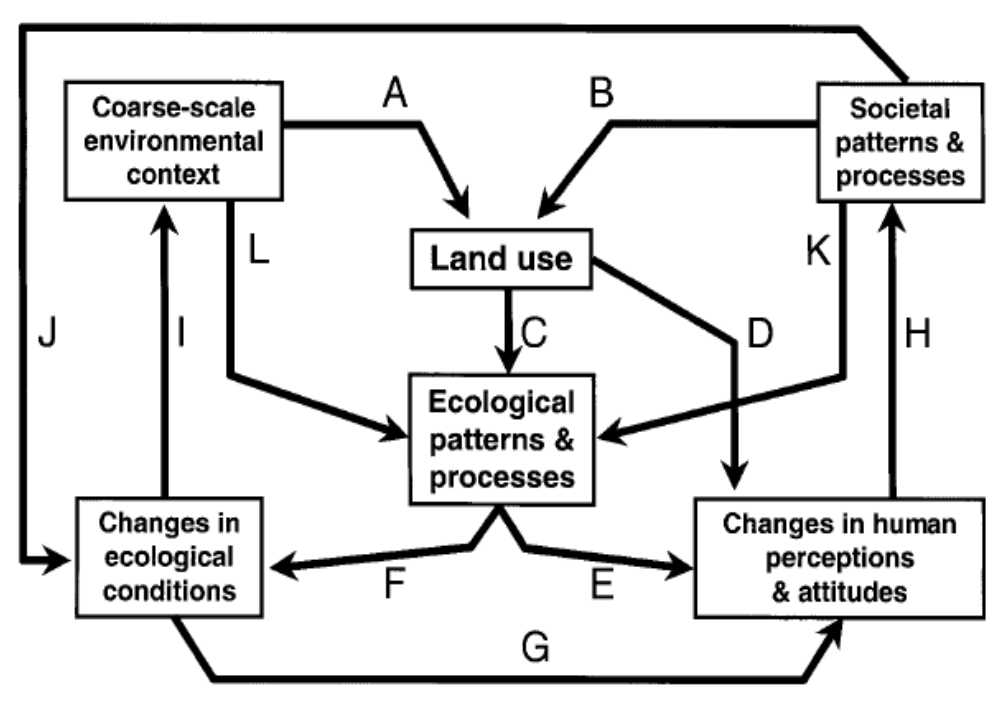
New Trends in Scientific Integration



John Parker

Arizona State University

National Science Foundation, Arizona State University Division of Graduate Studies, International Institute for Sustainability

Scientific Integration

- **Relatively Neglected Driver of Scientific Change**
  Astrophysics, Biochemsitry, Moleccular Biology

- **Previously: Grassroots** **(Ben-David and Collins, 1966; Mullins, 1972; Bechtel, 1986, 1992)**

- **Changes in Scientific Practice**:
  *Large-scale Collaboration
  *Academic Capitalism
  *Mode 2 Knowledge Production

Now: Diverse Organizations

Aims

*Explore facets of integration

*Asses success of integration and impact on science

*Implications for theory

Case Study: Integration of Social Science into Ecology

Methods

1) Bibliometric

2) Content Analysis

3) In-depth Interviews

4) Network Analysis

Three Organizations

Baltimore Ecosystem Study (BES)

1) Understand fluxes of energy/matter in urban ecosystems
2) Understand relationship between spatial structure (physical, ecological, social) and ecosystem functioning
3) Improve ecological understanding of urban residents to improve environmental and life quality

Central Arizona-Phoenix (CAP)

1) How do the patterns and processes of urbanization alter the ecological conditions of the city, and how to ecological consequences feedback to the social system to generate further change?

Resilience Alliance (RA)

1) Explore dynamics of complex adaptive systems
2) Understand resilience of human-natural systems
3) Develop policy and management tools for sustainable development

Themes

- Programmatic Statements
- Technologies
- Face-to-face interaction
- Personality
- Organizational culture

