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Interdisciplinary Research: some background, principles, and methods

Machiel Keestra, Institute for Interdisciplinary Studies, University of Amsterdam

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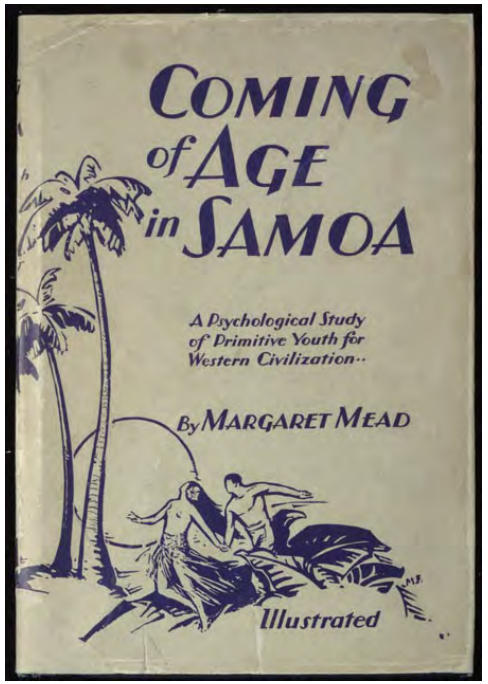
Explosion of scientific specializations according to Dewey's Decimal System:
1873 edition = 2000 entries
recent edition = 27.000 entries + 13.000 additions

000 – Computer science, information and general works
100 – Philosophy and psychology
200 – Religion
300 – Social sciences
400 – Language
500 – Science (including mathematics)
600 – Technology and applied Science
700 – Arts and recreation
800 – Literature
900 – History and geography

Interdisciplinarity's emergence as a counterforce

- 1920's ('26?): Social Science Research Council
- WW II and after: technological and social scientific demands for interdisciplinarity
- 1972: OECD report 'Interdisciplinarity: Problems of Teaching and Research in Universities
- 1979: Association for Interdisciplinary Studies
- 2011: International Network for Interdisciplinarity & Transdisciplinarity



Highly dynamical landscapes of disciplinary – and even more so of interdisciplinary – sciences

