COMMODORE

Process Book

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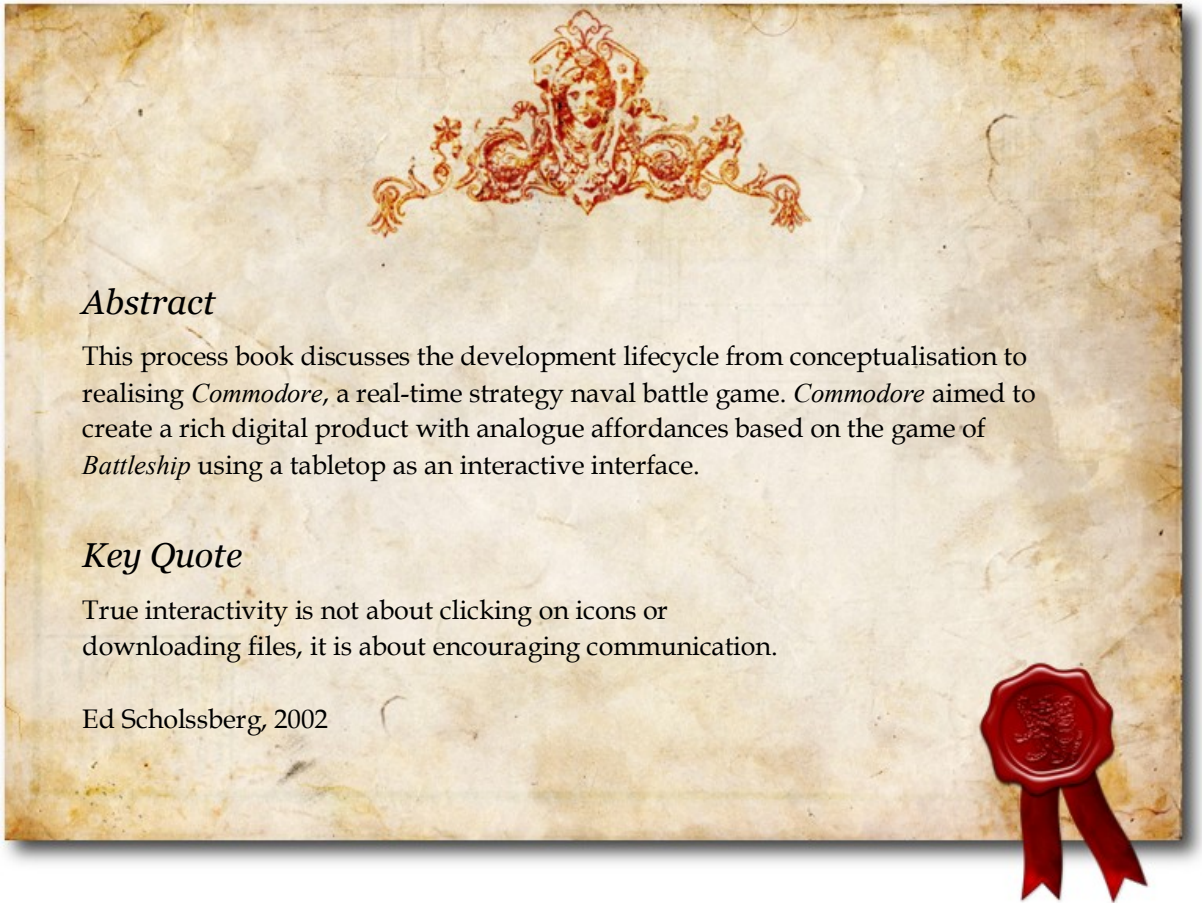
Appendix 1: Additional Resources



Abstract

This process book discusses the development lifecycle from conceptualisation to realising *Commodore*, a real-time strategy naval battle game. *Commodore* aimed to create a rich digital product with analogue affordances based on the game of *Battleship* using a tabletop as an interactive interface.

Key Quote

True interactivity is not about clicking on icons or downloading files, it is about encouraging communication.

Ed Scholssberg, 2002

Copyright

Introduction

The focus of *Commodore* was to explore new ways to interact with tangible designs.