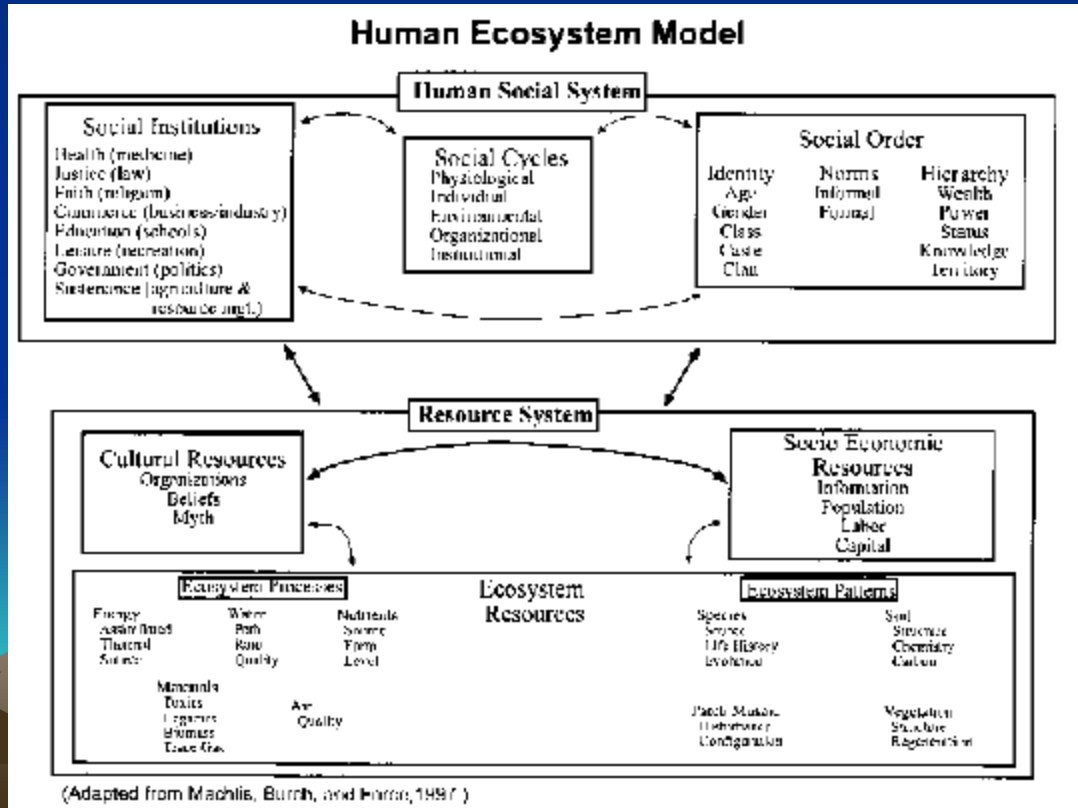
Programmatic Statements and Technologies
BES

Primary technologies:

1) Watershed based study of urban region as ecosystem (*GIS*)

2) Ecosystem valuation techniques

3) Social Surveys



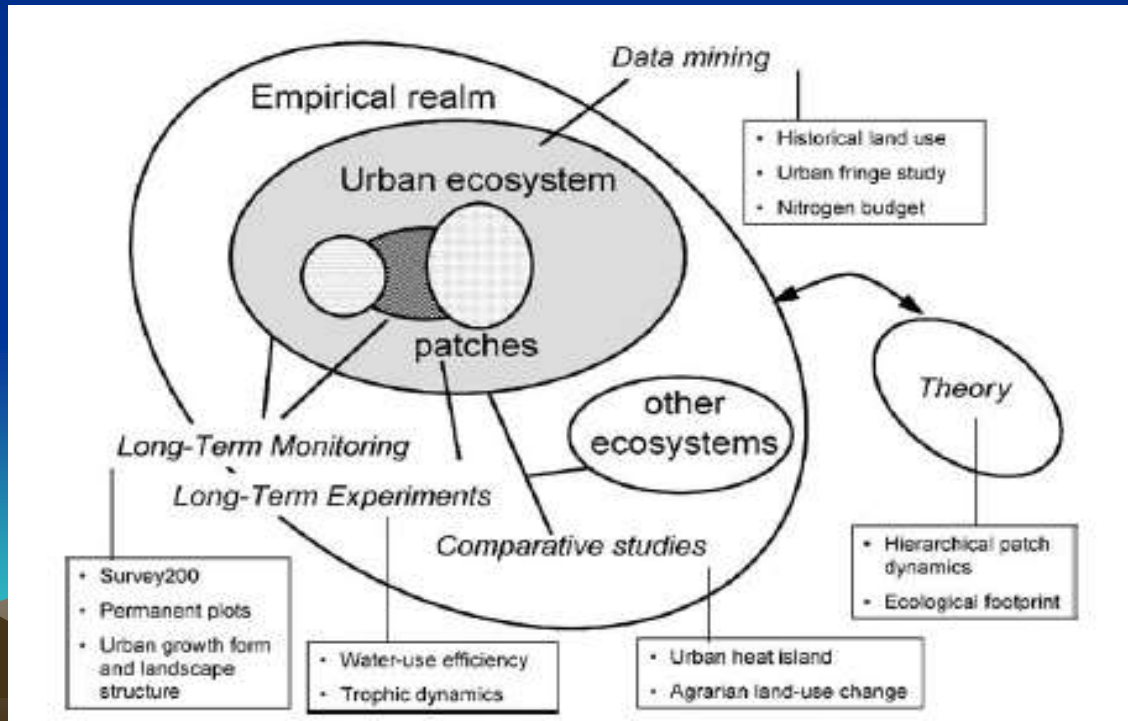
Conceptual Approaches and Technologies
CAP

