
CGMB534 Game Design

Chapter 14: Strategy Games

Objectives

- Know the definition of a strategy game and be familiar with the types of challenges that strategy games offer
- Define the set of orders that a strategy player will be able to give in your game
- Design a balanced set of units for use in a war game, including defining the attributes that govern their behavior

Objectives (Cont.)

- Compute the relative values of offensive and defensive units
- Understand Lanchester's laws and how they affect the relative strengths of forces of different size
- Create a technology tree of upgrades for the units that you have designed

Objectives (Cont.)

- Choose a system of logistics for your game and design the mechanism by which it works
- Know the most common types of artificial opponents and their strengths and weaknesses

What Are Strategy Games?

- The majority of challenges are strategic conflict
- Player chooses from a variety of potential actions or moves at most points in the game
- Victory is attained by superior planning and taking the best actions; chance must not play a large role
- Other challenges may also be present; physical challenges play little or no part

Game Features

- Two main subgenres
 - Classical turn-based games
 - Pure strategy games tend to be turn-based
 - In multiplayer turn-based computer games, players often choose their next move simultaneously
 - Real-time strategy games
 - Developed after turn-based games
 - RTSs add time pressure to strategy games

Game Features (Cont.)

■ Challenges

□ Strategic conflict

- Conflict is combat between groups of units
- Factories generate more units
- Players can choose from among a variety of units

□ Diplomacy and espionage offer alternatives to combat

Game Features (Cont.)

■ Challenges (cont.)

□ Exploration challenges

- Allow players to investigate unknown territory
- Fog of war—unexplored areas shown in black and explored but unpatrolled regions shown dimly

□ Economic challenges

- Players can collect resources to buy units
- If the economy is complicated, the game is actually a hybrid game made up of a strategy game and a construction and management game

Game Features (Cont.)

- Player actions involve giving orders to units
 - Move to a location
 - Attack
 - Stop moving
 - Hold a position
 - Establish a formation
 - Produce new units

Core Mechanics

- Designing units
 - Units usually fall into types so that all units of a type share a set of attributes
 - Some units will also have special unique capabilities
 - Rock-paper-scissors (RPS) model is suited only to simple games
 - Cannot be balanced for complex game
 - Doesn't take into account battlefield conditions

Core Mechanics (Cont.)

- Designing units (cont.)
 - Modern war games use numeric attributes to describe unit's abilities
 - Numeric attributes used more often are:
 - Health
 - Weapons
 - Range
 - Shot mass and velocity (or power)
 - Accuracy
 - Defensive dodging
 - Speed
 - Turn rate
 - Mass and acceleration
 - Range of vision

Core Mechanics (Cont.)

- Designing units (cont.)
 - Special capabilities include:
 - Stealth
 - Flying or sailing
 - Repair
 - Transport
 - Building construction and production of mobile units
 - Leadership
 - For every special capability you create for one side, you must also create a capability of similar military value for the other side OR a way to defeat the special capability

Core Mechanics (Cont.)

■ Designing units (cont.)

□ Computing the relative value of units

- Value based on time and resources

- Equation for attack units:

Attack unit value = maximum health × shot power
× rate of fire × theoretical accuracy
× range × maximum speed

- Equation for defensive units:

Defense unit value = maximum health × shot power
× rate of fire × theoretical accuracy
× (range² - 2)

Core Mechanics (Cont.)

- Designing units (cont.)
 - Production rates, unit numbers, and Lanchester's laws
 - Lanchester's Linear Law: In hand-to-hand combat, the relative strengths of two armies are simply proportional to their numbers of troops
 - Lanchester's Square Law: For units that can aim and shoot at one another from a distance and can concentrate their fire, the strength differential is proportional to the *square* of their sizes

Core Mechanics (Cont.)

- Health, morale, and fighting efficiency
 - Units normally fight at full efficiency until their health points are gone
 - Morale is represented by a number that increases or decreases an army's fighting effectiveness
 - Leadership bonus works better than diminishing fighting effectiveness in proportion to health or morale losses, because it doesn't involve positive feedback

Core Mechanics (Cont.)

