Stackelberg Extensive-Form Correlated Equilibrium with Multiple Followers

(abbreviated as SEFCE)

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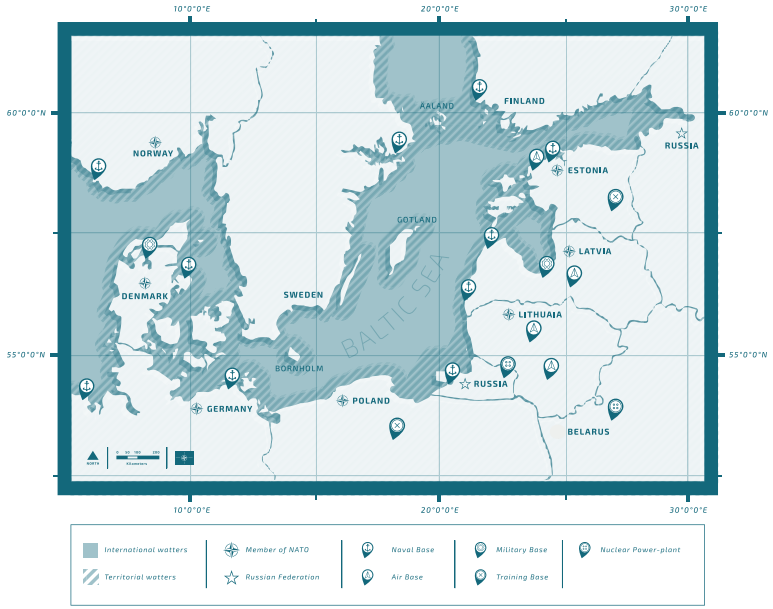
We formalize a sequential coordination of individual members in large organizations like NATO or UN. Presented solution concept enables computing optimal strategies for each member. We analyze the computational complexity of different interaction scenarios.

Game-Theoretic Model of Coordination

- Coordination of independent members can not be enforced, because of legal sovereignty
- Each member follows his own goals and defends his own interests in the first place
- Cooperation is profitable, but **no computational concept** directly models it
- In our approach, we model individual members as players in sequential game

Solution Concept

- SEFCE describes a situation when an organization (called the leader) commits to a strategy that is observed by other members (called the followers)
- The leader then coordinates them through a series of recommendations
- Each recommendation is revealed once a member reaches a point where he can (possibly) follow it
- In equilibrium, **no deviation** is profitable



Real-World Applications

- Coordination is required in many processes in human society
- SEFCE naturally implements the abstraction of complex control with multiple acting agents
- Straightforward applications can be found in economy: franchises, alliances of companies (e.g. airlines); or security: NATO's missions (e.g. Baltic Mission, Iceland Air Policing, Libya Intervention), UN's missions (e.g. Somalia Civil War)

Practical Example: NATO's Baltic Mission

- The scenario is inspired by recent exercises in Baltic region and a report of **wargames** played by NATO's generals
- The leader is NATO itself with its own brigades
- The followers are individual Baltic states

- NATO deploys its troops and schedules military exercises
- Each Baltic state perceives NATO's actions and receives suggestions concerning which area to patrol and where to deploy the brigades

Results

- Optimal set of strategies **always exists** in every game
- Computing an exact strategy is **NP-hard** whenever at least three members interact or the interaction is influenced by random events

- Designed and implemented algorithm computes optimal strategies in **every game**
- Experiments were performed on randomly generated games with negatively correlated outcomes