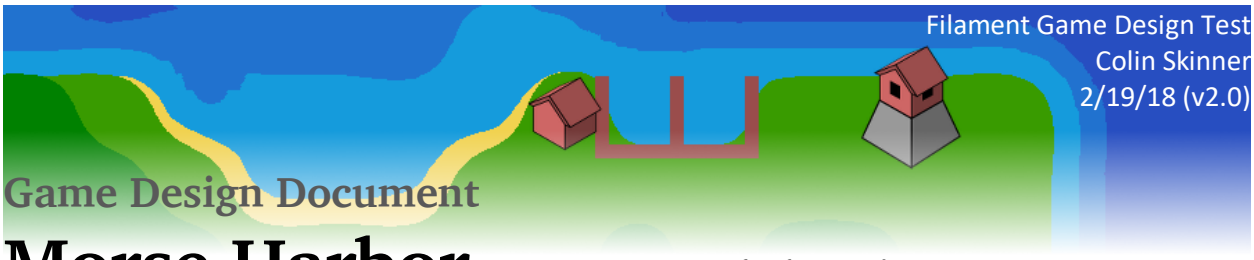

Game Design Document

Morse Harbor : a Morse code learning game

Contents

General Summary

In this game, players assume the role of a radio operator charged with directing boat traffic in a busy port of trade. Morse Harbor is frequented by a variety of seafaring vessels, from small fishing boats to gigantic ocean liners. In **story mode**, players will develop their radiotelegraphy skills as they help sailors navigate, coordinate rescue missions, and foil an international smuggling operation. Once they've grasped the basics, players can put their Morse **sending** and **receiving** skills to the test in the exciting and unpredictable **arcade mode**.

Target Audience

This game is designed to be a fun learning tool for anyone who wants to learn and use Morse code, from no knowledge to full proficiency. **Story mode** will be accessible to a broad range of ages and play styles, requiring only hunt-and-peck typing skills and a desire to learn Morse code. Practically speaking, this translates to an age range of middle school and up. Because **arcade mode** leaves more decisions up to the player, it may be more suitable for older players or those with experience playing other simulation and/or management games. While the focus is on standard Morse code, the game holds additional educational value for those interested in other aspects of maritime communication, such as the International Code of Signals (ICS).

Learning Objectives

Learning objective	How the game meets it
The player will understand the concept and general application of Morse code.	The concept of Morse as a way to encode text information using simple aural or visual patterns will be explained as part of the game's tutorial. The general application of Morse as a language for long-distance communication will be conveyed by the game's maritime theme and core gameplay (using Morse to communicate with ships).
The player will be able to receive Morse code, or specific phrases in Morse code.	One of the game's core mechanics is **receiving** Morse code messages sent by ships. Receiving a message involves listening to audio containing Morse patterns and typing the corresponding characters. Through extended play, as players encounter longer messages with a wider variety of characters, their aptitude at receiving Morse will continually improve.
The player will be able to send Morse code, or specific phrases in Morse code.	The game's other core mechanic is **sending** Morse code messages to ships. Sending a message is accomplished by pressing two buttons that emit Morse code dots and dashes; they must be pressed in a particular pattern. At first the game will prompt which characters the player should send; later, the player will be able to send messages as he/she sees fit depending on the situation.
The player will appreciate the pros and cons of Morse code.	The pros and cons of communicating with Morse vs. with conventional voice radio could be conveyed via plot details. For example, a loss of signal quality could cause the coast station and a ship to switch from a voice channel to a Morse channel. Conversely, communicating fine details in Morse could become tedious and necessitate a switch to a voice channel. In another scenario, perhaps no one on a ship knows English, but they discover they can communicate effectively using ICS signals sent via Morse.

Game Modes

Becoming proficient in sending and receiving Morse code can take a long time. In *Morse Code: The Essential Language*, Peter Carron estimates that learning to receive Morse at a speed of 5 words per minute (basic proficiency) takes the average learner approximately 30 hours. In order to provide the requisite amount of practice, this game offers two modes of play: **story mode**, a linear, scaffolded learning mode, and **arcade mode**, which learners will enjoy replaying over and over in an attempt to beat their high score.