- Upgrades and technology trees
 - Researching upgrades
 - Player must initiate research
 - Organize upgrades into a sequence
 - Allow player to choose upgrade to research
 - Upgrades can be applied to single units, unit types, or globally
 - Upgrades can be temporary or permanent
 - Create a technology tree to organize large numbers of upgrades

Core Mechanics (Cont.)

■ Logistics

- Management of supply: the production, distribution, maintenance, and replacement of personnel and materials
- Supplies and consumable items
 - Don't track food and fuel
 - If ammo is cheap and quickly expended, provide unlimited supply
 - Highly destructive ammo should be rare and tracked

Core Mechanics (Cont.)

■ Logistics (cont.)

□ Supply lines

- Route over which fresh troops and war materiel must be transported from their source to where they are needed
- Cutting the supply line is a classic strategy
- Most computer war games model supply lines correctly for the troops but not the supplies
 - Players don't want to manage supplies
 - Realistic supply lines mean creating transport units and modeling the supplies as individual objects

Core Mechanics (Cont.)

- **Logistics (cont.)**
 - **Abstracting the distribution process**
 - Completely abstracting distribution can cause exploits
 - Alternative is verifying that supply routes are open, but don't actually require transport
 - **Road-building**
 - Build roads to access resources
 - Roads provide supply routes

Core Mechanics (Cont.)

- Logistics (cont.)

- Influence maps

- Any unit within a certain distance from a supply depot can receive supplies
 - Unobstructed route not required

The Game World

■ Historical settings

- Military strategy games tend to be set in the past
- Historical setting will be scrutinized for accuracy by players familiar with the event
- World War II market oversaturated
- Need a less popular time period or unique approach

The Game World (Cont.)

- Modern settings
 - Risks generating controversy and negative public opinion
 - Must be rigorously accurate and politically neutral
 - Must address the issue of battlefield scale

The Game World (Cont.)

- Future (science fiction) settings
 - Popular and allow a lot of scope for invention
 - Might not catch public's imagination
 - Use technology carefully
 - Define terminology
 - Must address the issue of battlefield scale

The Game World (Cont.)

- Fantasy settings
 - Use magic rather than technology
 - More emphasis on close-range and hand-to-hand combat

The Presentation Layer

- Interaction model
 - Large scale—player indirectly controls units and has godlike view of the game world
 - Squad scale—smaller group of 20 individual units
- Perspective
 - Players need to see the big picture
 - Aerial perspective needed

The Presentation Layer (Cont.)

- User interface
 - Player must control action at different scales
 - Usually present related data in separate windows
 - Make unavailable options gray
 - Provide beginner and advanced modes for commands
 - Group commands by function

Artificial Opponents

- Game tree search
 - Game tree is the set of all possible future moves
 - This approach works for only the simplest games
- Neural net
 - Mimics the brain's ability to recognize and correctly identify patterns of data
 - Not currently used in consumer games

Artificial Opponents (Cont.)

- Hierarchical finite state machines
 - Most successful mechanism for creating AI opponents in war games
 - What is a finite state machine?
 - Conceptual machine rather than a piece of mechanical engineering
 - Its rules establish a simple behavioral system for an individual automated character
 - Define each state and condition or event that causes transition to a new state

Artificial Opponents (Cont.)

- Hierarchical finite state machines (cont.)
 - Hierarchical finite state machines in games
 - Ones higher up in the hierarchy give orders to the ones lower down
 - Higher FSMs can order lower FSMs to change state
- AI alone usually can't beat a human player except in simple games
- Most AI opponents get other advantages
 - Human doesn't know where his enemy is
 - Designer gives AI more resources to start with

Summary

- You should now understand
 - How to identify a strategy game
 - How to define the orders a player can give in your game
 - How to design a balanced set of units
 - How to use Lanchester's laws in combat
 - How to create a technology tree of upgrades
 - How to enact logistics
 - How to utilize artificial intelligence