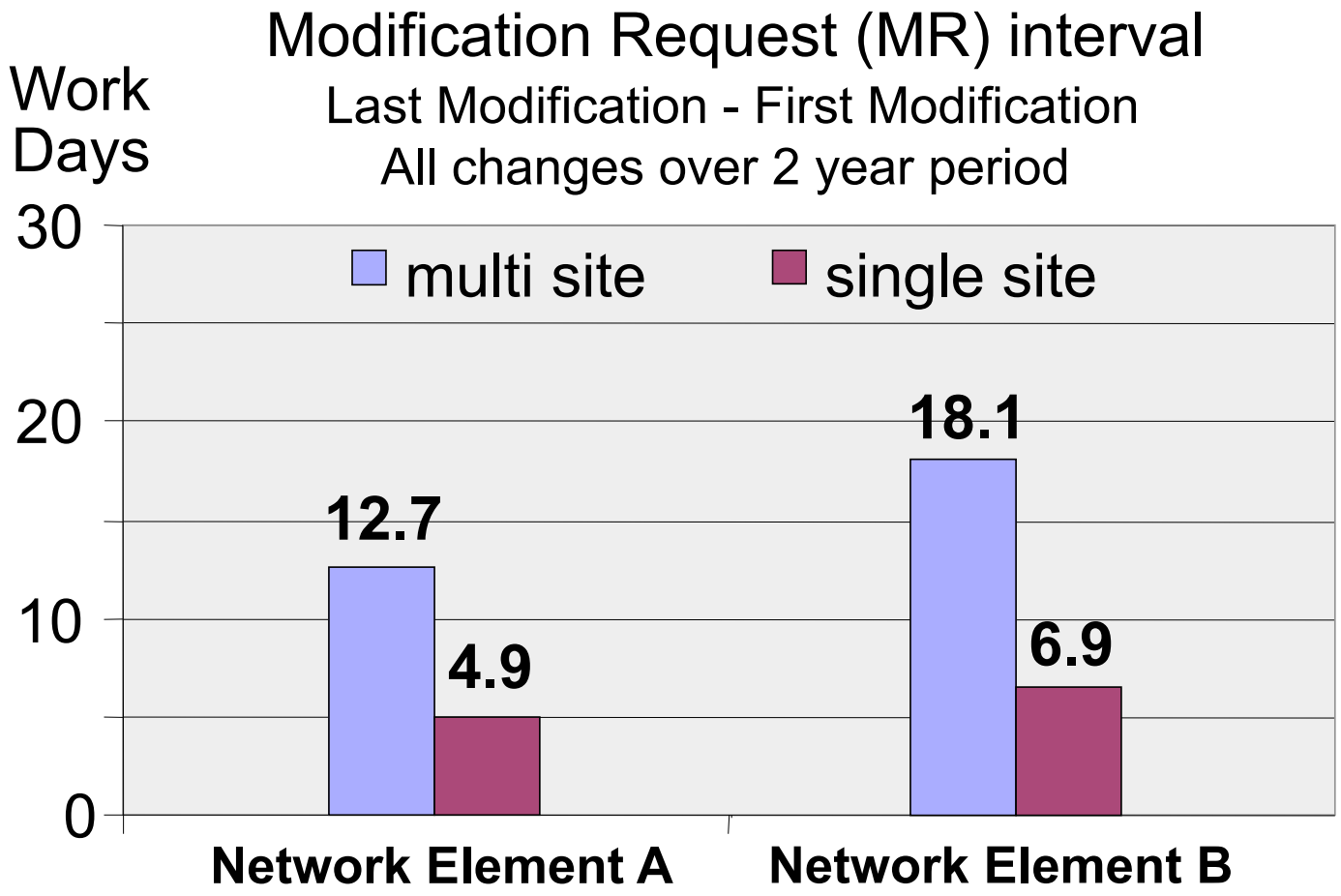
Tactics for Global Software Development: When to Do What?

James Herbsleb
Carnegie Mellon University

Multi-site Delay



Working Across Boundaries . . .

- Issue resolution paralysis
  - even small issues can take days
- Very difficult to stay “in the loop”
  - constantly surprised, “swimming upstream”
- Misalignment
  - undiscovered, conflicting assumptions
- Nonexistent or impaired social networks
  - loss of critical problem-solving mechanism
- Ineffective collaborative sessions
  - “What was decided?”
- Don’t know what you don’t know

