In Vivo Studies of Transdisciplinary Scientific Collaboration

Lessons Learned and Implications for Active Living Research

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TD Core Research Team

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are needed to see this picture.

Active Living Research

Major Goal:

Increase the Health Promotive Capacity of Human Environments

Criteria for Evaluating the Health Promotive Capacity of Environments

- Protect Hygienic Quality
- Provide Health Behavioral Supports
- Foster Sociability Among Occupants
- Offer Aesthetic and Spiritual Qualities
- Include Diversity of Occupants and Settings
- Afford Safety and Security
- Economically Viable
- Ecologically Sustainable

Transdisciplinary Scope of Active Living Research

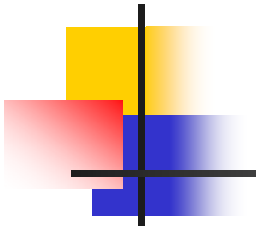
Major Question:

What are the most effective strategies for promoting the integration of diverse disciplinary perspectives encompassed by active living research?

Presumed Benefits of Transdisciplinary Scientific Collaboration

- Greater Explanatory Power
- Methodological Pluralism
- Advantages of Generalist Training Programs
- Broad-Gauged Public Policies

Geographically Dispersed Teams vs. Place-Based Centers



Barriers Faced by Dispersed Teams

- Time-limited nature of the teams
- Limited time for face-to-face meetings
- Other constraints on members time

Geographically Dispersed Teams vs. Place-Based Centers

<u>Barriers Faced by Place-Based Centers</u>

- Bureaucratic Constraints on Collaboration
- Ethnocentrism of academic departments
- Departmental criteria for promotion
- Highly dissimilar ‘world views’ regarding natural and behavioral sciences

UCI TTURC Transdisciplinary Core Research Team

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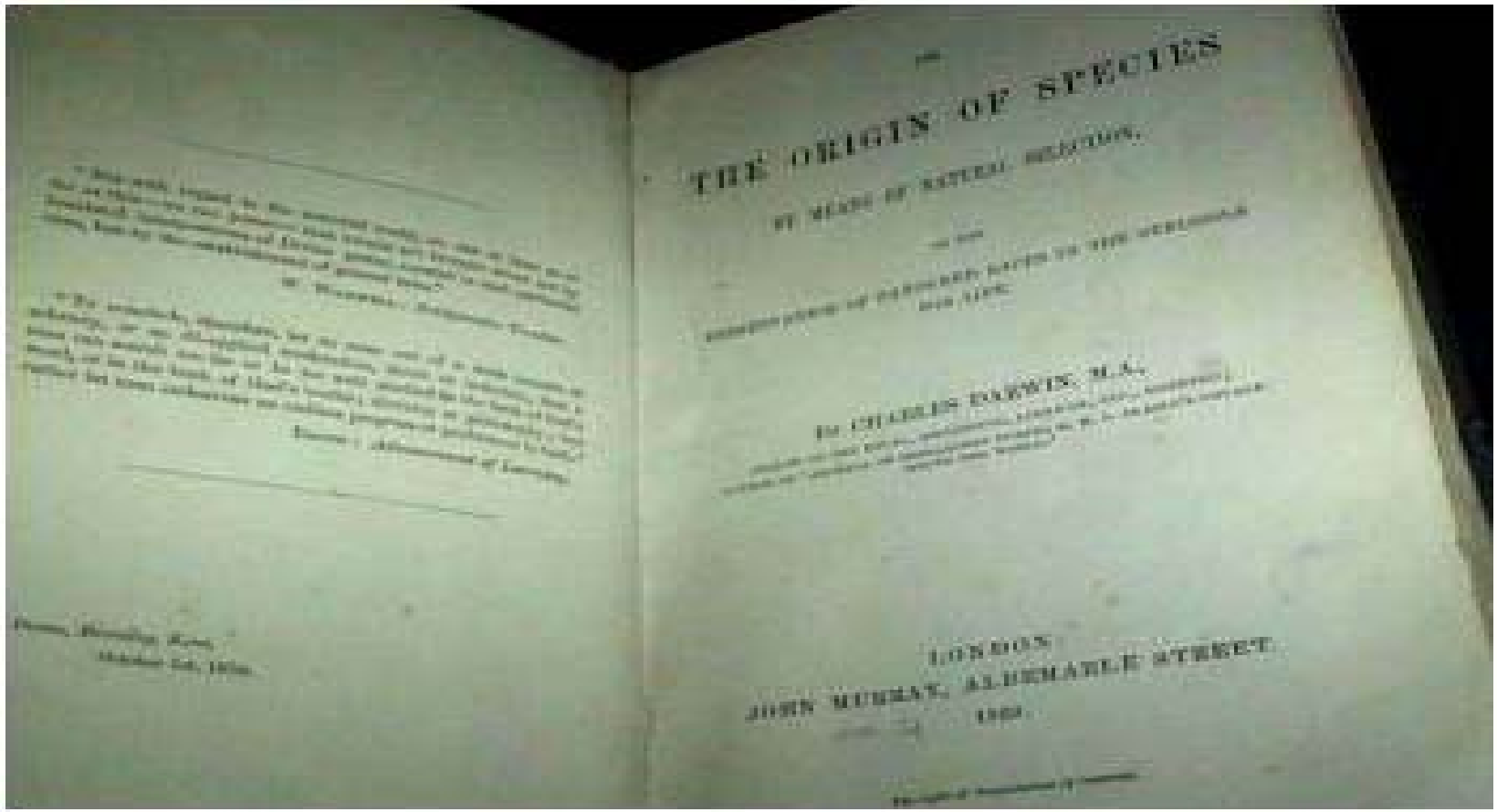
UCI TTURC Transdisciplinary Core Study: Goals and Strategies