Primary technologies:

1) Hierarchical patch dynamics approach to landscape and ecosystem modeling (*GIS, Remote Sensing*)

2) In situ adaptive experimentation

3) Social Surveys



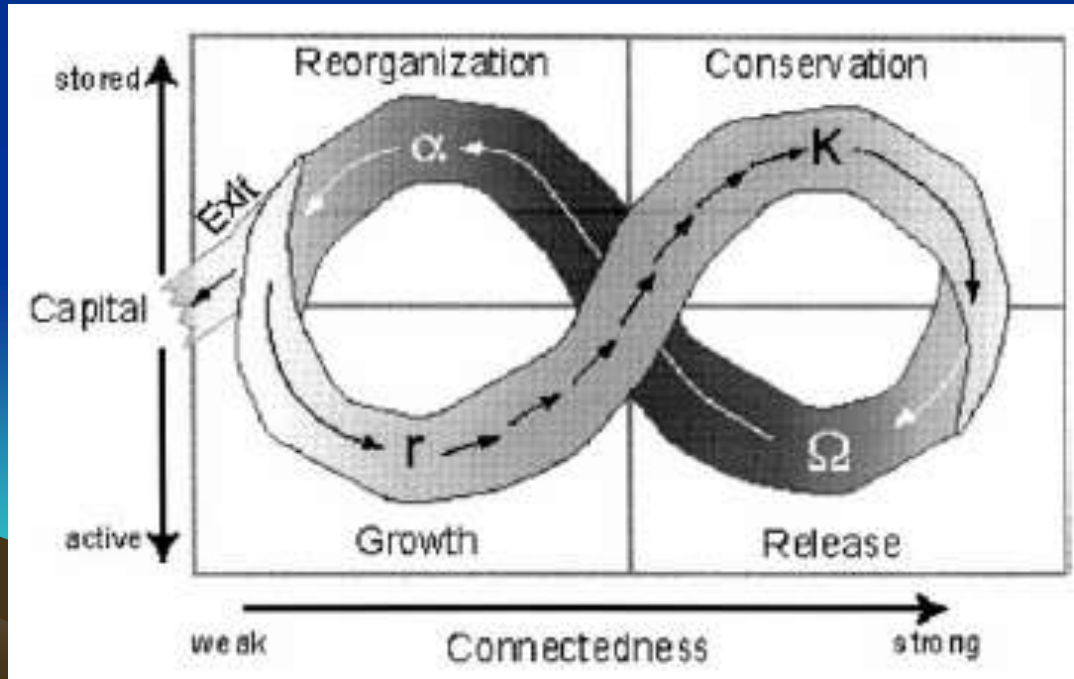
Conceptual Approaches and Technologies
RA

Primary technologies:

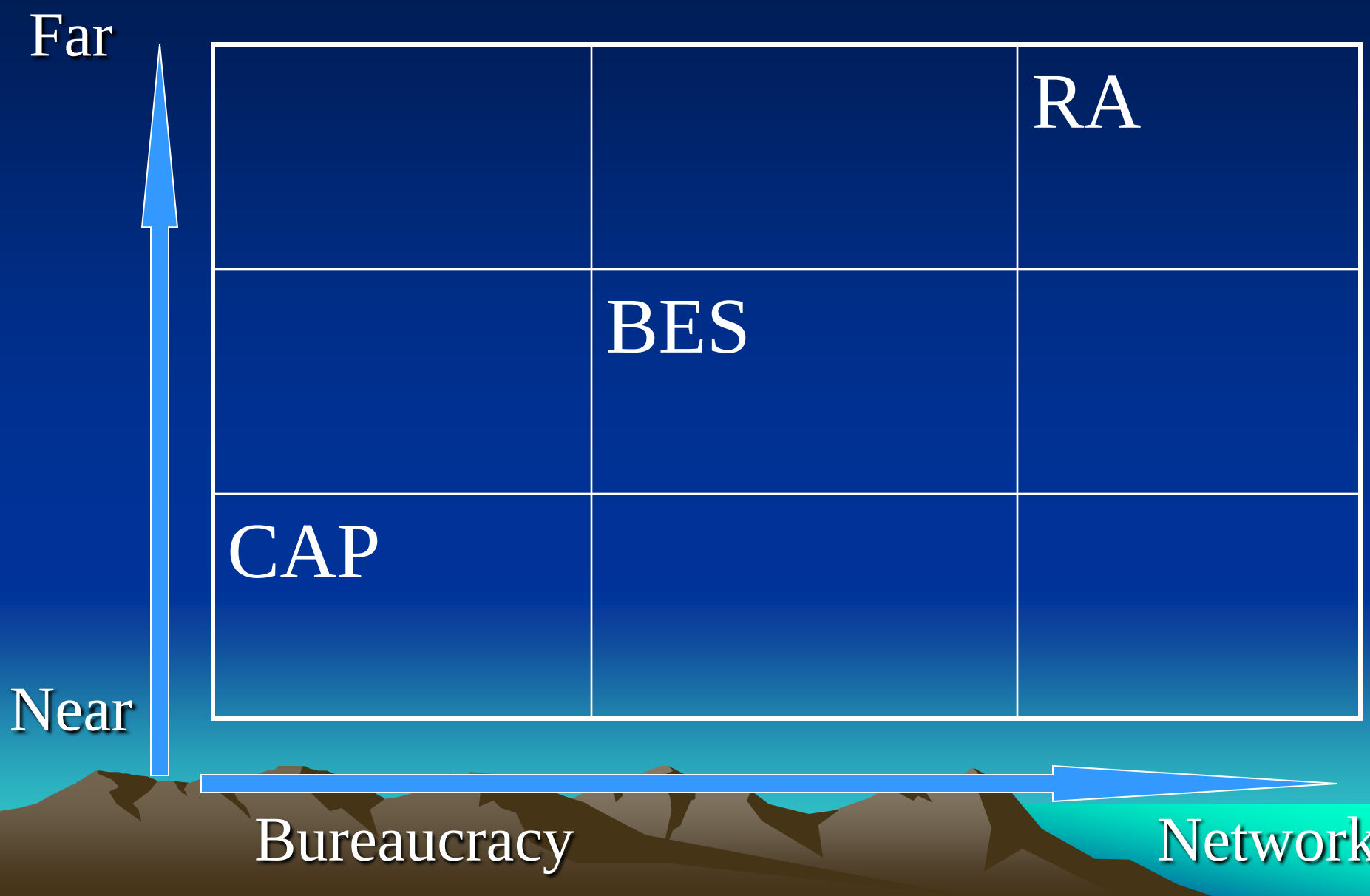
1) Qualitative, participatory approach to regional case studies

2) Construction of ‘minimal’ mathematical models

3) Scenarios/Games/Envisioning tools



Face-to-face Interaction



Personality

- “That they can…try to separate their own personality from their feelings…Because doing this interdisciplinary work is a big challenge… its much more difficult…in terms of your creative thinking and the challenges you are facing. It requires that you are fairly mature as a human being.”

- “People we wanted to be involved, we always said, were ‘people who were good on islands.’ And what we meant by that was that they were very, very knowledgeable, expert in their field. They were curious about and enjoyed efforts to mutually discover something…they really like someone introducing ideas that were different from theirs. So they had this joy in mutual discovery. And third, they had fun. And after five days on an island in a workshop, these were the ones that would sing the songs and make the limericks and ended up as good friends. Others would have the first two qualities, but not the people sense.”

- Personalities as barriers to collaboration

Normal versus Revolutionary Culture

- 1) “So a lot of work …in the [RA] has been very **visionary**, but also **intuitive**. It’s—the **soul** is connected to the brain…It’s like being an **artist**. We’re not hammering the RA in a very rational, logic thinking way and try to take small steps in the understanding. But we really we **paint broad pictures** with lots of new hypotheses, some of them totally untestable and some of them testable. But it generates understanding.”