Coordination is the Key

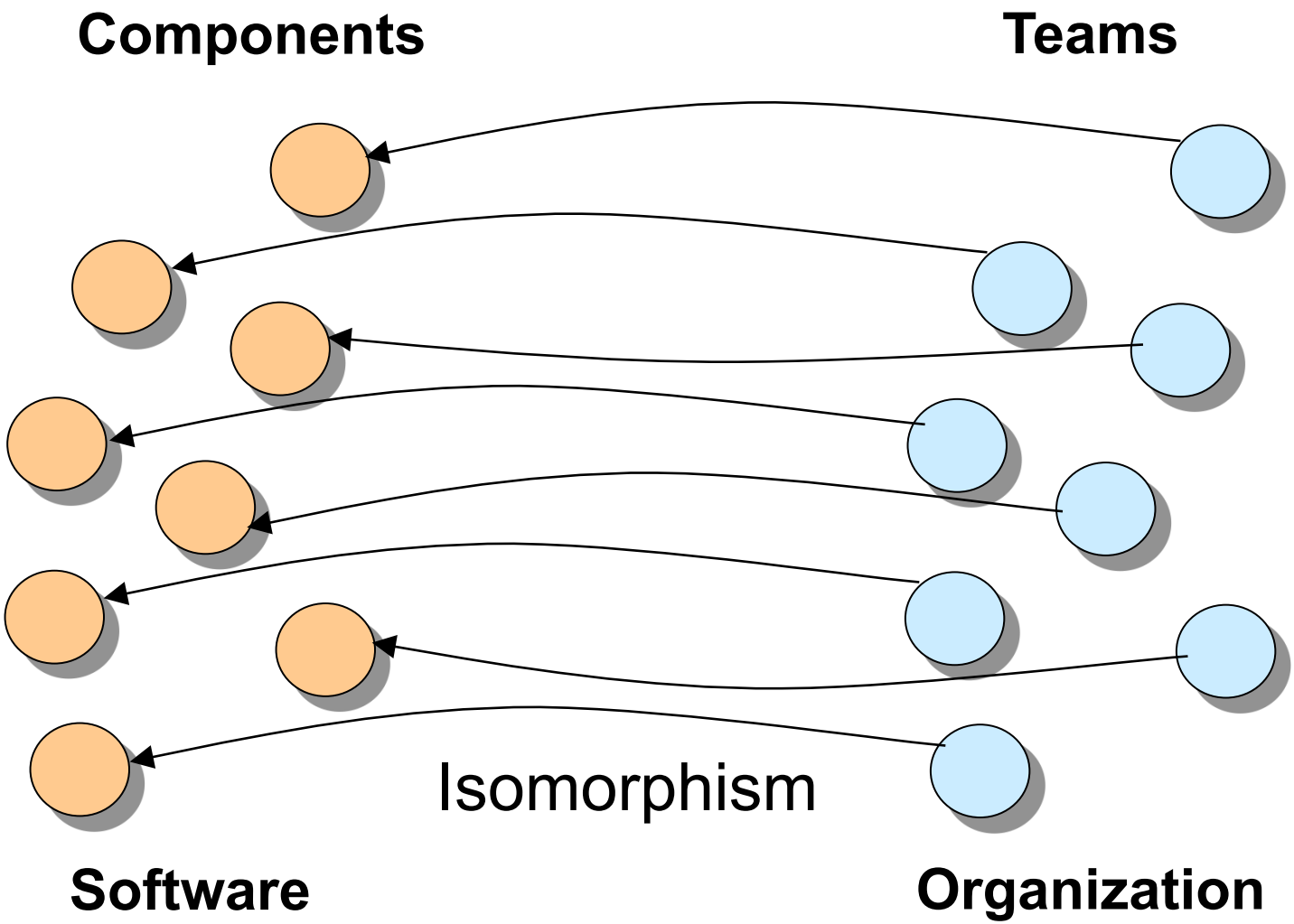
- Managing dependencies between tasks*

***Malone, T.W. and Crowston, K., The interdisciplinary theory of coordination. *ACM Computing Surveys, 26, 1* (1994), p. 87-119.**

