



SciDesign
Enabling Collaboration in Science

Opportunities and Challenges of Collaboration in Science & Technology

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Using TECHNOLOGY to enable COLLABORATION and
COLLABORATION to advance SCIENCE & TECHNOLOGY

COLLABORATION
to advance
S & T

**Collaborating
Designers &
Developers**



Technology-enabled
COLLABORATION

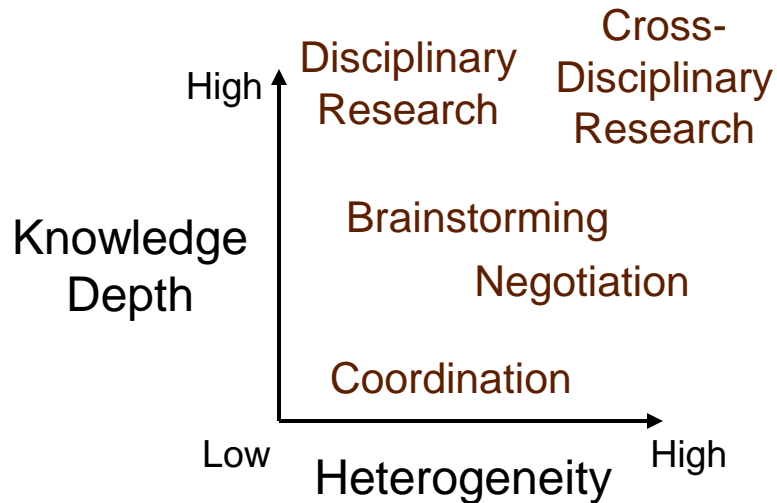
**Collaborating
End Users**





3 factors:

- Heterogeneous perspectives
- Depth of knowledge
- Problems are ill-structured





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The Challenge

Introducing new IT for existing work processes (incremental innovation):
Difficult and risky

Changing work processes and introducing new IT (radical/disruptive innovation):
VERY difficult and VERY risky

Stimulating new IT, change scientific work, introducing new IT, and revolutionize science: **SHEAR MADNESS!** *(But some of us are crazy enough to take it on anyway)*

Better understanding of collaboration processes

- Social factors
- Cognitive factors* => “Learning in the Wild” (allusion to Hutchins, 1995)



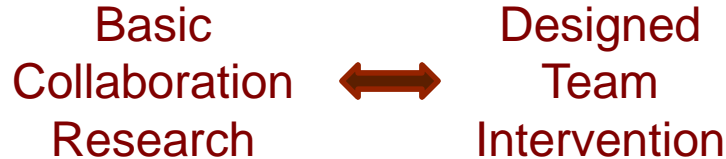


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CI-Team Project

NSF CI-Team program: eScience workforce development

Design-based experiment for investigating science & technology collaboration



This work was supported by National Science Foundation grant numbers 0636317 and 0753336 for the CI-Team Demonstration and Implementation Projects: Advancing Cyber-infrastructure Based Science Through Education, Training, and Mentoring of Science Communities.