Project Description

The principle aim of the design was to create an interface that exposed all the functions required to complete a real-time strategy game. The objective was to facilitate the players' belief that they are in control of all aspects of the game, rather than a computer.

Fundamentally, *Commodore* encompasses tangible interaction and physical feedback. Unlike computer-based games, interacting with physical icons [phicons] means players are able to communicate through the battle scenario without learning the functions of a computer interface (including clicking, selecting, dragging and scrolling).

Game Narrative

The game exposes the hidden realms of a military tactician by utilising a plotting table to visualise a naval battle. Tacticians can then command a battalion to advance or retreat in order to gain a competitive edge and defeat their opponent. Warfare and aesthetics typical of the British Regency period (1811-1820) informed the *Commodore* game.

Figure 1 (above): Digital construction of a person interacting with *Commodore* using one of three phicons.

Figure 2 (left): One of two battlefields in the *Commodore* game.

Background

Investigations of military plotting tables in board games, moving image, research settings and computer games informed *Commodore*.

Moving Image

Throughout the development process, many movies were examined to explore how popular culture portrays military plotting tables.

The movie Harry Potter and the Philosopher's Stone portrays a game of Wizards Chess. Attacking the opponent is visualised through the physical destruction of a chess piece. A chessboard is a grid-based representation of a battlefield.

Figure 3: A battle of Wizard's Chess, *Harry Potter and the Philosopher's Stone* (2001).

In Cleopatra (1963), the manoeuvring of model ships on a plotting table correlates to the physical location of a ship.

The destruction of the correlating ship was visualised through a chemical change through the burning of its phicon.

Figure 4: The progression of a naval battle, *Cleopatra* (1963).

Board Games

Parallels exist between the classic 1950s game of *Battleship* and *Commodore*. The objective of both games is for a player to destroy their opponent's navy. The physical layout is also similar as both players have the ability to see their opponents however; neither player can see their opponent's game board.

Figure 5: Cover of the *Battleship* game (1950s).

While similar, *Battleship* does not directly inform the interaction and experience of *Commodore*. Distinct differences include:

Battleship	Commodore
Turn-based	Real-time Strategy
Grid-based Movement	Vector-based Movement
Independent Battlefield	Shared/Common Battlefield
Board Game	Tangible Media Computer Game

Research Settings

At the National University of Singapore (NuS), Dr. Adrian Cheok leads the Mixed Reality Lab. His department has published the *Digital Sand Table*, which depicts a military plotting table.

In order to engage with the work, the user wears a see-through head-mounted display. The display layers a virtual environment over a physical world resulting in an augmented reality.

The user interaction of the *Digital Sand Table* centres on a paddle system. By utilising a spatula, elements in the virtual environment are inserted or manipulated.

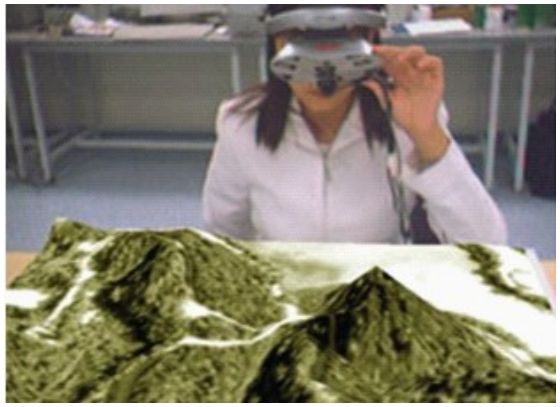


Figure 6: A digital still from the *Digital Sand Table*, National University of Singapore (Cheok, n.d.).

Computer Games

Developed by UbiSoft, R.U.S.E. is a WWII strategy computer game designed for use with a standard PC or upon the Microsoft Surface.

When utilising the Microsoft Surface, the player has the ability to command an army, navy or air force around a battlefield using touch. This method of interaction inspired the initial concepts of *Commodore*.

For further information regarding the *Digital Sand Table* from the National University of Singapore and the *R.U.S.E.* promotional trailer from UbiSoft, please refer to the moving image resources in appendix 1.

Figure 7: Digital stills from the *R.U.S.E.* promotion trailer (UbiSoft, 2009).

Methodology

Commodore underwent an iterative development lifecycle. The design of the project evolved in accordance with the results of user testing. Through this agile methodology, ideas were generated, evaluated and refined.