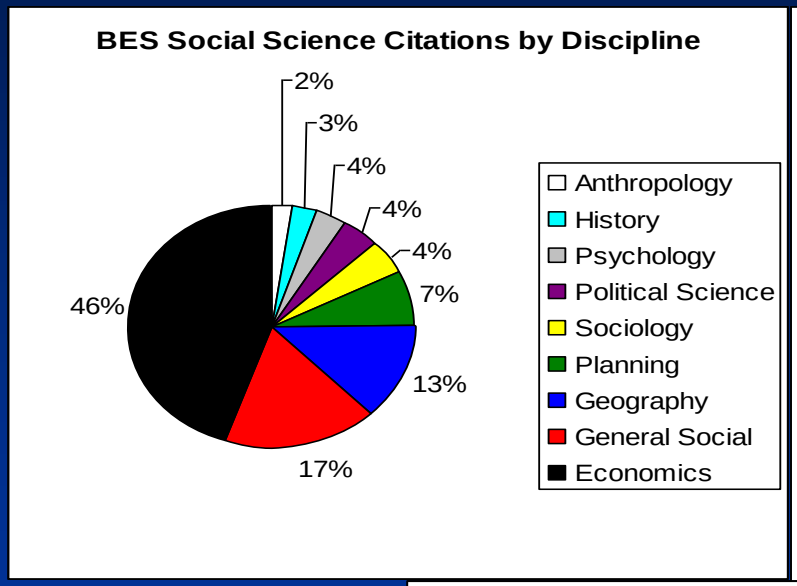
- 2) “Kind of like, **open-system**. It’s an open system in the sense that you can try out crazy ideas and not get shot down. So it’s **very free**.”

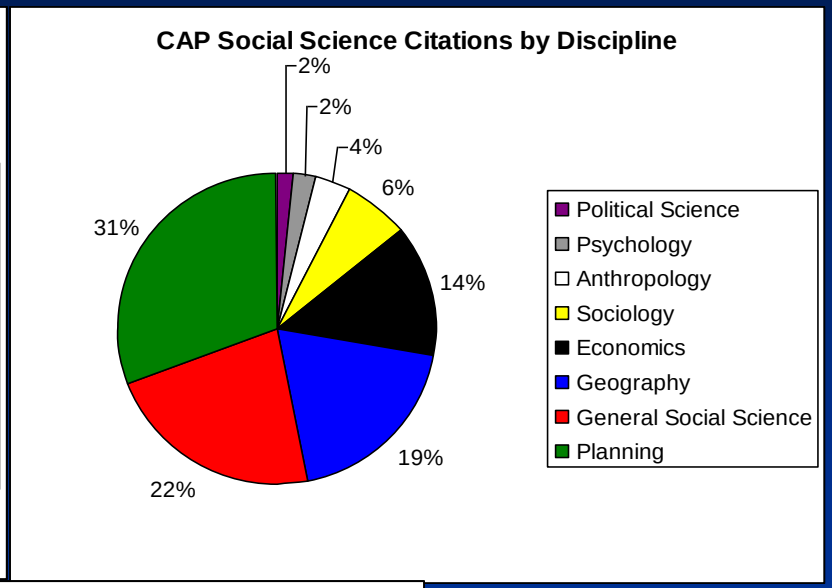
- 3) “…you see the nature, the culture of the [RA] is very, very different from the culture of science.

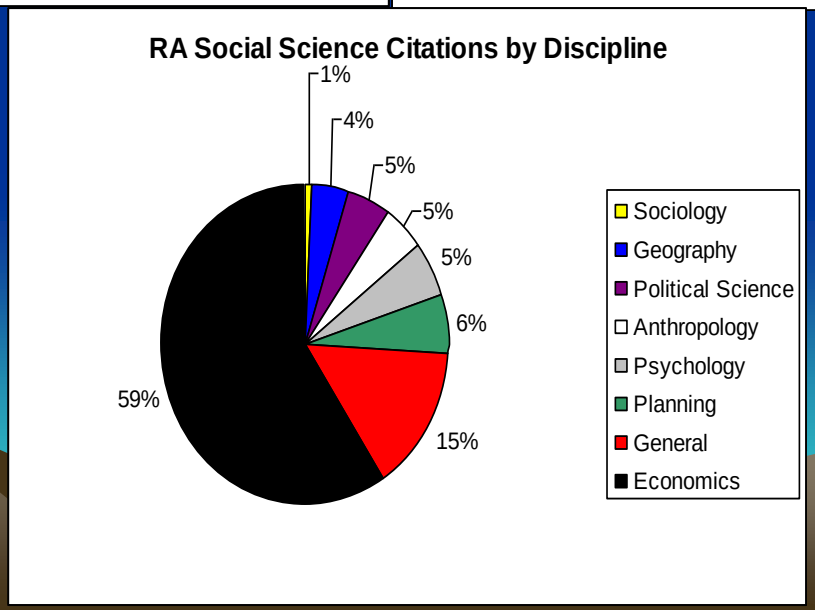
- JP: In what way?