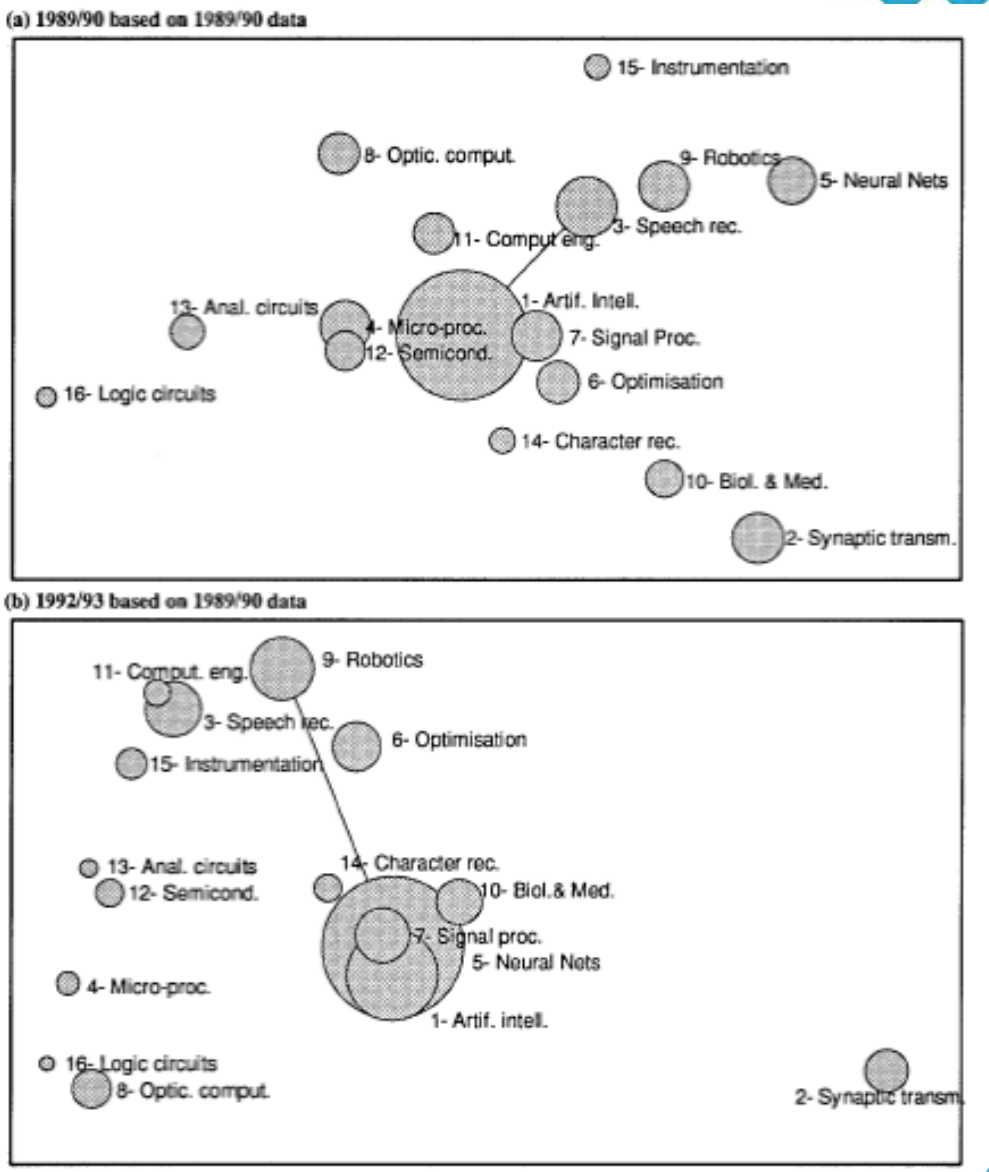


FIG. 1. Neural network research maps (a: 1989/90 and b: 1992/93). Two-dimensional representation of sub-fields. Definition of sub-fields based on clusters of the most important classification codes in 1992/93. Cluster size (surface area) represents the proportion of publications included in each sub-field. Lines between sub-fields indicate relatively high number of 'common' publications.

Drivers towards IDR research:

- The Inherent Complexity of Nature and Society
- The Drive to Explore Basic Research Problems at the Interfaces of Disciplines
- The Need to Solve Societal Problems
- The Stimulus of Generative Technologies

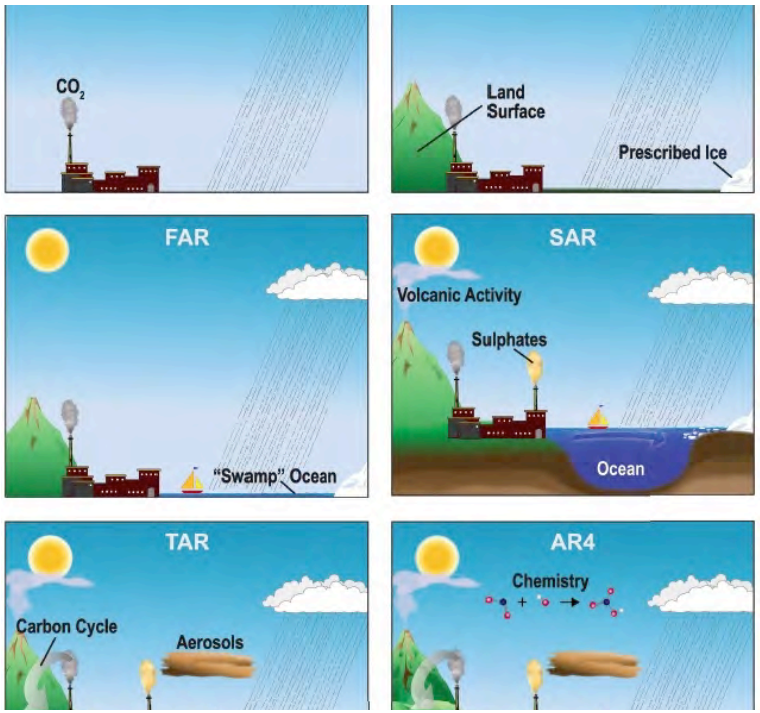
(Nat. Acad. Sciences report: Facilitating interdisciplinary research, 2004)

An influential definition of interdisciplinarity:

[Interdisciplinary studies is] a **process** of answering a question, solving a problem, or addressing a topic that is **too broad or complex** to be dealt with adequately by a single discipline or profession . . . and draws on disciplinary **perspectives and integrates** their insights through construction of a more comprehensive perspective."

(J. Klein & B. Newell: Advancing Interdisciplinary Studies,1997.)

Integration is essential for distinguishing ID from multi-disciplinary research.