Concept Sketches

Early concept sketches of the *Commodore* project were made to describe the setting of the installation. These identified that the most important aspects of the project involved producing tangible media, selecting and maintaining an aesthetic and creating an engaging game play in order to produce a rich user experience.

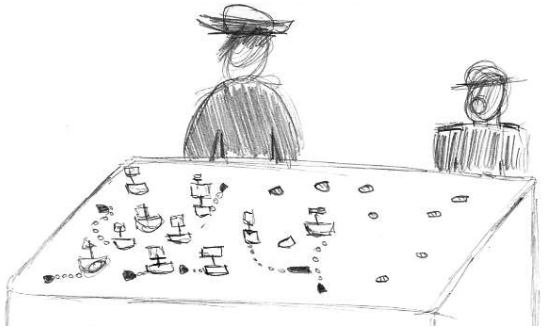


Figure 8: Early concept sketch of *Armchair Generals (*working title of *Commodore)* depicting many ships on a plotting table.

User Stories

After interviewing gamers and members of the target audience, user stories were written to design a SURAC (Statement of User Requirements and Acceptance Criteria). The SURAC outlined guidelines for the successful implementation of the project.

Paper Prototyping

Paper prototyping provided a means to evaluate the effectiveness of the interaction and game components without overinvesting valuable resources.

Multiple game testers analysed tangible and graphical user interface prototypes. They were filmed as one of multiple weekly PICTIVE (Plastic/Paper Interface for Collaborative Technology Initiative through Video Exploration) sessions.

The aim of a PICTIVE session was to determine whether the physical interaction related appropriately to the virtual game play. Participatory design allowed gamers to engage in the development process without having to understand the technical aspects of the installation.

Prototypes were refined with the review of PICTIVE recordings. This includes adding more interaction (how to start a game) and inserting more feedback (visualising the amount of damage a ship has sustained).

Figure 9: Digital still from paper prototype PICTIVE session.

Figure 10: Original concept of attacking an opponent.

Design

Tangible Media

In their publication *Tangible Bits: Towards Seamless Interfaces between People, Bits and Atoms*, Ishii and Ullmer describe the dual citizenship of a human being between the physical and digital worlds.

Ishii and Ullmer also describe the existence of "rich languages and cultures which valued haptic interaction with real physical objects" and the degradation of this richness with the advent of digital technologies. By implementing tangible media, *Commodore* re-explored the analogue realms to produce a digital media.

Aesthetic

After exploring the Queensland Maritime Museum (Brisbane, Australia) and the Greenwich Maritime Museum (Greenwich, United Kingdom), a similar approach to Ishii and Ullmer's process was employed.

The methodology utilised wood and brass for the visual aesthetic. This design approach was carried throughout the installation from the physical (ships, tables, etc.) to the virtual battlefield (map, cannon balls, etc.).

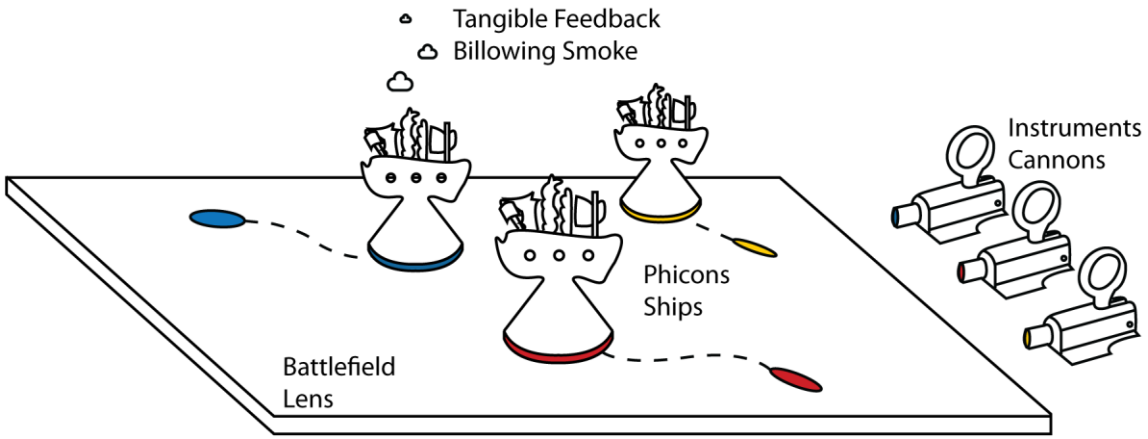


Figure 11: Mockup of the fundamental Tangible Media elements in *Commodore*.