- Well, the culture of science is dominantly skepticism, and appropriately so. But that is not true in the [RA]. Rather the culture is much more focused on the generation of innovative ideas, and testing. But not skepticism, so it is a very, very different culture.”

Flavors of Integration



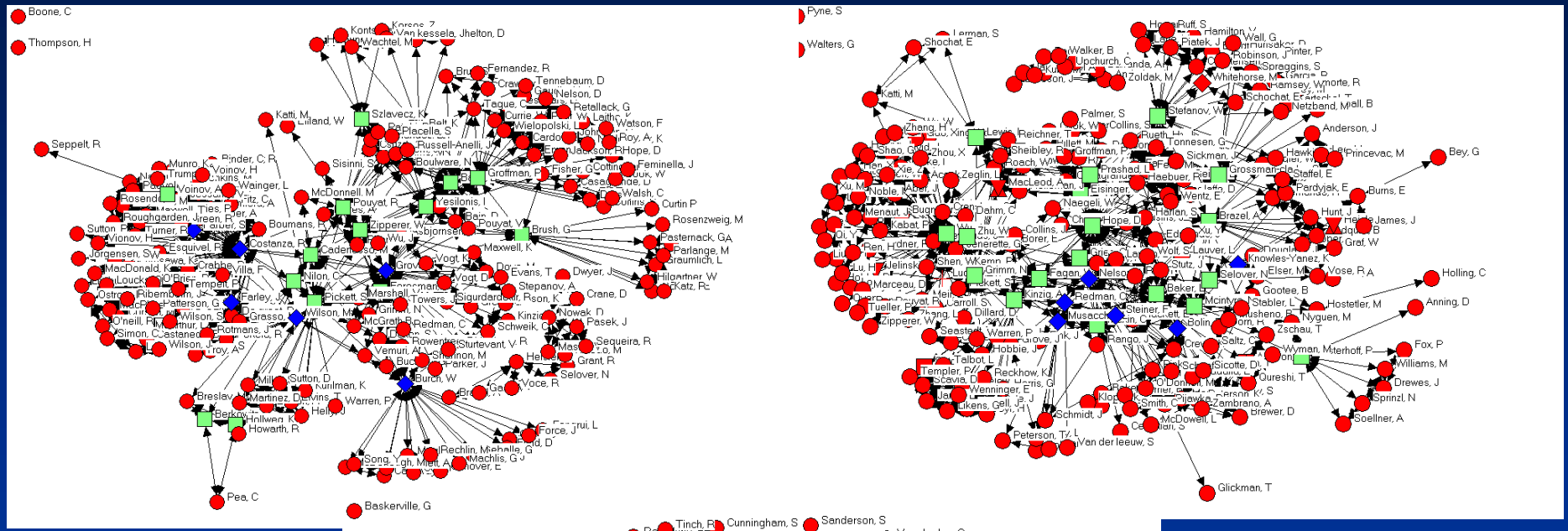




Measures of Integration

	BES	CAP	RA	Ecology
% Citations to SS Journals	0.05	0.05	0.07	0
% Articles Published in SS	16.5	13	14	NA
% Articles with SS Author	71	17	41	1
% Articles Considering Humans	59	61	69	21

Centrality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Gallopin, G
Ayre, D
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Le Page, C
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Impact on Science

	BES	CAP	RA	Ecology
Journal Impact Factor	2.32	2.17	4.14	2.04
Immediacy Index	0.51	0.47	1	0.372
Citation Half-Life	5.94	6.86	5.68	8.3
Mean Citations/Article	6.18	4.54	12.27	NA
Mean Citations/Chapter	0.86	1.7	3.9	NA
Mean Citations/Book	2.14	22	40.6	NA

Conclusions

- Key elements of integration still matter, but vary importantly across organizations
- Variations in these elements matter for success
- Integration of knowledge and actors apparent in each organization
- Integration appears to be happening at approximately same levels, but of qualitatively different types
- Need to consider variation in organizational efforts to integrate