For example: integration of insights in an increasingly complex & dynamic explanatory mechanisms

Nota bene: interdisciplinarity occurs with differences in depth…

1. Borrowing of concepts, methods
2. Problem oriented collaboration
3. Bordering interdisciplinarity; increasing unification
4. Emergence of a new inter-discipline

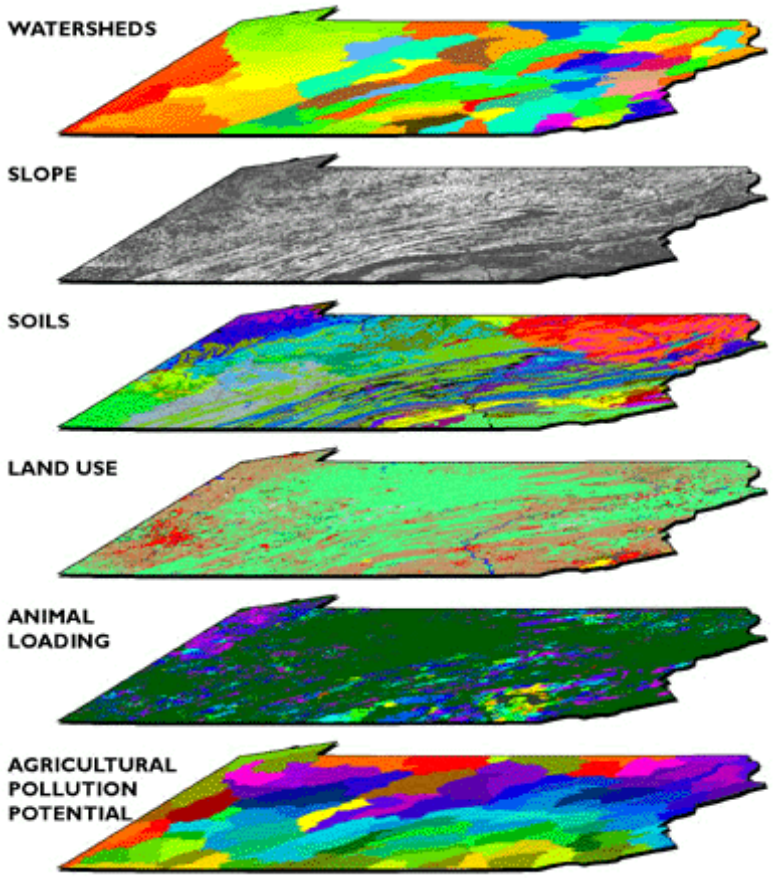
"I understand they're going to connect them. The Provost ordered it."

(naar J. Thompson Klein, 'Interdisciplinarity', 1990 64-66)

…and differences in scope: from narrow to broad Interdisciplinarity

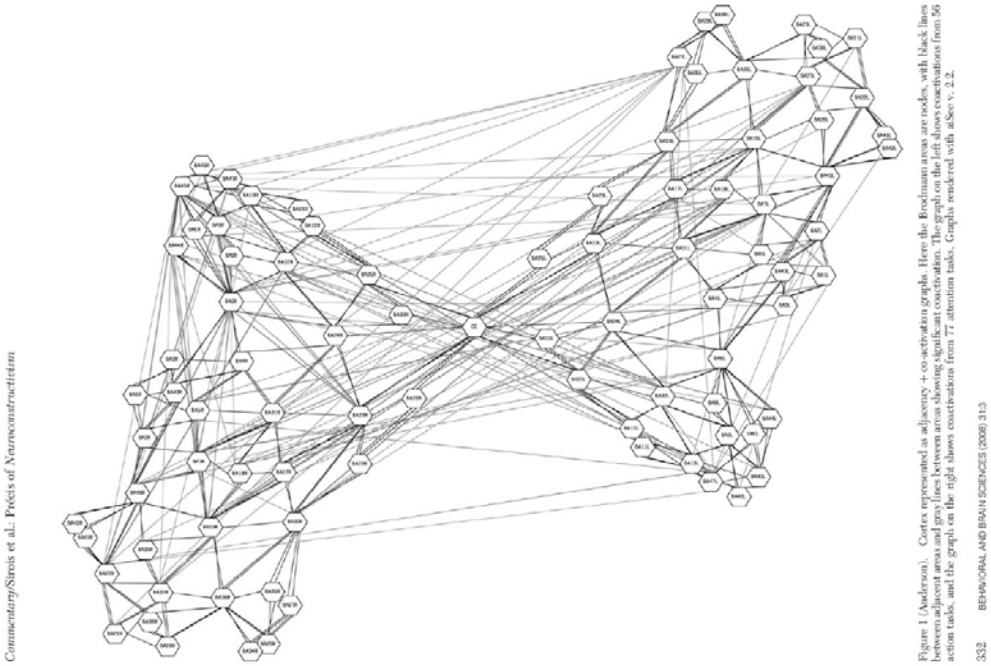
Such differences affect also the barriers that must be taken, i.e. differences regarding:

- norms and objectives
- theories and models
- epistemological assumptions
- societal positions
  - (Lele & Norgaard, 2005)



Assumptions as barriers.
Cf. tacit assumptions in cognitive neuroscience

- modularity
- localization
- animal models
- cultural generalizability



Commentary/Sirois et al.: Précis of *Neuroconstructivism*

Figure 1 (Anderson). Cortex represented as adjacency + co-activation graphs. Here the Brodmann areas are nodes, with black lines between adjacent areas and gray lines between areas showing significant coactivation. The graph on the left shows coactivations from 56 action tasks, and the graph on the right shows coactivations from 77 attention tasks. Graphs rendered with aSee v. 2.2.

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(Anderson, BBS comm 2008, co-activation sites because of neural re-use)

For example: assumption of cultural generalizability of 'WEIRD' cognitive neuroscience

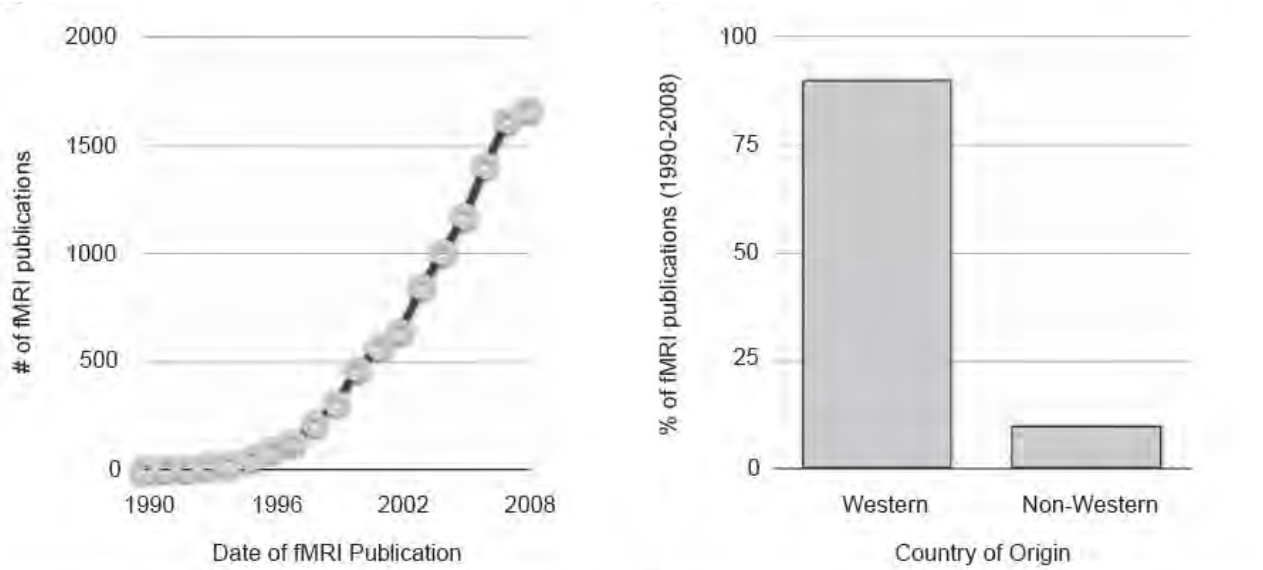


Fig. 1. Growth trends and publication bias in peer-reviewed human neuroimaging literature. (a) Graph illustrating the growth in peer-reviewed human neuroimaging studies from 1990 to 2008; (b) graph illustrating the publication bias within the human neuroimaging literature whereby the vast majority (~90%) of publications to date originate from a Western country.

