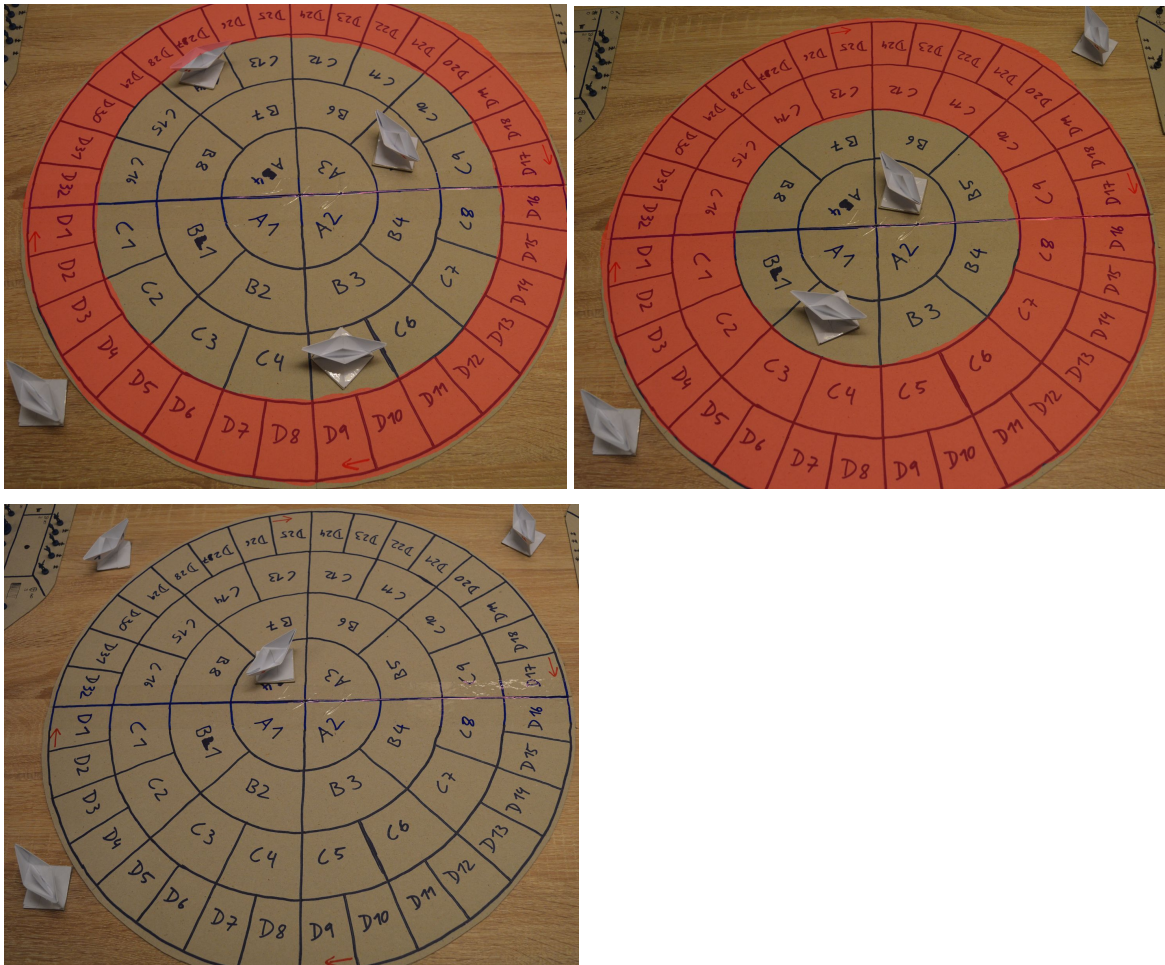
At the last turn, if any ship is on the center, the kraken tries to sink it. A 6-sided dice is rolled and the ship takes damage equal to the roll.

2.2.6.3. Attacking on Same Side



If the ships are on the same quadrant on the battle phase, the attacker's offense value is doubled. This is because the ships are near each other so that cannons won't miss their target as easily. Being on the same quadrant is risky but a player can also inflict serious damage to an assailant.

2.2.7. Players Get Eliminated



When a player gets eliminated, the maelstrom gets stronger. When starting a new round, the most outer ring will be inaccessible. With every ship sunk, the map gets smaller so the game length is exponentially reduced, preventing boredom.

2.3. Experience

When we played our prototype we realized that it got really exciting and competitive. This is due to the nature of multiplayer battles. We also came up with the rules that support our core ideas like giving each ship a base movement speed, making traversal faster in inner rings or doing more damage when ships are near each other. We also needed to adjust some numbers for offense, defense, hit points etc. which also took some time to figure out.

2.4. Learnings from Prototype

We think that we are on the right track since our gameplay experience was really fun and immersive. Prototyping enabled us to see where to focus on our project and merge additional details to provide a good playing experience.

2.5. Game Revisions

We are thinking about doing some simplification for our early version. Complex details will be handled if we have enough time for them as we will first focus on making a stable game with the core and fun elements in it. The importance of balancing has also shown itself: Poor balancing can lead to frustrating experiences and we will need to fine-tune some values to make the game more enjoyable. More time will be reserved for playtesting to find the optimal balance.

3. Interim Report

4. Alpha Release

5. Playtesting

6. Public Presentation and Conclusion