Story Mode

Story mode is a linear, scripted experience designed to familiarize the player with the game's mechanics and also teach them the fundamentals of communicating with Morse code. To the greatest extent possible, story mode will employ the Koch method of teaching Morse in which characters are introduced one at a time, mixed in with characters the student has already mastered. As the player advances, the messages they will need to receive and send become progressively longer and use a wider variety of characters. By the end of story mode, the player will have encountered all 36 letters and numbers at least once and will be adept at using the **code reference** to look up any characters they may have forgotten.

Arcade Mode

Arcade mode is a timed, scored challenge in which players try to earn as many points as they can in one **day** (i.e. before the timer runs out). The types of ships in play, their routes of travel, and the events that befall them—and therefore the kinds of messages that the player will need to send and receive—are all different with each playthrough. This makes arcade mode highly replayable, and able to provide the volume of practice required to learn Morse code. Because attempting arcade mode could be overwhelming without a strong grasp of the game mechanics and basic Morse, players should be advised to complete **story mode** first.

Game Mechanics

In *Morse Harbor*, the player communicates with ships by **sending** and **receiving** audio messages in Morse code. The other mechanics serve to support these two core mechanics. I'm going to start by describing the harbor and the ships that inhabit it, but feel free to skip ahead to the core sending and receiving mechanics on page 8 if you like.

The Harbor

Morse Harbor is a busy place. Several industries ply their trades on its waters—shipping, passenger carrying, fishing, scientific research—and portions of the harbor are specialized to serve each industry. Below is a map of the harbor and the surrounding waters.

Map Legend

Key	Name	Description
	Coast Station	The player is a radio operator at the **coast station**, a radio station on a hill overlooking the harbor. An adjacent building houses the **patrol boats** that the player will use to respond to emergencies.
	Docks	The **docks** are the destination of **coastal** and **cargo ships**. A large crane is bolted to the deck, ready to unload shipments of goods.
	Pier	The **pier** is where **ferries** and **ocean liners** pick up passengers for regional trips and international voyages. Nearby, a fancy restaurant looks out onto the harbor.
	Wharf	The **wharf** is where the region's **fishing boats** unload their daily catches. In the back, fishmongers sell seafood to customers seeking maximum freshness.
	Lab	The **lab** is the home base of any **research vessels** operating around the harbor.
	Waters	The waters in and around Morse Harbor are not uniformly deep. The three depths, **shallow**, **intermediate**, and **deep**, are indicated by different shades of blue. If a large ship enters intermediate water, or if a medium-sized ship enters shallow water, the ship will likely run aground and will need to wait for a **patrol boat** to free it.
(not pictured)	Shoals	Large **shoals** of fish are a common sight around the harbor. Wherever a shoal appears, it's just a matter of time before a **fishing boat** arrives.
	Reefs	Coral **reefs** lurking just under the water's surface pose a real danger to ships navigating the harbor's waters. If a ship runs into a reef, it begins to sink and must wait for a **patrol boat** to come and patch it up.

Ship Types

Morse Harbor is frequented by several types of ships of different sizes, speeds, and occupations. Below is a list of the various ships that the player may encounter.

Type	Size*	Speed	Description
Coastal Ship	Medium	Medium	**Coastal ships** and **cargo ships** carry shipments of goods to and from the **docks**.
Cargo Ship	Large	Slow	

Ferry	Medium	Medium	**Ferries** and **ocean liners** carry passengers to and from the **pier**.
Ocean Liner	Large	Slow	
Fishing Boat	Small	Medium	**Fishing boats** collect fish from **shoals** and deposit their catches at the **wharf**. Other ships must take care to avoid their nets.
Research Vessel	Small	Slow	**Research vessels** move slowly between **reefs** conducting marine biology research. Other ships must take care to avoid its divers.
Patrol Boat	Small	Fast	**Patrol boats** provide assistance to other ships in times of need. They can tug other craft, patch hulls, put out fires, rescue survivors, provide medical assistance, provide pilots, etc.

* A ship's size determines not only its **radius**, but also how much cargo or passengers it carries (large ships carry twice as much as medium ships) and the water **depth** required for safe passage (medium ships can't travel in shallow water; large ships can *only* travel in deep water).

Ship Radius & Route

Every ship has a **radius** indicating how much space it takes up and a **route** indicating its intended path of travel. These details are indicated visually on the game screen (see *Fig. 1*).