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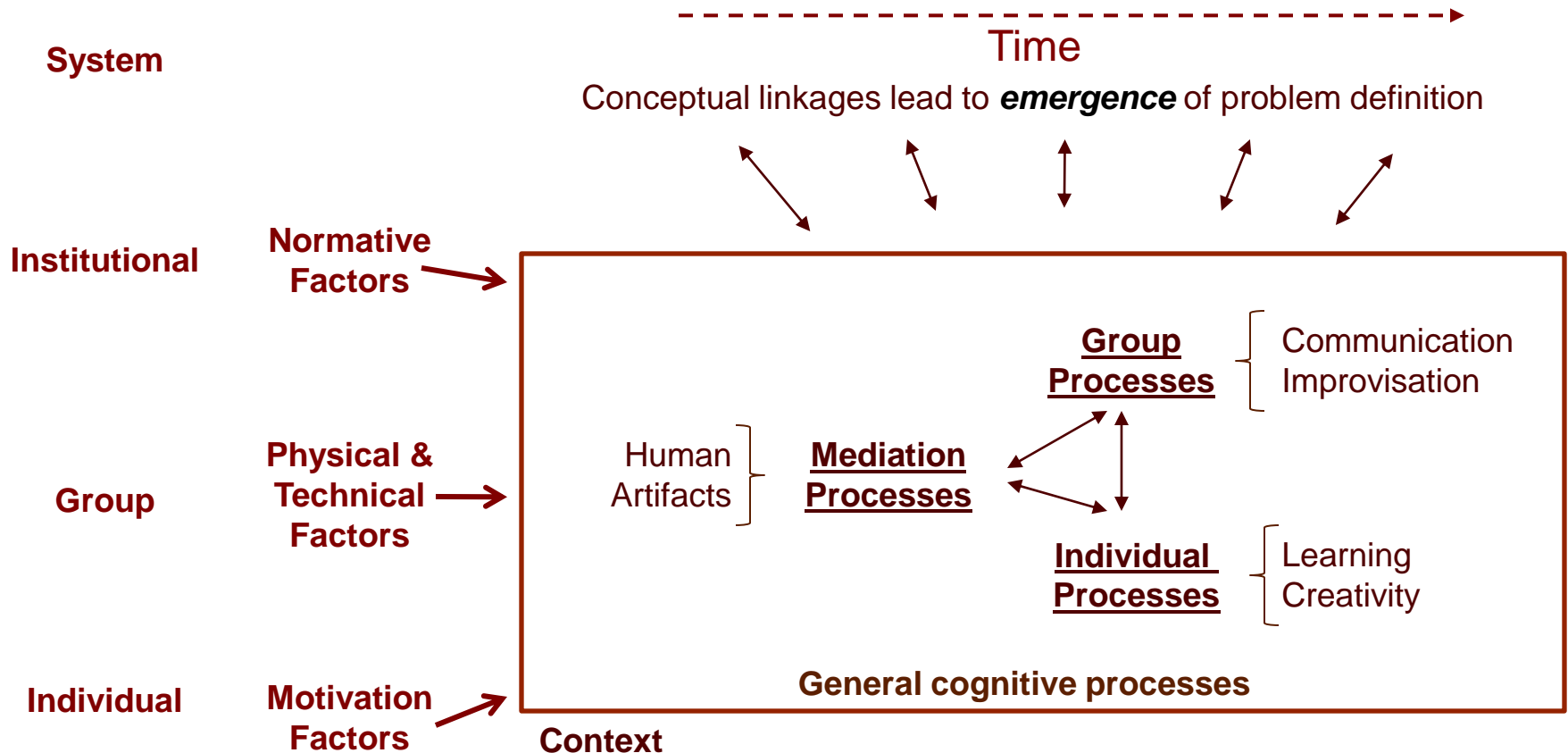
Lessons learned