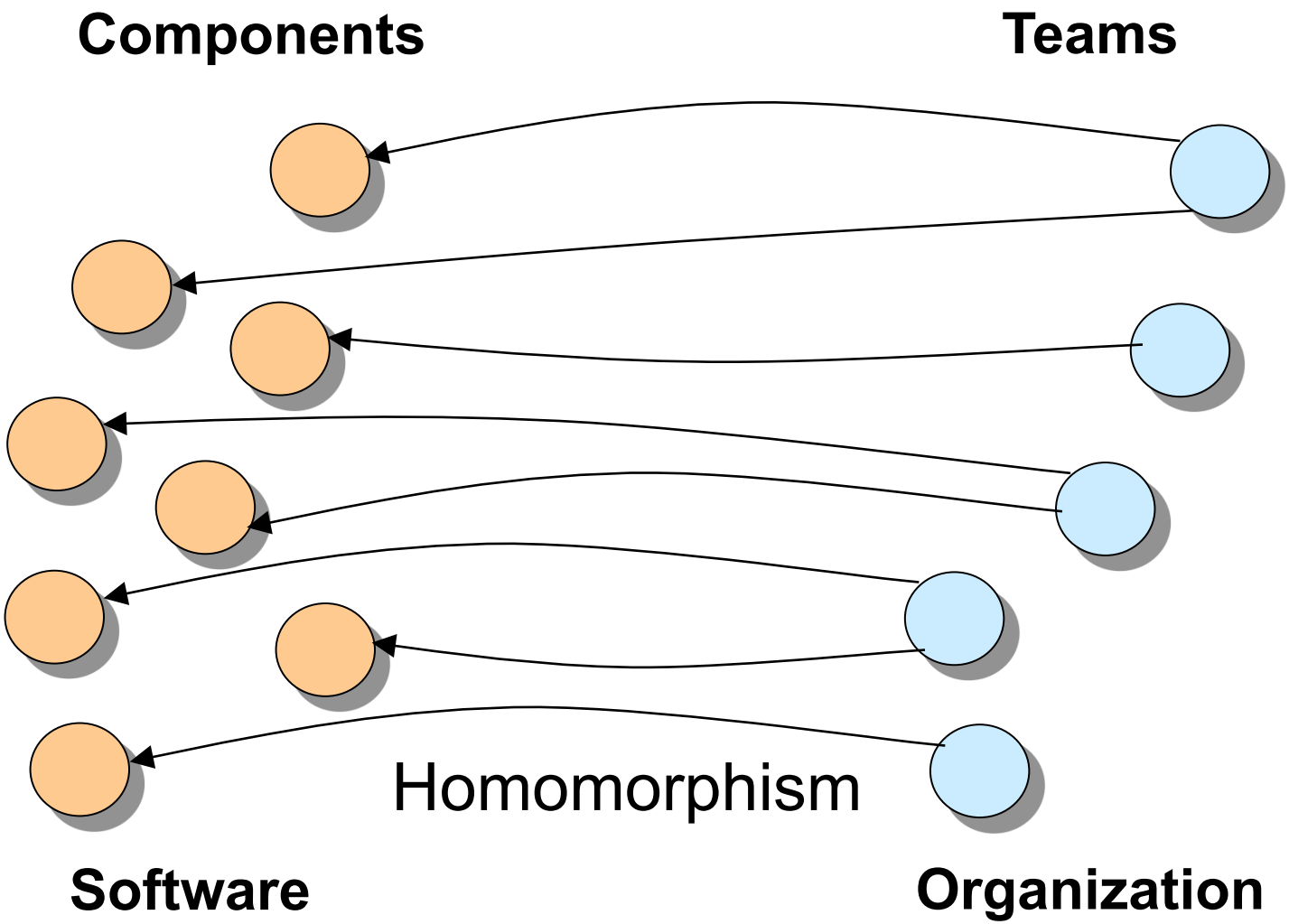
Conway's Law

- **"Any organization that designs a system will inevitably produce a design whose structure is a copy of the organization's communication structure."**
  - M.E. Conway, "How Do Committees Invent?" *Datamation, Vol.* 14, No. 4, Apr. 1968, pp. 28–31.
- **Implication:** Modularity works as a coordination strategy
- **Problem:** Modularity has major limitations

