Defensive Military Operations in Civ-Style Strategy Games

CS 395 GAI
Spring 2005
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