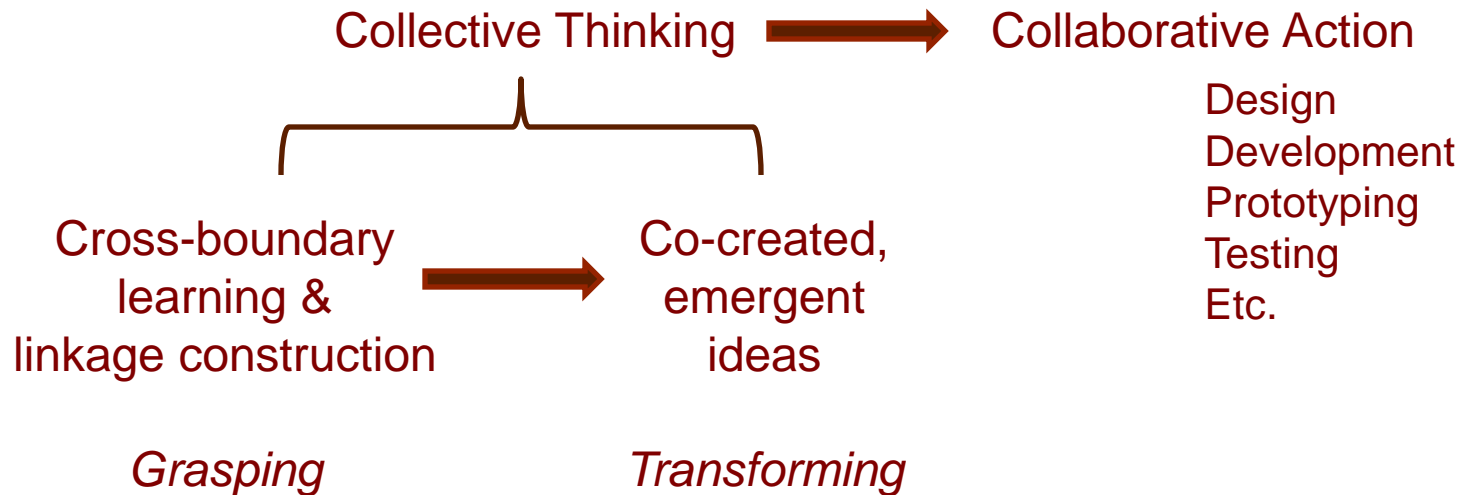
1. S & T collaboration as an ecological system
2. S & T collaboration as a learning problem
3. The role of human mediators
4. Orchestrating activities
5. The role of mediating artifacts





SCALE





Kolb, 1984: Experiential learning:

Grasping (Concrete observation & abstraction)

Transforming (Reflection & action)

Pennington, 2008, "Cross-disciplinary collaboration and learning", *Ecology & Society*, 13(2):8 [online]