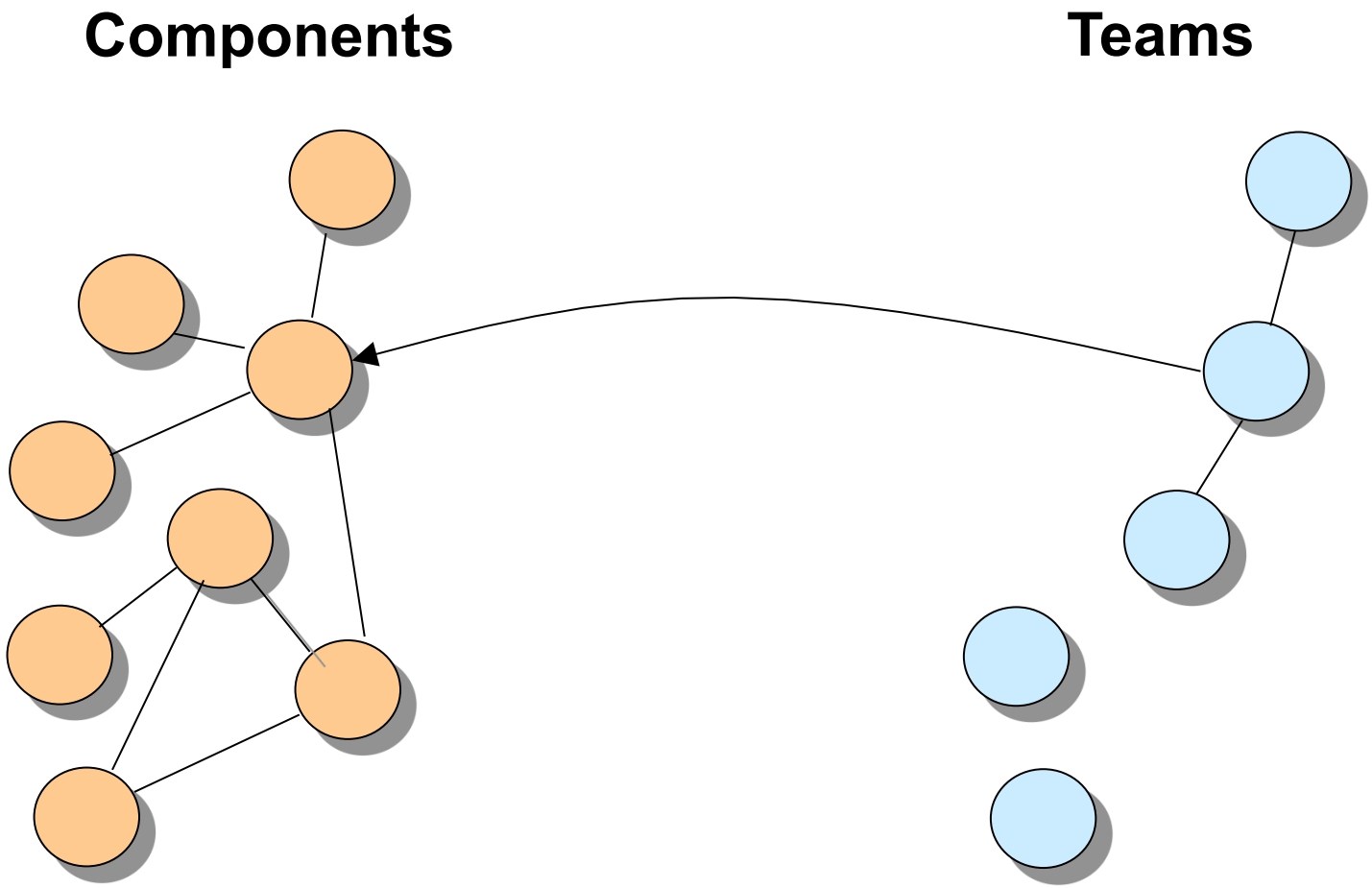
Conway's Law



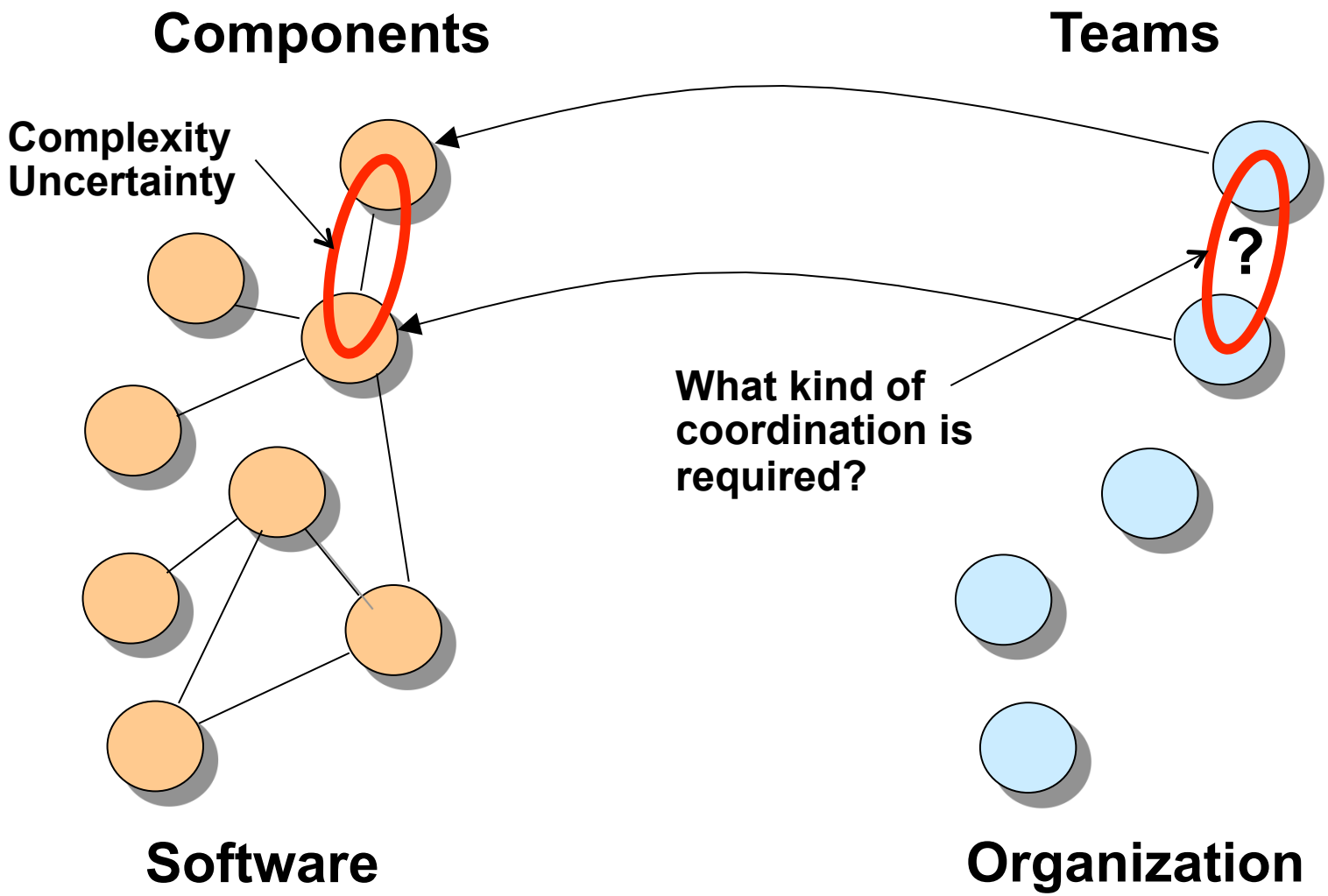
Conway's Law



What about the Connectors?