1. Establish criteria for assessing Transdisciplinary Scientific Collaboration (TDSC)
2. Model the antecedents, processes and outcomes of TDSC
3. Develop data-gathering tools for analyzing TDSC
4. Develop a grounded theory of TDSC

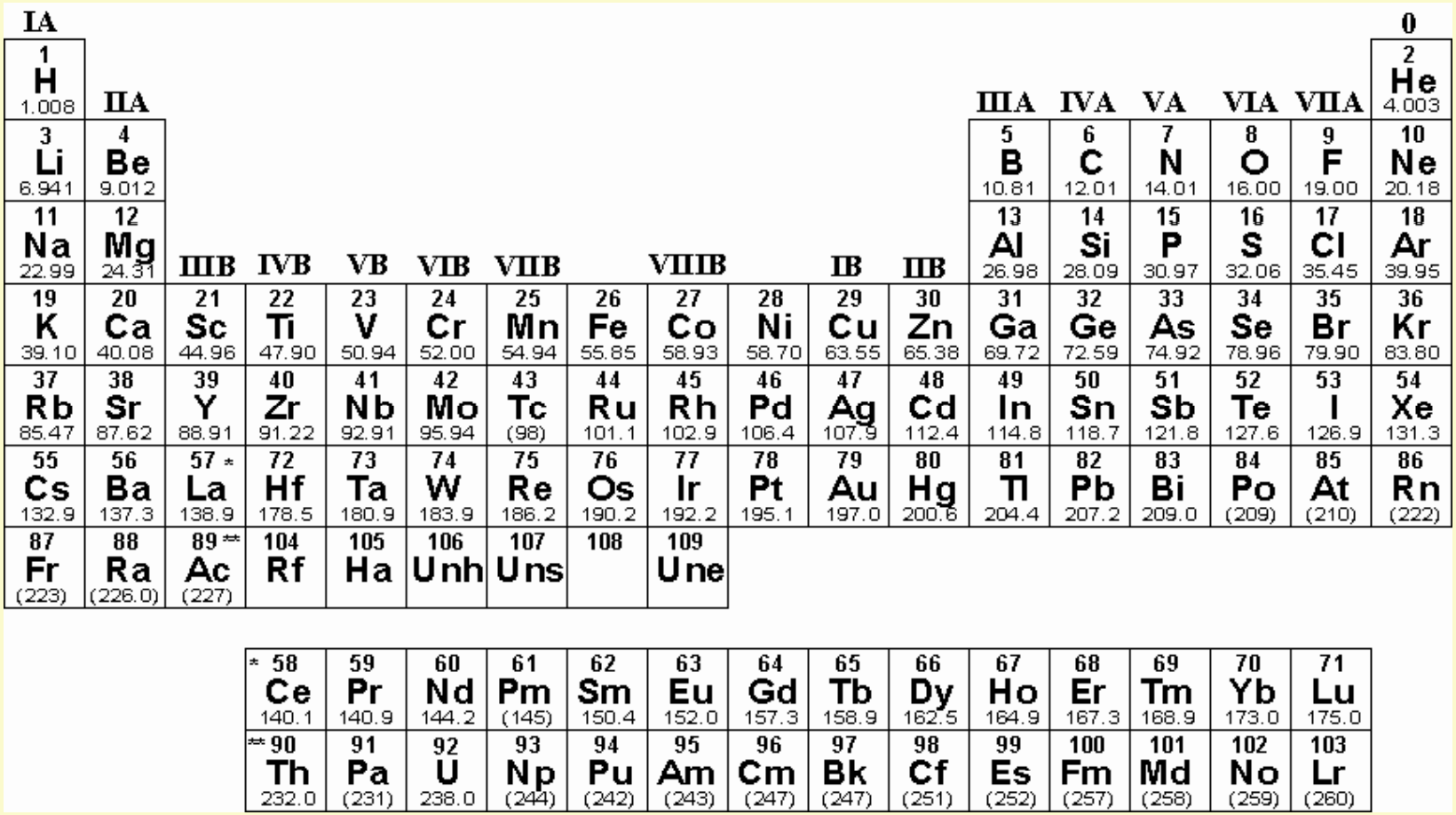
Some Caveats to Keep in Mind

- Very few precedents for this type of research in the field of science studies
- Little prior agreement on the meaning and intended outcomes of transdiscipinary research
- Non-random selection of scientists into collaborative research ventures
- Non-neutral status of evaluators, reactivity of measures
- Indeterminant timeframe for evaluation--5 year program eval. vs. multi-decade historical perspective

Descriptive Research as a Basis for Experimental Biology



The Periodic Table of Elements



IA												IIIA	IVA	VA	VIA	VIIA	0
1 H 1.008	IIA																2 He 4.003
3 Li 6.941	4 Be 9.012											5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18
11 Na 22.99	12 Mg 24.31	IIIB	IVB	VB	VIB	VIIB		VIIIB		IB	IIB	13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.06	17 Cl 35.45	18 Ar 39.95
19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.90	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.70	29 Cu 63.55	30 Zn 65.38	31 Ga 69.72	32 Ge 72.59	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc (98)	44 Ru 101.1	45 Rh 102.9	46 Pd 106.4	47 Ag 107.9	48 Cd 112.4	49 In 114.8	50 Sn 118.7	51 Sb 121.8	52 Te 127.6	53 I 126.9	54 Xe 131.3
55 Cs 132.9	56 Ba 137.3	57 * La 138.9	72 Hf 178.5	73 Ta 180.9	74 W 183.9	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.1	79 Au 197.0	80 Hg 200.6	81 Tl 204.4	82 Pb 207.2	83 Bi 209.0	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra (226.0)	89 ** Ac (227)	104 Rf	105 Ha	106 Unh	107 Uns	108	109 Une									

* 58 Ce 140.1	59 Pr 140.9	60 Nd 144.2	61 Pm (145)	62 Sm 150.4	63 Eu 152.0	64 Gd 157.3	65 Tb 158.9	66 Dy 162.5	67 Ho 164.9	68 Er 167.3	69 Tm 168.9	70 Yb 173.0	71 Lu 175.0