The **radius** represents the amount of open water that the ship needs around it in order to operate safely. If a ship's radius overlaps with a **reef** or another ship's radius there is a chance that a **collision** event will occur. Likewise, if the radius overlaps water that is too shallow, the ship may **run aground**. The likelihood of these **events** is determined by the amount of overlap; the greater the overlap, the higher the chance.

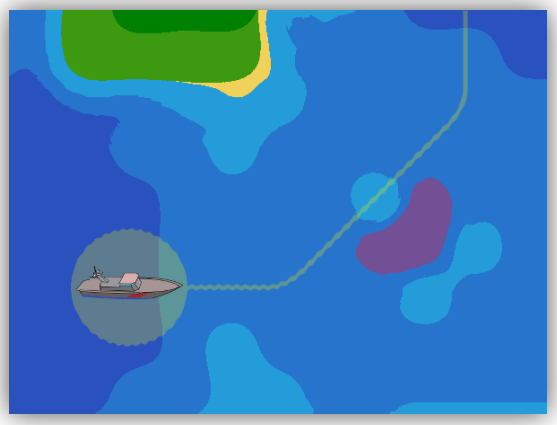

Figure 1a. A ship's radius and route are shown in faint yellow. This ship is in danger of colliding with the reef.

Figure 1b. The player sends *U l* ("you're running into danger; turn left") and the ship modifies its route accordingly.

Fishing boats and **research vessels** are special in that their radii are variable. When these ships are in transit their radii are small. However, when a fishing boat is stationary next to a shoal, or when a research vessel is stationary next to a reef, their radii become much larger. This is because their submerged nets / divers present a greater hazard to nearby vessels. Collision with a stationary fishing boat / research vessel may cause a special **event** to occur.

The **route** shows the path that the ship intends to travel along. Seeing the intended routes of travel allows the player to judge if ships are headed into trouble (e.g. sand bar, reef, another ship) and intervene as necessary.

Ship Status

Every ship has one of five statuses associated with it that describes its current situation. Ship status is indicated visually on the game screen via colored icons next to each ship. The five statuses are described below.

Icon	Status	Description
	Smooth Sailing	The default status; ship is traveling to its intended destination.
	Confused	The ship received a message it wasn't expecting or one that didn't make sense. **Confused** ships stop moving for a time before reverting back to **smooth sailing**.
	Assistance Requested	The ship has requested information or assistance and is waiting for a response from the coast station (player). Once the information or assistance has been provided, the ship will revert back to **smooth sailing**. Depending on the nature of the problem, if some time goes by and no assistance is provided the ship may enter **dire straits**.
	Dire Straits	The ship is in deep trouble (on fire, sinking, etc.). Having a ship in **dire straits** incurs a large score penalty. If enough time elapses and no assistance is provided, the ship **sinks** and is replaced by **lifeboat(s)** waiting to be rescued.
	Mission Accomplished	The ship has successfully completed its business in the harbor. Having a ship reach this status confers a score bonus.

Whenever a ship's status changes, the icon changes and a sound effect plays to alert the player to the change. Additionally, if the ship is currently off-screen, the camera pans to show the ship's location. The **smooth sailing** and **mission accomplished** icons fade from view after a short time, while the other three icons remain on screen to serve as a visual reminder. The player can click or tap a ship to see its current status.

Ship Events

The waters in and around Morse Harbor can be treacherous. A number of neutral or adverse **events** may befall its ships, requiring the player to intervene on their behalf. Events may be **conditional** (they occur when certain things happen in the game) or **random** (impossible for the player to predict).

Conditional events	**Random events**
Establishing radio contact	Requesting or providing information
Requesting permission to enter harbor	Requesting medical assistance
Requesting permission to leave harbor	Springing a leak
Requesting a pilot	Catching fire
Running aground	Man overboard
Colliding with reefs or other ships	
Colliding with fishing nets / divers	
Sinking	

When an event occurs, the affected ship typically sends a message describing the problem or request. The player then **receives** the message, learns the nature of the event, and decides how to respond. Some events can be resolved over radio simply by **sending** appropriate message(s) back to the affected ship, although many require the player to dispatch one or more **patrol boats** to the ship's location to provide the needed assistance.

Receiving Messages

Throughout the game, ships may send messages to the **coast station** to establish radio contact or request information or assistance. It is the player's job to receive these messages and respond accordingly.