Figure 12: Collage of marine instruments and sources of inspiration for the *Commodore* aesthetic.

Interaction

The *Commodore* narrative consists of:

- A prologue describing the game,
- A summons when one player is ready,
- A battle where two players compete,
- An epilogue indicating the winner.

Starting a Game

In order to begin a game, both players must summon the will to engage in battle. With the suppression of GUI-style interfaces, a method of tangible user input is required.

Options considered included: the placement of all ships on the tables, the blowing of a whistle and the raising of a flag – which draws to "hoisting the colours" (a dated naval term that signifies the declaration of war).

The ringing of a ships bell was selected as:

1. In the context of an exhibition, ringing a bell provides a sonic cue that a game is about to begin. In contrast, a flag could be easily missed in an exhibition environment.

2. The use of a bell provided a simplistic design as the ability to detect a bell ringing was much easier than checking and manipulating the state of a flag.

Figure 13 (above): A ship bell used to start a game of *Commodore*.

Figure 14 (left): This photo of a ship's bell and rope from a naval vessel provided inspiration for utilising a bell as a means to begin play. Image by Bruno Girin (enlarge).

Ship Artefacts

The ship pieces act as a physical icon [phicon] that allows for game input and output. The phicon design endeavoured to ensure the user experience was as rich as possible.

As Input

During battle, the game is divided into two intertwined interfaces: physical and virtual.

The phicon on the physical layer connotes the desired location of a ship. The image of a ship on virtual layer denotes the actual location of the ship in battle.

Moving the phicon commands the movement of a virtual ship to arrive at its correlating location. In order to afford bilateral movement, a croupier baton accompanies each player.

As Output

Electronics fitted in the phicon actuate situational feedback. These components respond to the progress of a game.

When commanded to fire, LEDs illuminate from the port and starboard side batteries. As a ship sustains damage, smoke billows from its sails. On its destruction, masts fall signifying its inability to compete.

Figure 15 (above): Ship with smoke billowing from the masts.

Figure 16 (left): A croupier baton affords bilateral movement of phicons.

Firing

For two players to compete against each other, a firing interaction needed to be realised. Firing interactions explored included:

a. Touch
   Pressing on the virtual opponent ship and neighbouring allied ships within range attacking.
b. Speech
   Attack by yelling the name of the allied ship followed by "FIRE".

A cannon trigger was chosen as it follows the aesthetics of British Regency naval warfare and naturally enforces a waiting period for the trigger to recoil. The sound of the trigger springing back was also satisfying as it produced a loud bang.

Reloading

Not all elements of the game employ tangible media.

Auditory and visual feedback was utilised for the reloading of a cannon. An audio cue of a sailor is played when a cannon reloads. A light also signifies the corresponding cannon's reload state.

Figure 17(above): Cannon triggers used to attack the enemy with reload-state.

Figure 18 (left): Cannon triggers from a player's perspective.

Game Play

The game play addresses fundamental elements of early 1800s naval warfare. This includes wind-force; shallow reefs and having ships tack in order to arrive at their commanded location. Ships must also align broadsides in order to attack an opponent; otherwise, they are not within range.

Interactive Soundtrack

A musical score was produced which responded to the intensity of the game. The sequence played is calculated depending on the proximity of enemy ships and game progression (the amount of damage sustained by allied and enemy ship).

Multi-player Competitive

Dividing the installation into two separate plotting tables forms a competitive multi-player environment. This follows the design of the 1950s game of *Battleship*, which allows both players to see each other without exposing any strategies. Fog of war simulates a real-world naval battlefield, as allied ships are completely visible while opponents are only visible when in range of attack.

Figure 19: Digital still of the virtual battlefield seen through the tangible lens. Allied ships (white sails) are always visible and opponent ships (black sails) are only visible when in range. The shroud of the fog hides one of the enemy ships.

