Defensive Military Operations in Civ-Style Strategy Games

CS 395 GAI

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Problems in Defensive AI Design

- How to create a defensible civilization?
- How many resources should be devoted to defense?
- How should the AI respond to threats and attacks?

Defensible Civilizations

Defensible Civilizations

- Clusters of cities to create defensive support networks
  - Distributed production capacity for bolstering a local defensive force
  - Road networks allow rapid inter-city movement of units
  - Leveraging terrain features to limit avenues of approach
  - Well-insulated locations for production centers and valuable assets (wonders)

Clustering Cities

- Mutual protection
  - A defensive response force built one unit at a time may arrive too late
  - Units can defend nearby cities
- Exploit a wider range of resources
  - e.g. specialize in growth vs. production
- Prevent a "city rush"

Road Networks

- Allows rapid redeployment of troops in case invaders arrive

- Improves access to resources

- Double-edged sword
  - In FreeCiv, enemy units may also travel your roads
  - Railroads make this even more dangerous
    - Zero-cost movement can lead to total collapse in just a few turns
    - Standing army needed to react quickly

City Placement

- Well-placed cities can be more easily defended
- Mountains, water, etc. can limit avenues of approach, especially when undeveloped
- Create natural chokepoints
  - May focus on defending chokepoints instead of individual cities

Protecting Assets

- Minimize threat to production centers
  - Keep them away from the front lines
  - Use their production capacity, road networks to supply positions at chokepoints
- Wonders
  - Keep them at the center of your empire
  - Not only very expensive, but draw the attention of enemy players

Defense Resource Allocation

Defense Resource Allocation

- City garrisons
- City improvement trade-offs
  - Guns vs. Butter
- Standing army outside cities
- When to shift production to defenders
- Demobilizing armies
- When to research military techs

City Garrisons

- How many troops to leave in your city?
  - Maintenance cost vs. defense value
  - Empty cities are easy to pick off, but well-manned cities slow growth
- Garrison as policy or in response to threats?

City Improvements

- Guns vs. Butter
  - Barracks and other defense improvements can significantly improve defensive position
  - Cost of maintaining those improvements detracts from improving productivity
- Cities might specialize in military vs. research vs. expansion
  - Determine specialties based on location, available resources, goals, tactical situation
  - Strengthen a cluster of cities by building a more complete mix of specialties

Standing Armies

- Mobile force for deployment as needed
- May serve as a deterrent
- Drain on exploration

Shifting Production to Defenders

- When should you make a shift?
  - Preemptive vs. JIT production

Demobilizing Armies

- You've just beaten off the invading army
  - Now what?
- Experience army is stronger
- But what happens when they come back with tanks?
  - Demobilization frees up resources for innovation

Researching Military Techs

- Similar concerns to unit production
  - Stay ahead or play catch-up when "badder bad-guys" are discovered?

Responding to Threats

Responding to Threats

- Standing armies
  - Distributed vs. Concentrated
- Finding the right mix of troops
  - Land vs. Sea vs. Air
- Engaging invaders
  - "Bait and wait" vs. pre-emptive action

Distributing Armies

- ## Distributed armies
  - First line of defense for any situation
  - Tougher to respond with a strong second-wave

- ## Concentrated armies
  - Good chance of routing invaders on first contact
  - But risk exposing an Achilles heel
    - If they slip through to your production center, you're in big trouble

Troop Mix

- Land vs. Sea vs. Air
  - Terrain will be the biggest influence
  - Weak sea defense can be exploited to bypass strong land defense
  - Air defense is expensive, but tough to shore up once you fall behind

Engaging Invaders

- Strike first or wait until they can't escape?
- May depend on your assessment of their forces
  - If you think you can win handily, you might as well get them too close to escape and then wipe them out
  - If you're not so sure, you might want to strike hard early and hope they think twice about their plans

Flexible Planning for Defense

Planning Problems

- Global vs. local planning
- Pursuing multiple goals in parallel
- Making plans that support a fall-back option
  - Inexpensive/partial replanning
  - Knowing when a plan has gone awry
- Reactionary capabilities
- Opportunity costs of plans/actions

Search Problems

- Intelligence on other players
  - Based on observations, what might they have?
- Finding chokepoints to defend
- Pathfinding
- Optimizing unit/tech choices based on current events
- Wonder production based on what others have been producing
- Cashflow management