Incoming messages appear in an interface along the bottom of the game screen (see *Fig. 2*). When ready, the player clicks a button to listen to the message. The player hears a series of short and long beeps and pauses (a Morse audio code). While the audio plays, the player transcribes the code into text, typing each letter they hear into a text input field. The player can replay the message as many times as they want. They can also slow down the recording to 0.75x or 0.5x speed to make it easier to transcribe in one go. When they have the full message transcribed, the player clicks a button (or presses Return on their keyboard) to submit their work.

Sending Messages

The player can also send messages to ships to provide information, alert ships of danger, or issue commands. In **story mode**, the game will tell the player what to send in each message. In **arcade mode**, it is up to the player to decide what messages to send and when.

For sending messages, the / (forward slash) and Shift keys on the player's keyboard together function as a telegraph key (the player can click UI buttons instead if they prefer; see *Fig. 2*). The game interprets the input as follows:

/	Dit / dot
Shift	Dah / dash
Short pause	End of current letter; begin a new one
Medium pause	End of current word; insert a space
Long pause	End of transmission; send message

Much playtesting will be needed to fine-tune what constitutes a short pause, a medium pause, etc. in order to make this mechanic as user friendly as possible. The player will be able to preview their message as they are sending it, so they will be able to tell if they made a mistake and need to start over.

Figure 2. A mockup of the main game screen, including the interface for sending and receiving messages.

Message Format

Most messages that the player will need to send or receive will follow a standard format. The format below is similar to the format specified by the International Code of Signals (ICS) guidelines for maritime communication.

[Receiver's Call Sign] DE [Sender's Call Sign] [Message]

Notes:

- DE means "from".
- Call signs consist of two or three alphanumeric characters.
- The [Message] is typically a one-, two-, or three-character ICS code, although plain English may be used as well. If plain English is used the message is preceded by "YZ".

Examples:

- "Z1 DE HJ4 K" means "HJ4 calling Z1: I wish to communicate with you."
- "HJ4 DE Z1 YZ GO AHEAD HJ4" means "Z1 to HJ4: Go ahead HJ4."

Since this game is intended to teach Morse code and not ICS code, ICS messages will be translated for the player whenever helpful. For example, if the player successfully receives a message consisting of the letter K, we could have some text appear next to the sending ship saying, "I wish to communicate with you" (see *Fig. 2*).

Issuing Commands

By sending messages containing certain ICS codes, the player can instruct ships on how to move and where to go. This can be done proactively, i.e. to keep ships from getting into trouble, or reactively, i.e. to rescue ships from trouble once they are in it. Here is an overview of the some of the commands the player can give to ships via ICS; see the Appendix for the full list.

ICS Code	Meaning
P	Maintain present course
E	Turn right
I	Turn left
L	Stop
X	Wait for further instructions
RV2	Enter harbor
RV3	Leave harbor
MB1	Keep right
MB2	Keep left
CH . .	Vessel requests assistance at [latitude] [longitude]
CC . .	Vessel in distress at [latitude] [longitude]

Note that in most cases the player needs to give proper justification for the command (e.g. "you are running into danger") or the ship will become **confused**.

When a ship requires assistance, the player can use the CH or CC command to instruct a **patrol boat** to travel to its location. Once its radius overlaps that of the other ship, the patrol boat begins providing assistance. After a short time (the exact amount of time varies based on the nature of the problem), the ship's status changes from **assistance requested** or **dire straits** to **smooth sailing** and the patrol boat returns to the **coast station**.

Code Reference

Any time the player forgets what a piece of code (Morse or ICS) means, they can check the **code reference**. The code reference is an in-game reference manual that lists each letter and number, its Morse code, and its ICS meaning. The reference also lists all the two- and three-letter ICS codes that appear in the game. To avoid information overload and help the player find what they need quickly, letters and ICS codes start greyed out and only fill in once the player encounters them in game.

Controlling the Camera

The player can manipulate their perspective in order to take a wide view of the whole harbor or to focus on specific ships, as the situation requires. The player can switch between zoom levels using the mouse wheel and pan the camera by moving the mouse to the edge of the screen or by using the arrow keys. On tablet, standard swiping and pinching gestures are supported. The game itself may take control of the camera at certain points, e.g. during **story mode** or upon receiving a distress signal.

Pausing the Game

Because **sending** and **receiving** messages both take a significant amount of time, the game should automatically pause while the player is sending or receiving and resume afterwards. We could also consider allowing the player to freely pause and unpause the action.