Implementation

Phicon

As most model ships sold at hobby stores were obtusely disproportionate to the size of the battlefield, custom phicons were constructed.

The foundation of the ship is a 3D fridge magnet found at a local children's toy store.

The fridge magnets were traversed with a 3D scanner to produce a computer-assisted drawing (CAD) wireframe. The outcome was manipulated to define a blueprint for the phicons.

Once the shape of the phicon was complete, it was built using a rapid prototyping machine. Through a Fused Deposition Modelling process, Acrylonitrile Butadiene Styrene (ABS) powder was structured and moulded into a solid plastic object. The construction process for a single phicon took approximately 26 hours.

The phicons were then stained and glossed to produce a wood effect found commonly in the British Regency period. Electronics were then inserted into the phicons to actuate situational feedback.

Figure 20: Process of converting fridge magnets to phicons.

Tracking

To identify the location of a phicon, the installation originally used the Reactivision fiducial tracking system. The major advantage centred on the ability to simulate tabletop interaction without setting up the table, computer, and projector (etc). However, problems occurred when the projected image interfered with the fiducial image.

Figure 21: Examples of Reactivision fiducials found underneath a ship phicon.

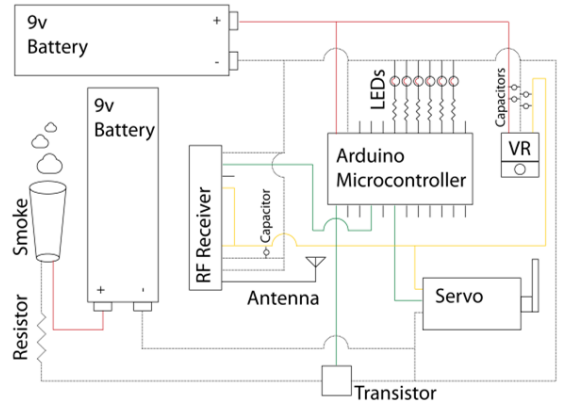
An implementation of colour tracking was made in order to identify the location of each ship individually. Colour tracking had a higher fidelity as the processing required to identify colour was significantly simpler.

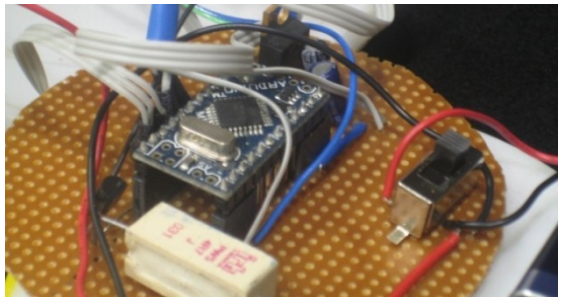
Although a loss of phicon orientation is the by-product of utilising colour over fiducial tracking, it was not required for the game. For a ship to attack broadside, it must sail past its opponent. Orientation of the phicon is ignored in the movement of a ship.

Electronics

The computer communicates with each phicon through a half-duplex radio frequency. It controls actuators such as the firing of LEDs, billowing of smoke and a servo for the mast.

Each ship contains two 9-volt batteries. The Arduino microcontroller processes information on the server (PC) and client (phicon) interface. Smoke stacks were sourced from model-trains and servos were purchased from a hobby store.





Tables

The design of the tangible user interface followed conventional lens-based displays.