Complexity and Uncertainty



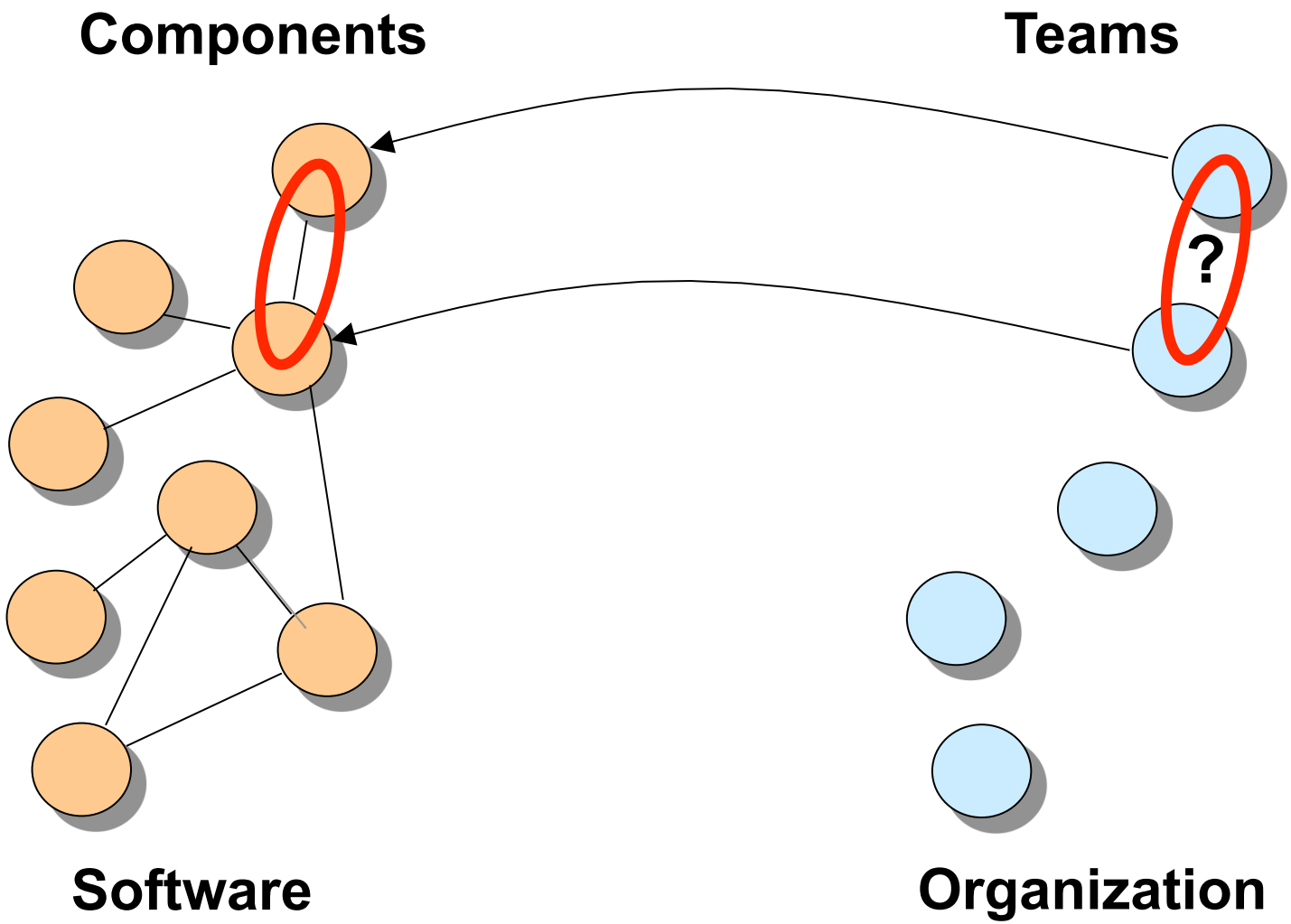
Coordination Requirements: Complexity

- Examples
  - How “big” is an API?
  - How complicated are API usage policies?
  - Features with implementations spanning components
  - Challenging non-functional requirements
    - Performance
    - Security
    - Availability
    - Etc.

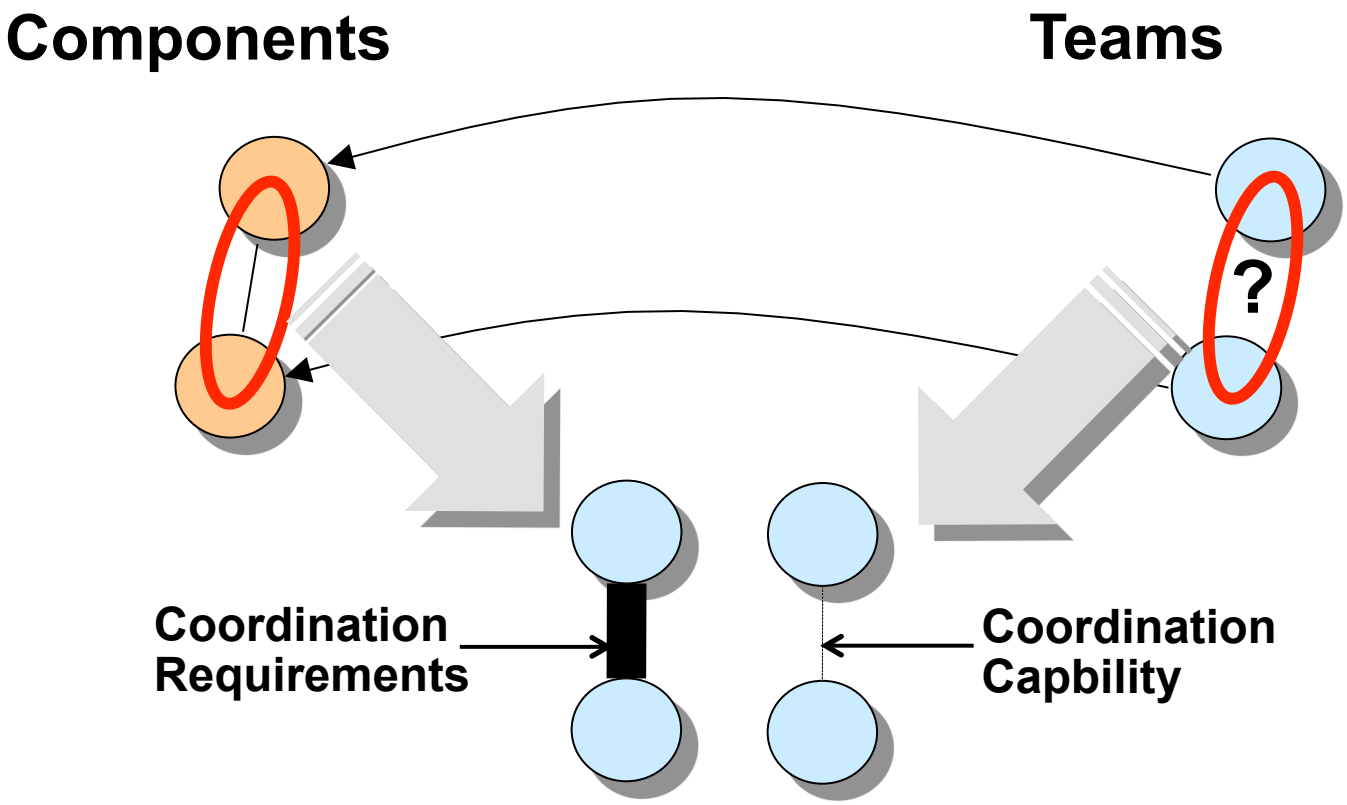
Coordination Requirements: Uncertainty

- Examples
  - Allocation of functionality to components
  - Modification and refinement of component interfaces
  - Volatile requirements
  - Dependencies on other systems that are changing
    - Hardware
    - Firmware
    - Middleware
    - Etc.