** 90 Th 232.0	91 Pa (231)	92 U 238.0	93 Np (244)	94 Pu (242)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (260)

Elements of a Scientific Discipline

- Organized around the *analytic levels*, *concepts* and *methods* associated with the study of particular *substantive phenomena* (e.g., social, biological "facts")
- Boundaries between specific disciplines and sub-disciplines are, to some extent, arbitrarily defined and agreed upon by communities of scholars
- Some fields are inherently multidisciplinary, combining multiple perspectives in the analyses of complex topics

Disciplinary Foci

- Biological Facts
- Psychological Facts
- Social Facts
- Physical-Environmental Facts

Cross-Disciplinary Research

...a process through which the perspectives of two or more scientific or professional fields are combined to achieve a more complete understanding of a particular phenomenon

Horizontal Integration of Disciplines

Crosses disciplines within one level or category of analysis and discourse

Vertical Integration of Disciplines

Links disciplines across analytic levels:

1. molecular/genetic/biological
2. psychological/developmental
3. social/organizational/institutional
4. societal/community policy levels

Types of Cross-Disciplinary Research

- **multidisciplinary -** researchers in different disciplines *work independently* or sequentially, each from his or her own disciplinary-specific perspective, to address a common problem
- **interdisciplinary -** researchers *work jointly*, but from each of their respective disciplinary perspectives, to address a common problem
- **transdisciplinary -** researchers work jointly using a *shared conceptual framework* that draws together discipline-specific theories, concepts, and approaches, to address a common problem