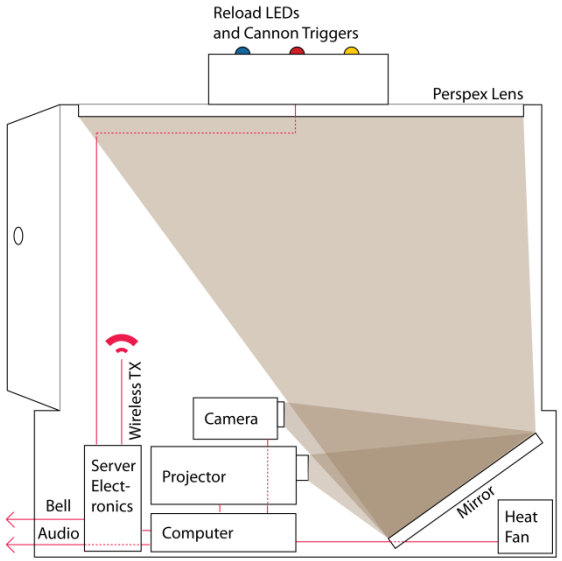
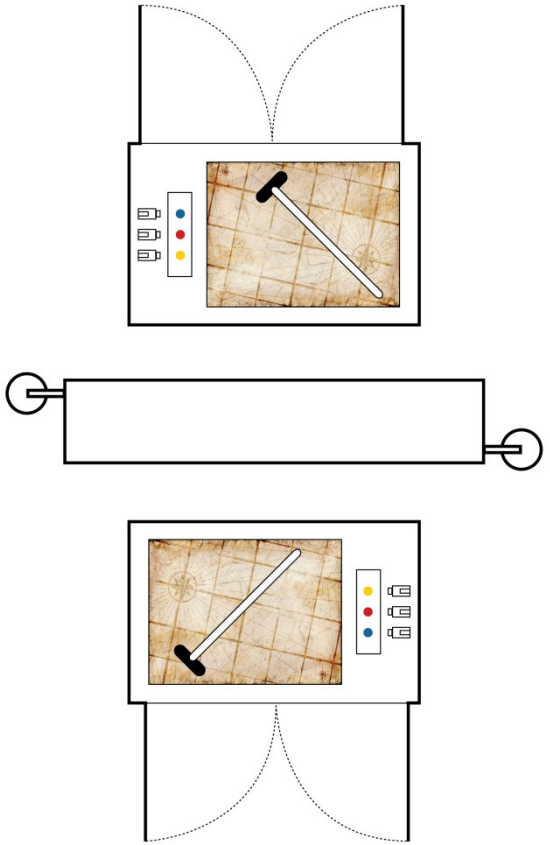


Figure 22: Layout of the internal components of the Battle Tables.

A frosted sheet of Perspex provided agency for a lens. It allowed a projector to visualise the battlefield yet deny the player from seeing inside the installation. It also blurs items not rested on top the lens, increasing the fidelity of image tracking. Using a mirror increased the projector's image throw allowing for a larger battlefield.

Exhibition Layout

In an exhibition environment, *Commodore* is arranged in the following composition.



One player (English) and their opponent (Pirate) compete against each other.

Reflection

This Way Up 2009 marked the first public exhibition of *Commodore*. On presentation, the project had successfully implemented 97% of the SURAC (including 100% of medium and high priority user requirements).

Throughout development, it was discovered that creating tangible user interfaces is far more complex than graphical user interfaces. This was due to the acute amount of resources required to design and realise functional physical components.

It was also found tangible media was not always the most appropriate implementation for a solution. Some design elements were more appropriate as auditory or visual feedback – such as the cannon reload-state.

The *Commodore* project facilitated communication between two opponents through a naval battle scenario. The ability to compete and converse with one other provided agency for an engaging and fun experience enjoyed by people of all ages.