Congruence



Congruence



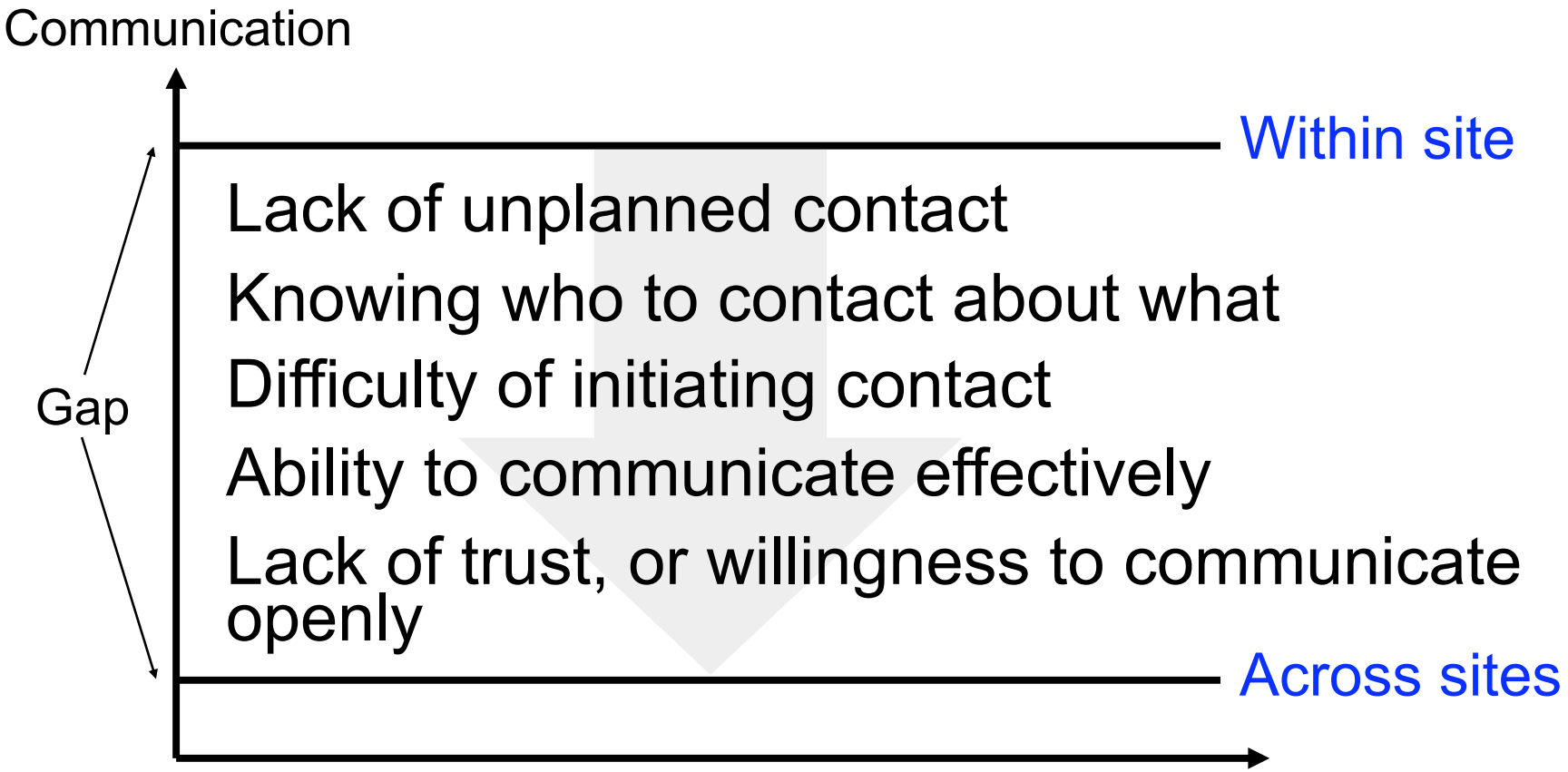
What determines coordination capability?