In-Game Assessment

During game play, the player's performance sending and receiving Morse is assessed via constructive feedback on each transmission. Whenever the player receives a message and submits their transcription, or sends a message using the telegraph key, the correct message and the one the player sent/received are shown side by side. The player's message is color-coded to show which characters the player got correct and which ones they got wrong. The player receives a score for the transmission based on various factors including the length of the message, the number of characters gotten correct, and (in the case of received messages) the number of times the player replayed the Morse audio. The score for the message is added to the player's total score.

In addition to the scores for each message, the player also receives a score bonus based on the current statuses of the ships around the harbor. This score is calculated every second and added to the player's total.

Status	Effect on score
Smooth Sailing	Small score bonus per ship per second.
Confused	Small score penalty per ship per second.
Assistance Requested	No effect on score.
Dire Straits	Large score penalty per ship per second.
Mission Accomplished	Large one-time bonus per ship.

At the end of each **day** (a day is a level of **story mode** or one play session of **arcade mode**), the player sees a **results panel** summarizing their performance. The panel shows the player's final score, their previous high score for that **day**, and whether they set a new record. Below, it breaks down the score a bit further and lists various play statistics and how they contributed to the final score. Some of the stats we might want to track include:

- Characters received
- Characters sent
- Receiving accuracy (correct characters received / total characters received * 100)
- Sending accuracy (correct characters sent / total characters sent * 100)
- Receiving speed (words per minute)
- Sending speed (words per minute)
- Total seconds of smooth sailing
- Total seconds of confusion
- Total seconds of dire straits
- Missions accomplished

Post-Game Assessment

When you're teaching how to do something, it's important that the assessment is actually doing that thing. In this case, sending and receiving Morse code. Receiving would be as easy as having the student listen to a 5 wpm audio file and having them transcribe on paper. Sending would be a little trickier; you'd probably want an actual telegraph key and someone who knows Morse listening on the other end.

Appendix

ICS Codes

Following is a tentative list of ICS codes that could allow for some interesting story beats (in Story Mode) and/or emergent gameplay (in Arcade Mode); these seem like good candidates for inclusion.

Code	Meaning
A	I have a diver down; keep well clear at low speed.
C	Affirmative.
E	You should alter your course to starboard. (turn right)
F	I am disabled; communicate with me.
G	I require a pilot.
I	You should alter your course to port. (turn left)
J	I am on fire.
K	I wish to communicate with you.
L	You should stop your vessel instantly.
M	I have run aground.
N	Negative.
O	Man overboard.
P	My nets have come fast upon an obstruction.
T	Keep clear of me; I am engaged in trawling.
U	You are running into danger.
V	I require assistance.
W	I require medical assistance.
X	Stop carrying out your intentions and wait for my signals.
Z	I require a tug.
AE	I must abandon my vessel.
CC	Vessel indicated is in distress in [latitude] [longitude] and requires immediate assistance.
CE	I will attempt to obtain for you the assistance required.
CH	Vessel indicated is in [latitude] [longitude] and requires assistance.
CP	Vessel indicated is proceeding to your assistance.
CR	I am proceeding to the assistance of the vessel in distress at [latitude] [longitude].
CS	What is the call sign of your vessel (or station)?
CV	I am unable to give assistance.
DX	I am sinking.
HB	I have rescued [number] survivors.
HW	I have collided with surface craft.
HZ	There has been a collision between vessels indicated.
IN	I require a diver.
IZ	Fire has been extinguished.
JL	You are running the risk of going aground.
JW	I have sprung a leak.
LI	Increase speed.
LJ	Decrease speed.
MB1	You should keep on the starboard side of the fairway.

MB2	You should keep on the port side of the fairway.
MO	I have struck a reef.
NC	I am in distress and require immediate assistance.
PI	You should maintain your present course.
RV2	You should proceed into port.
RV3	You should proceed to sea.
SN	You should stop immediately. Do not scuttle. Do not lower boats. Do not use the wireless. If you disobey I shall open fire on you.
ST	What is your cargo?
SU	My cargo is [number indicating cargo type].
UN1	May I enter harbor?
UN2	May I leave harbor?
UW	I wish you a pleasant voyage.
VL	Tropical storm is approaching; take appropriate precautions.
XP	I am (or vessel indicated is) stopped in thick fog.
YZ	The words which follow are in plain language.
ZL	Your signal has been received but not understood.