System Analysis for Games

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課程內容

- System Analysis
- Mind map
- Game System
Why System Analysis (1/2)

- Connection from Game Design to Implementation
- For Program Structure Analysis (程式結構分析)
  - Program modulus
  - Tools needed
- To Identify Work Load (工作量)
  - How much code to be done?
  - What tools to be developed?
- For Resource Management (資源管理)
  - Man month? (人月)
  - How many programmers?
  - Development tools?
  - Specific requirements?
Why System Analysis (2/2)

- For Jobs Dependency Analysis
- To Analyze Technical Implement Possibility
  - 技術可行性分析
  - R&D
  - Work-flow
- Pre-processor for
  - Game / technical design document (GDD/TDD)
  - Project management
Something about System Analysis

- There Are No Standard Procedures
- It’s Not a Theory, Just Something Must Be Done!
- Popular Solutions:
  - UML
  - Mind map (心智圖法)
    - This is the one we will use for this course
System Analysis Steps

- Brainstorming (腦力激盪)
- Integration (整合)
- Dependency Analysis (相依性分析)
- Create the Project (專案建立)
- Write the Design Document (設計文件撰寫)
Brainstorming

- Select a Tool
  - Mind map
- Based on the Game Design to Put Everything in Structure As Many As You Can
- Including
  - Game system
    - Combat / Village / Puzzle / ...
  - Program modulus
    - Camera / PC control / NPC AI / UI / FX / ...
- Tools
  - Level editor / Scene editor / ...
- Entities in games
  - Characters / vehicle / terrain / sky dome / audio / ...
- Technical hi-lights
Integration

- Confirm the Resource Limitation
- Technical Implement Possibility
- Connect All Related Items Together
- Remove Redundant Items
- Jobs / System Identification
- Man Month Analysis
  - Budgets
  - How many?
  - Who?
Dependency Analysis

- Sort the Jobs
  - By dependency
  - By human resource
- Prototype for scheduling
- The Step That Always Is Ignored by Everyone
  - Doing good will make the schedule practical
  - Reduce unnecessary risks
Create the Project

- Scheduling (時間排程)
- Job Assignment (工作指派)
- Resource Allocation (資源配置)
- Check points
- Milestones
- Risk Management Policy (風險管理)
Writing Design Document

- **GDD**
  - Game design document
- **MDD**
  - Media design document
- **TDD**
  - Technical design document
Mind map

- 心智圖法
- A Radiant Thinking Tool
- Applications
  - 讀書心得
  - Proposal (提案)
  - 上課筆記
  - 遊記
  - System Analysis
  - ...
- Reference
  - Program
    - Visio
    - MindManager
    - ...
  - Tony Buzan, Barry Buzan, “The Mind Map Book: How to Use Radiant Thinking to Maximize Your Brain's Untapped Potential”
Mindmap Tools

- Use MindManager Pro
- Developed By MindJet
- MindManager Demo
Game Systems

- Game systems
  - Control & camera system
  - Combat system
  - Reward system
  - Game FXs
  - Levels
  - Village system
  - User interface
  - The main program
Game Control System (1/2)

- Game control is the interface between the game and the user.
- Game control is not only input device control but also the camera control.
- Input device control
  - On PC
    - Mouse
    - Keyboard
    - Gamepad
  - On game console
    - Gamepad buttons
      - 0 or 255
    - Joystick
      - 0 - 255
Game Control System (2/2)

- Camera control
  - First-personal view
  - Third-personal view
  - God view
  - Pre-set camera view
  - Etc
Mouse Control (1/3)

- Mouse is a 2D device.
  - 2-axis moving
  - Related movement
  - 2 or 3 buttons
- Mouse can:
  - Move
  - Drag
  - Double-click
- Behaviors
  - Hit test
  - Selection
  - Pilot
    - Position & orientation
Mouse Control (2/3)

- Typical game types using mouse control
  - Real-time strategy games
  - Role Playing Game
- Typical game play examples:
  - Path finding for playable character
  - Hitting the enemy
  - Selecting a group of units
  - Orientating the camera in FPS games
  - Menu selection
  - ...
- Features
  - Always coupling with god-view camera control
    - Viewing from the top of game world
Mouse Control (3/3)

- Easy to hand on
  - 一鼠到底
- Slow action
  - Compared with joystick
  - Value range from -32727 ~ 32727
Keyboard Control (1/3)

- Standard PC input device
- Simulating the gamepads
  - Not every PC game player having gamepad
  - Using keyboard as the alternative device
- Hotkey system
  - Each key has two states.
    - Pressed
    - Released
  - 256 keys
- Behaviors
  - Key presses/released
  - ASCII code
- One hotkey can represent a set of commands
  - Very fast input device
Keyboard Control (2/3)

- Communication tool
  - Typing messages

- Typical game types using keyboard
  - MMORPG
    - Needs chatting with friends
  - Real-time strategy games
    - Hotkey system
  - First-person shooting games
  - Fighting games

- Typical game play examples:
  - Chatting
  - Character controls
    - Move forward
    - Turning
Keyboard Control (3/3)

- **Features**
  - Shortcut for a sequence of actions
    - Commands
    - Menu selection
  - But a little bit complicated for players
    - 256 keys
A small “keyboard” designed for game playing
- Gamepad can map to the hotkey system
- Same behaviors
- Less than 20 keys

Majors keys:
Recent gamepad capable of two extra digital joysticks
- For buttons
  - Value range: 0 or 255
- For joystick
  - Value range: 0 to 255

Typical game types using gamepad
- Almost all types of games except
  - Need typing
  - Need large-range selection for game units

Typical game play examples:
- Character controls
  - Move forward
  - Turn
Gamepad Control (3/3)

- Combat system in a fighting game
  - Move forward
  - Turn
  - ...

- Features
  - Designed for game playing
    - Look and feel
  - Easy to hand-on
    - If you not to challenge the players’ usual practice
Camera Control

- Types
  - First-personal view
  - Third-personal view but following the playable character
  - God view
    - Fixed
    - Following the playable character
  - Fixed view
    - Pre-rendered background
  - Pre-set view
  - ...

- Very sensitive to game play design & game control
- Camera control is not an independent system
God-view Camera Example

Age of Empire 3
Combat System (1/4)

- Major source of the game fun
- Take the action game as our example
- Controls
  - Attack
  - Stun
  - Defend
  - Parry
  - Fatality
- Motion management and blending
- NPC AI
- FX
  - Visual
  - Audio
An Example
Motion management

- Motion blending in runtime
- A popular solution - “Blend tree”
  - Game Developers Conference 2003
  - Proceedings CD, Programming Track
  - “Animation Blending : Achieving Inverse Kinematics and More”
  - Jerry Edsall
  - Mech Warrior blend tree
NPC AI
- Finite state machine
  - Making decision
- Steering behavior
  - Steering control
  - Group movement
- Path finding
- Etc

FX
- Combat FX
- A game without FX is likely a man walking on street in nude.
Reward System

- Number system
- Level up
- Experience points
- Inventory
- Recovery
- Damage
- Mission complete
User Interface

- Menu
- Dialogue
- Pictures
- Mini-map
- Blood bar
- Caption
- Messages
- Game controls
Village System

- Story branching
- Script query
- Information exchange
- Trading
- Reinforce
  - Rest
Cheat Code System

- Game flow controls
- Jump level
- Number system testing
- Barrow inventory
- Game house keeping
- Game data editing
- Debugging