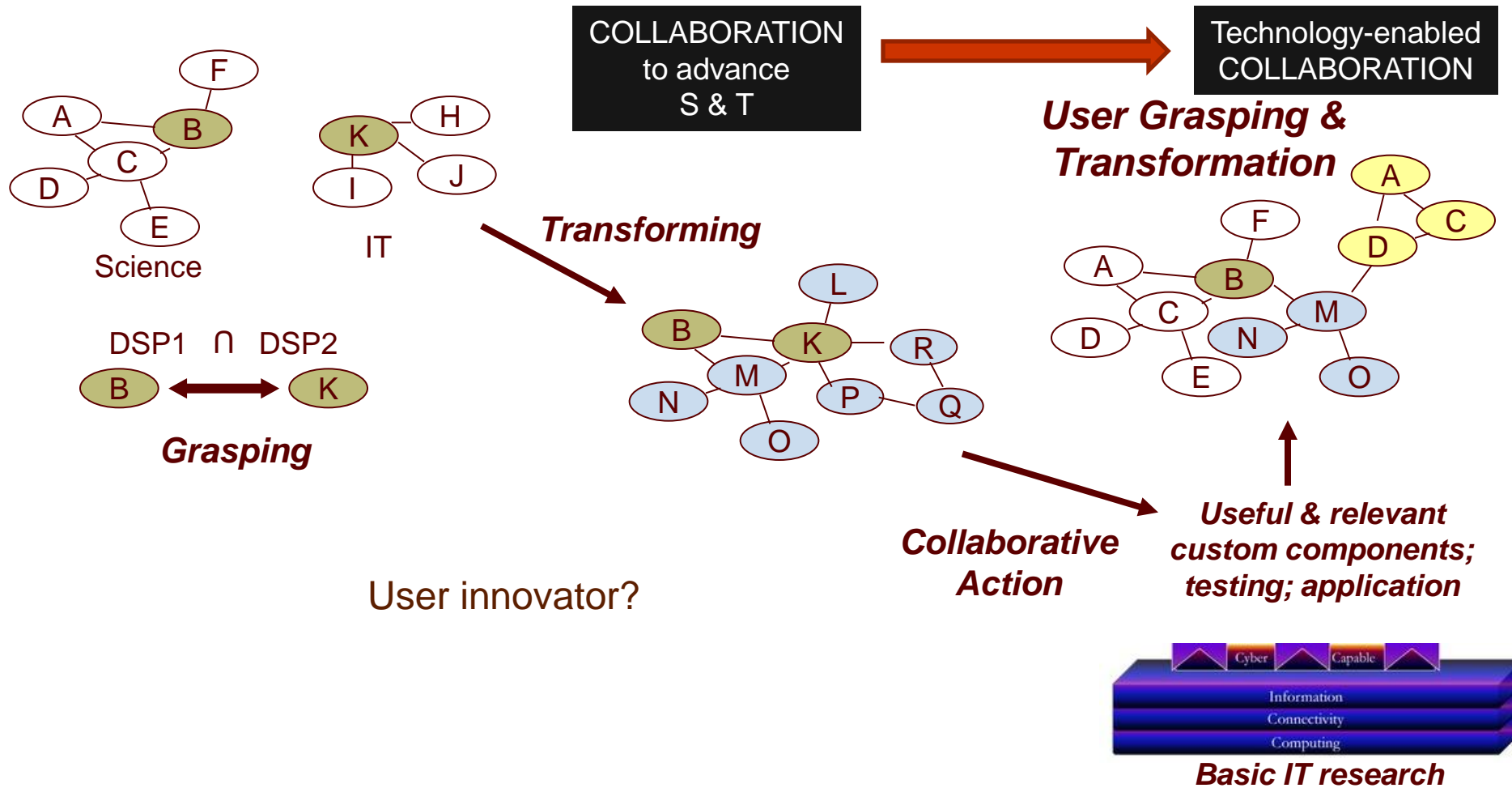
Pennington, 2009, "Creative collaboration between scientists and technology experts: Integrating conceptual spaces and constructing collaborative places." Annual Meeting American Association of Geographers, March 22-27, 2009, Las Vegas, Nevada.





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Grasping & Transforming



Pennington, 2009, "Creative collaboration between scientists and technology experts: Integrating conceptual spaces and constructing collaborative places." Annual Meeting American Association of Geographers, March 22-27, 2009, Las Vegas, Nevada.





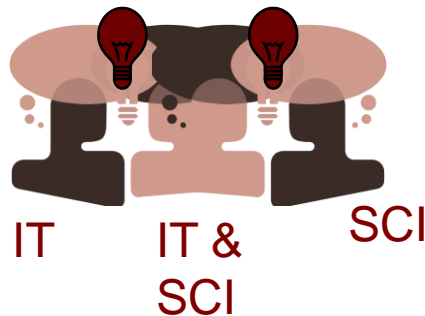
Kolb, 1984: Experiential learning:

Grasping (Concrete observation & abstraction)

Transforming (Reflection & action)

Sternberg, 1997 Apprenticeship studies:

Experts are unable to relate very abstract concepts in concrete forms that are easily grasped by novices



Intermediary (boundary spanner)

- Legitimate in both fields
- Translate
- Facilitate & manage interactions
- Negotiators
- Trust builders
- Synergistic & catalytic leaders
- Cultural brokers
- **Entrepreneurs & innovators**

Williams 2002; Yukl 2002; Cash *et al.* 2003;
Rhoten 2003; Hinds & Pfeffer 2003

What are the concepts, methods
and tools of innovation mediation?





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Conclusions

- Science & technology collaborative efforts are difficult because they depend on complex group learning and creativity issues (in addition to complex social issues)
- Improving our understanding of the process will lead to better collaborations
- Components include system design, cross-scale interactions, flows of information across scales, within group information flow mediated by humans and/or artifacts
- Difficult, but tractable





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