Software **Organization**

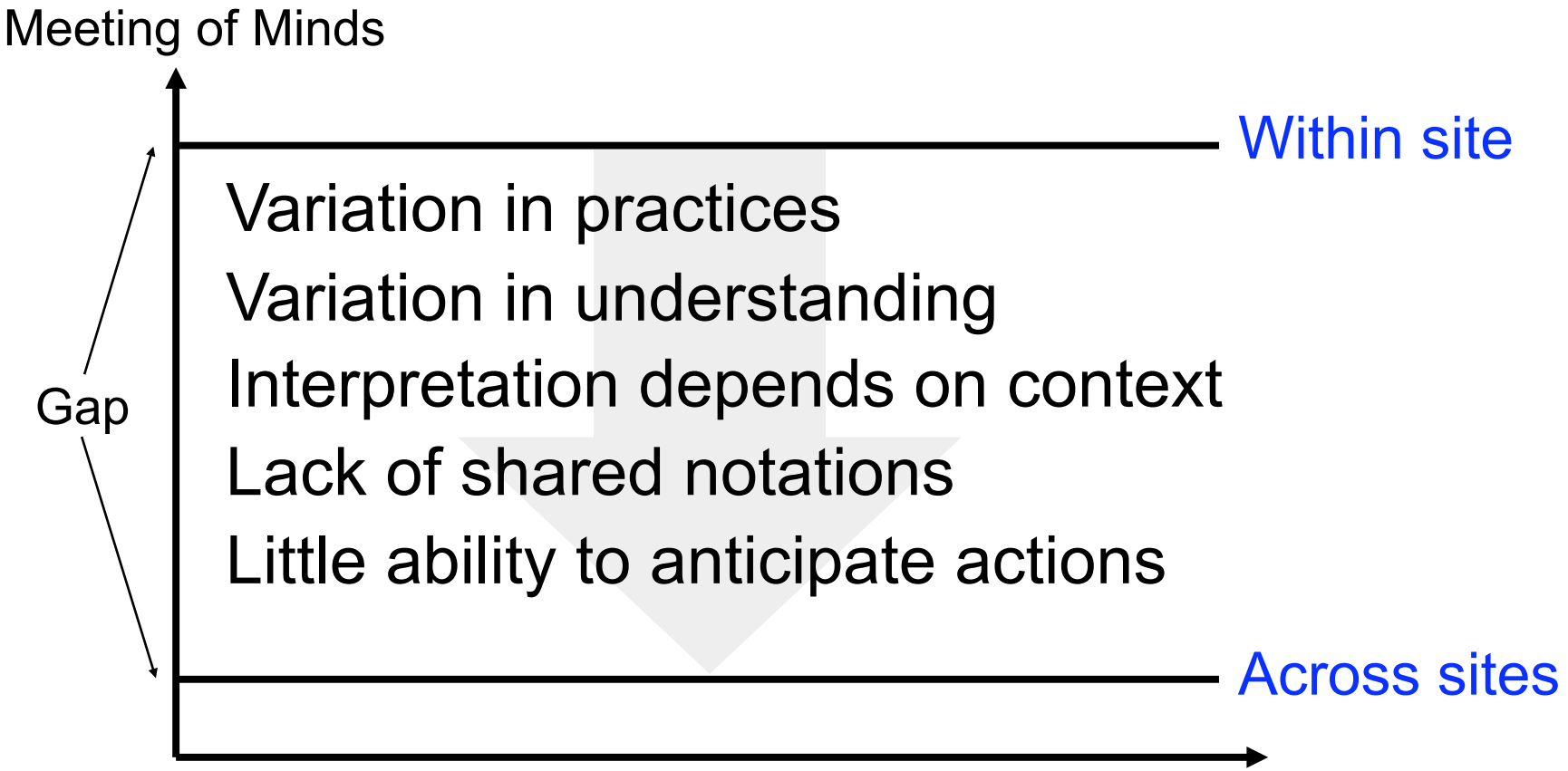
Coordination Mechanisms

- Preparation, e.g.,
  - Plans
  - Specifications
  - Defined processes
- Shared representation, e.g.,
  - Metrics dashboard
  - Posting test results
  - “Living” documents
- Communication, e.g.,
  - Meetings
  - “Informal” communication

Distance Breaks Down Communication



Distance Breaks Down Preparation and Shared Representations



Many Factors Affect Coordination Capability

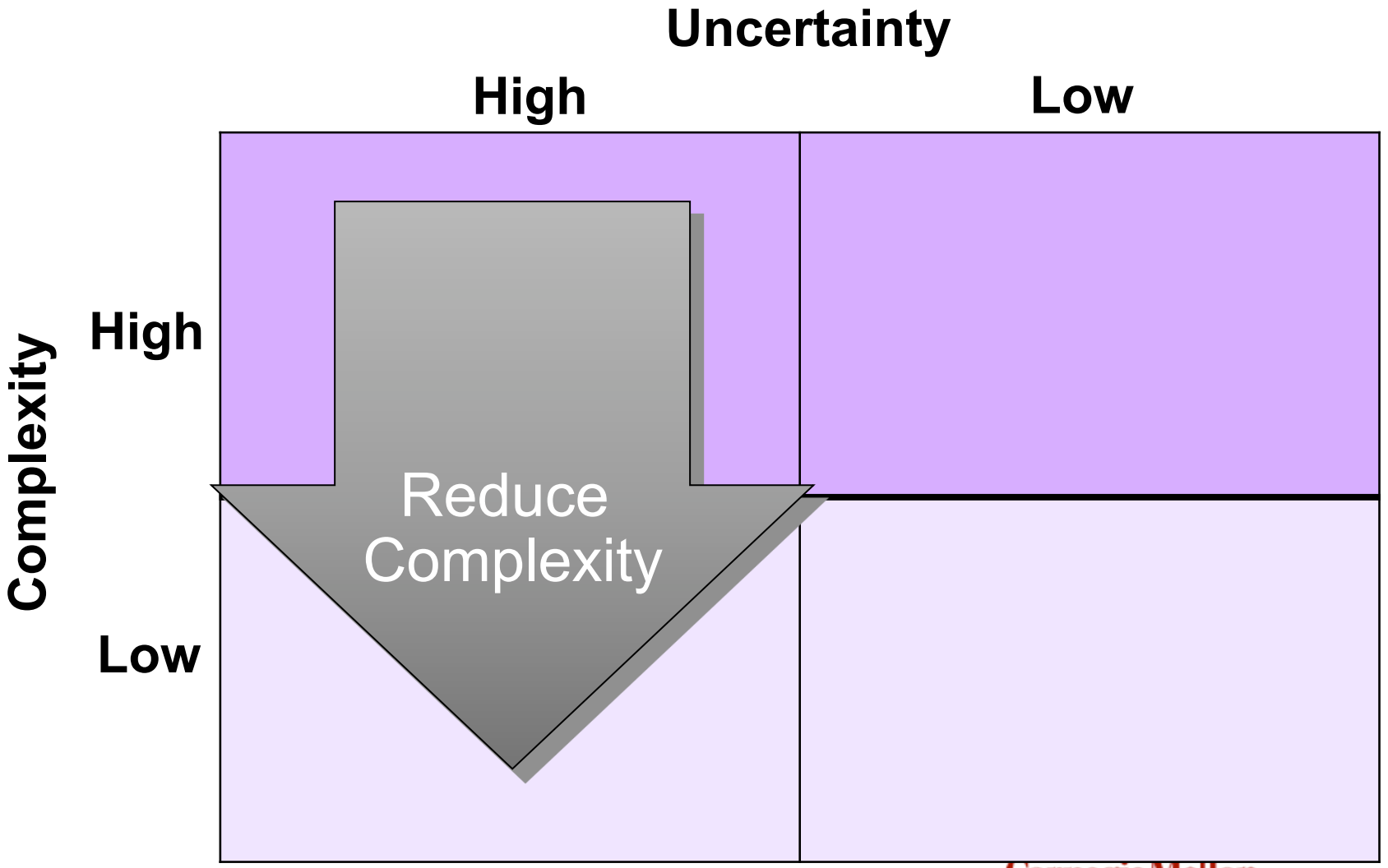
- Organizational factors, e.g.,
  - Geographic distribution
  - Divergent processes
  - Different management practices
  - Communication infrastructure
- People factors, e.g.,
  - Experience working together
  - Domain and technology expertise
  - Language skills