(Rosenfield, 1992)

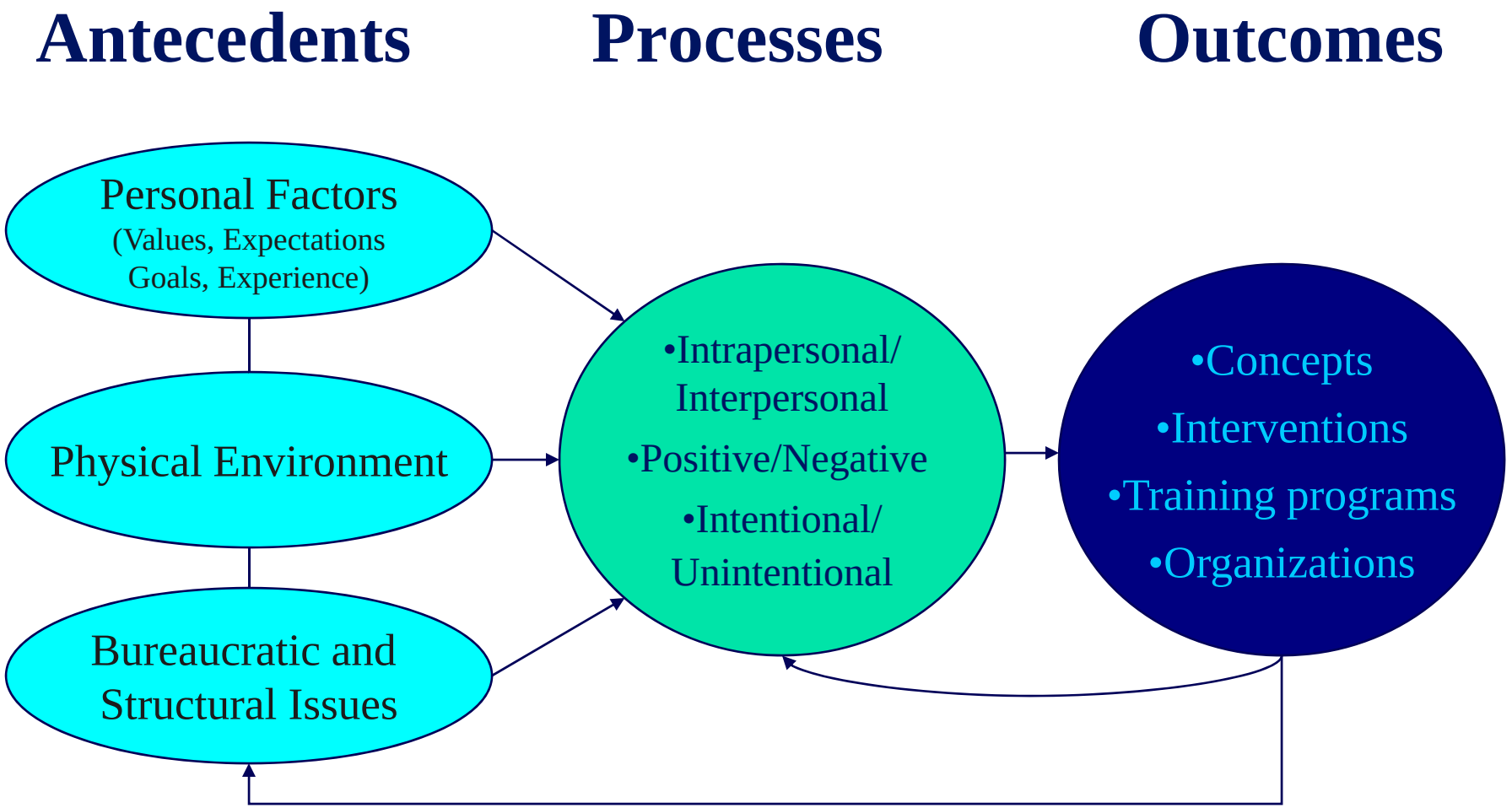
Transdisciplinary Scientific Collaboration (TDSC)

- TDSC by definition involves:
  - collaboration among scholars representing two or more disciplines
  - products that reflect an integration of conceptual and/or methodological perspectives drawn from two or more fields