From inter- to transdisciplinarity for a socially robust cognitive neuroscience

- Including various actors in scientific endeavours
- Making use of non-scientific forms of knowledge
- Explicit attention to implementation and moral issues

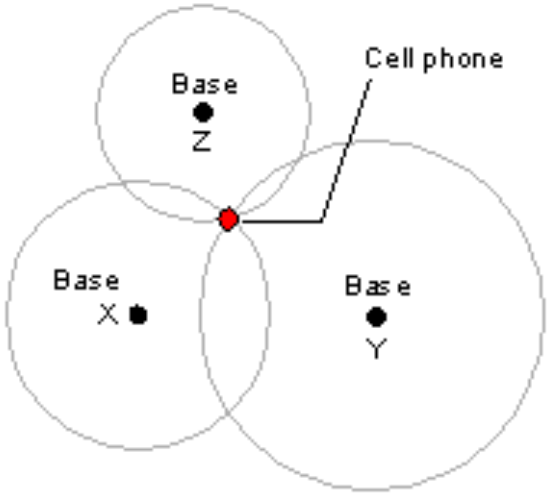
Interdisciplinary research processes require extra skills & efforts for bridging the barriers

Methods for supporting the interdisciplinary research process:

- conceptual analysis, articulation of assumptions, etc.
- ID research process model (AIS; Newell/Repko)
- dialogue methods (Bammer, I2S)
- Science of Team Science
- Toolbox project (O'Rourke, Crowley)

For example: use of concept/semantic maps for establishing a common topic

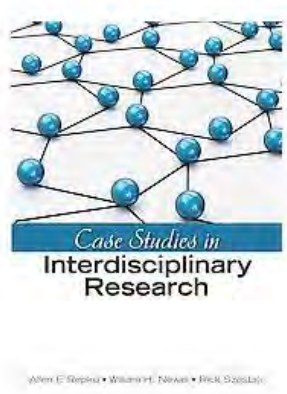
- Three different specializations
- Step 1: Subjects from your own discipline
- Step 2: Discover/formulate togethe overlapping subject domains
- (perhaps repeat now step 1)
- Step 3: Formulate several question topics on that subject from your own discipline
- Step 4: Consider what type(s) of integration you would aim at.



For example: AIS Model of the Interdisciplinary Research Process

A. Drawing on disciplinary insights.

1. Define the problem or state the focus question
2. Justify using an interdisciplinary approach
3. Identify relevant disciplines
4. Conduct a literature search
5. Develop adequacy in each relevant discipline
6. Analyze the problem and evaluate each insight to it



B. Integrating insights and producing an interdisciplinary understanding

7. Identify conflicts between insights and their sources
8. Create or discover common ground
9. Integrate insights
10. Produce an interdisciplinary understanding of the problem and test it

(Repko, Interdisciplinary Research, 2008; Newell, Szostak, Repko ed. Case Studies on ID research, Sage '12)

For example: Toolbox project (2 phases: questionnaire, workshop)

Toolbox excerpt

Metaphysics

IV. Reality

Core Question: *Do the products of scientific research more closely reflect the nature of the world or the researchers' perspective?*

17. Scientific research aims to identify facts about a world independent of the investigators.

Disagree *Agree*
1 2 3 4 5 I don't know N/A

18. Scientific claims need not represent objective reality to be useful.

Disagree *Agree*
1 2 3 4 5 I don't know N/A

19. Models invariably produce a distorted view of objective reality.

Disagree *Agree*
1 2 3 4 5 I don't know N/A

20. The subject of my research is a human construction.

Disagree *Agree*
1 2 3 4 5 I don't know N/A

21. The members of this team have similar views concerning the reality core question.

Disagree *Agree*
1 2 3 4 5 I don't know N/A

toolbox

Drivers against interdisciplinarity

- disciplinary structure of the university
- disciplinary structure of academic education
- organization and funding of research
- publication culture & peer review process

Irrespective of the plea for interdisciplinarity: we cannot thrive without disciplinary expertise

Attempting to vary upon Kant's dictum:

Disciplinarity without Interdisciplinarity is Blind

&

Interdisciplinarity without Disciplinarity is Empty

Thanks!

INTERESTED? Check these sites out:

- www.units.muohio.edu/aisorg/index.shtml (Association for Interdisciplinary Studies)
- www.transdisciplinarity.ch (Transdisciplinarity_Net)
- http://pin-net.gatech.edu/ (Philosophy of/as Interdisciplinarity Network)
- http://inidtd.org/ (Intern. Network for Interdisciplinarity & Transdisciplinarity)
- www.iis.uva.nl (Inst. Interdisciplinary Studies, Univ. A'dam)
- http://home.medewerker.uva.nl/m.keestra (m.keestra@uva.nl)