Achieving Congruence

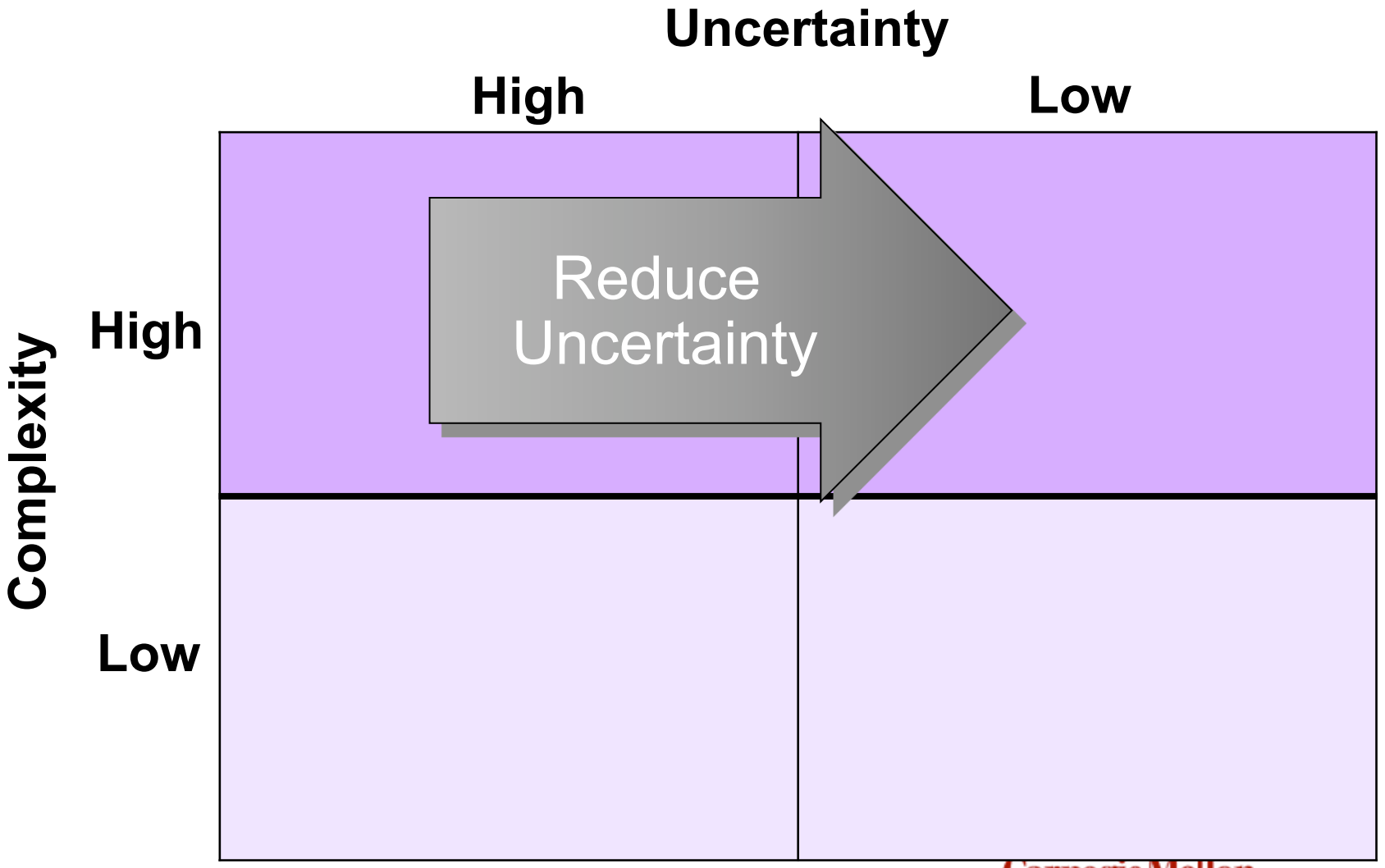
- Matching coordination requirements and coordination capability

Thinking About Tactics

Changing the Game



Changing the Game



Beware of Architectural Change

- Lessons from the history of photolithographic alignment equipment*

*Henderson, R.M. & Clark, K.B. (1990). Architectural Innovation: The Reconfiguration of Existing Product Technologies and the Failure of Established Firms. *Administrative Science Quarterly*, 35 (1), pp. 9-30.

Future Work

- “Coordination view” of an architecture
- Measuring congruence of architecture and organization
- Architectural tactics for improving congruence

Conclusion

- Architectural decisions create the "coordination landscape"
- Architectural structure and organizational structure are strongly related
- Congruence is necessary for project success
- Complexity and uncertainty present different problems
- Need research on measuring congruence, devising tactics for improving it