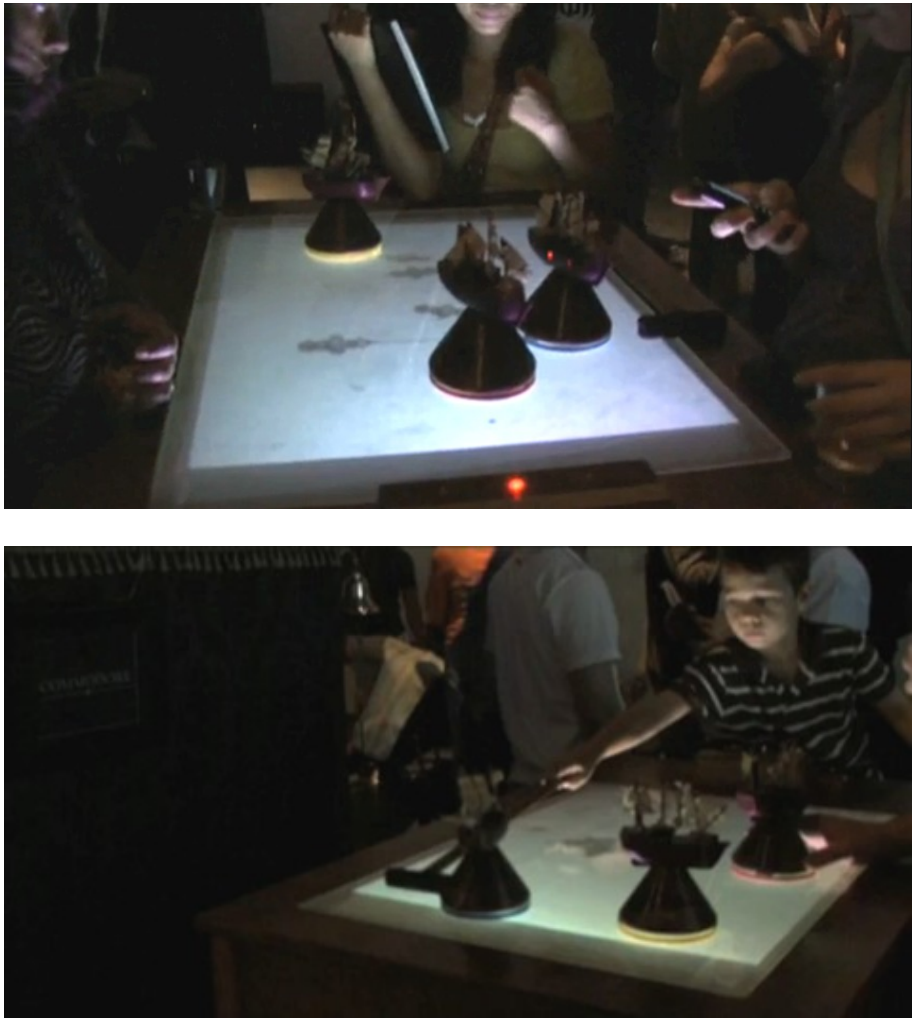
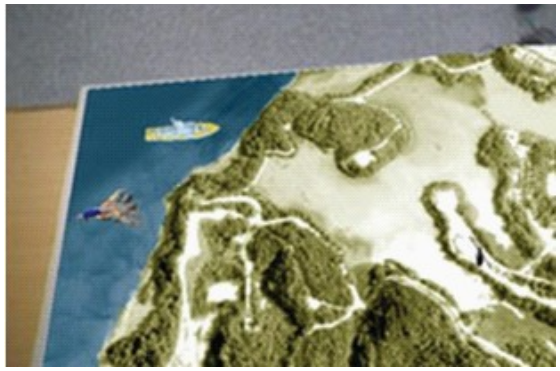


Figure 23: People engaging with *Commodore* at the *This Way Up 2009* exhibition.

Appendix 1

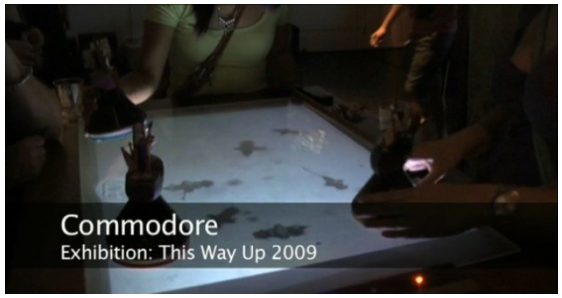
Moving Image Resources

2min 15 sec: *R.U.S.E.* Exclusive Trailer– UbiSoft
http://www.youtube.com/watch?v=5ohNzHWL7FI&fmt=16



1min 05sec: *Digital Sand Table* – NuS
http://www.mixedreality.nus.edu.sg/oldmxr/MEDIA/all%20videos/new.video.group/militarytable.mpg

Commodore



1min 38sec: *Commodore @ This Way Up 2009*
http://www.youtube.com/watch?v=1YGxvuDHC4M&fmt=16

About the Author

Bash attended the Queensland University of Technology in Brisbane, Australia throughout the years 2004-2009. During this time, he completed a Bachelor of Creative Industries (majoring in Communication Design) and a Bachelor of Information Technology (majoring in Web Services and Applications).

Related Resources

- Bashkim Isai: Creative Practitioner
- Commodore
- This Way Up 2009 Exhibition

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