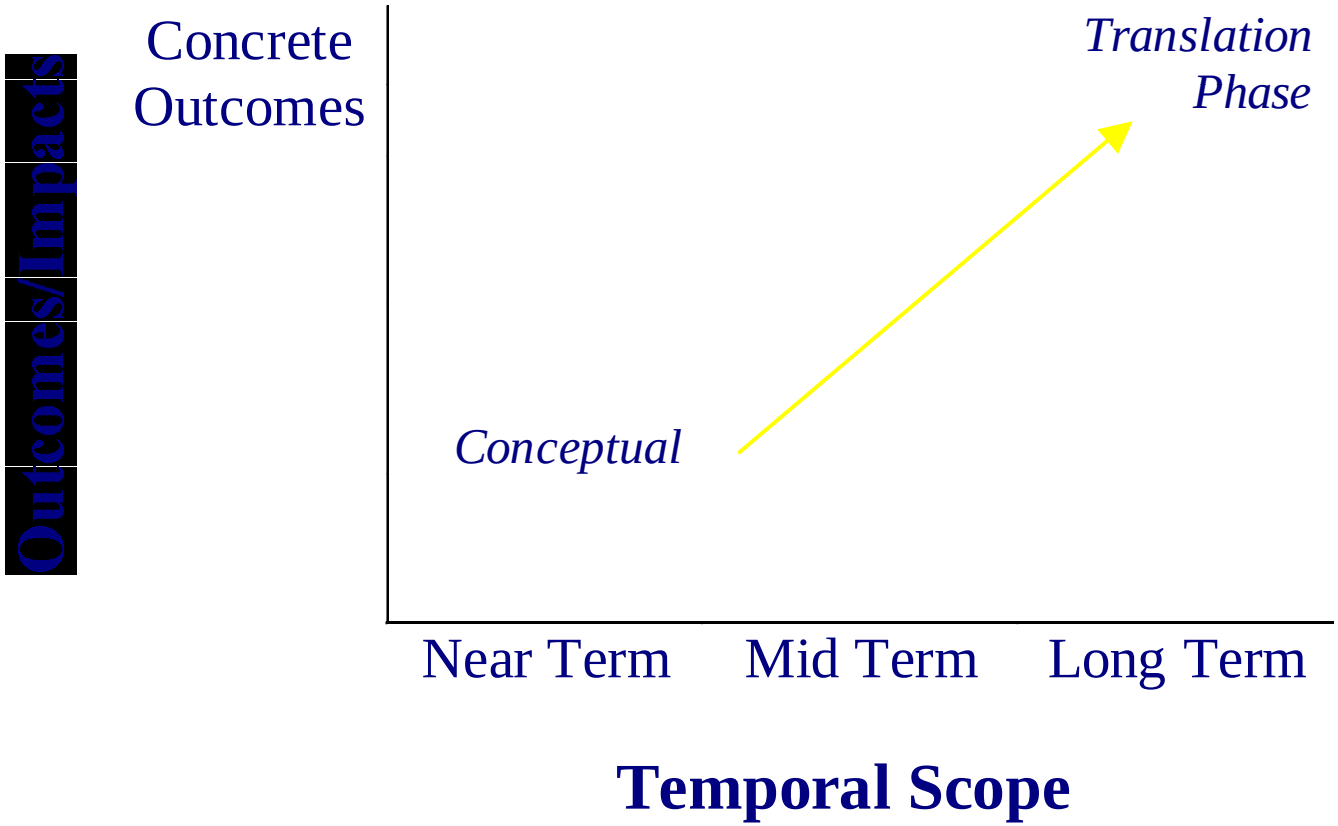
Evaluation of TD Science

- *Transdisciplinary science* must be judged by the quality, novelty, and scope of the intellectual integration it achieves (Thompson Klein, 1996)
- *Intellectual products* of TD Science include:
  - Generation of new hypotheses for research
  - Integrative theoretical frameworks for analyzing problems
  - Novel methodological and empirical analyses of problems
  - Theory-based recommendations for public policy

Working Model of Transdisciplinary Scientific Collaboration



Type and Scope of TTURC-Related Outcomes



Early TTURC "Tales of Success"

- US-China Study of Teen Smoking (USC/UCI)
- Study of Zyban (Brown-Georgetown/Penn)
- Nicotine Vaccine Study (UMin/UCI)
- Institutional changes prompted by TTURCs
  - Task Force on TDSC and seed funding (UCI)
  - Renovation of facilities to support TTURC (USC)
  - Modification of IRB structure/procedures (USC)

Behavior Change Index (BCI)

The Behavior Change Index (BCI) assessed behaviors that indicate a willingness to participate in TDSC. Sample items included:

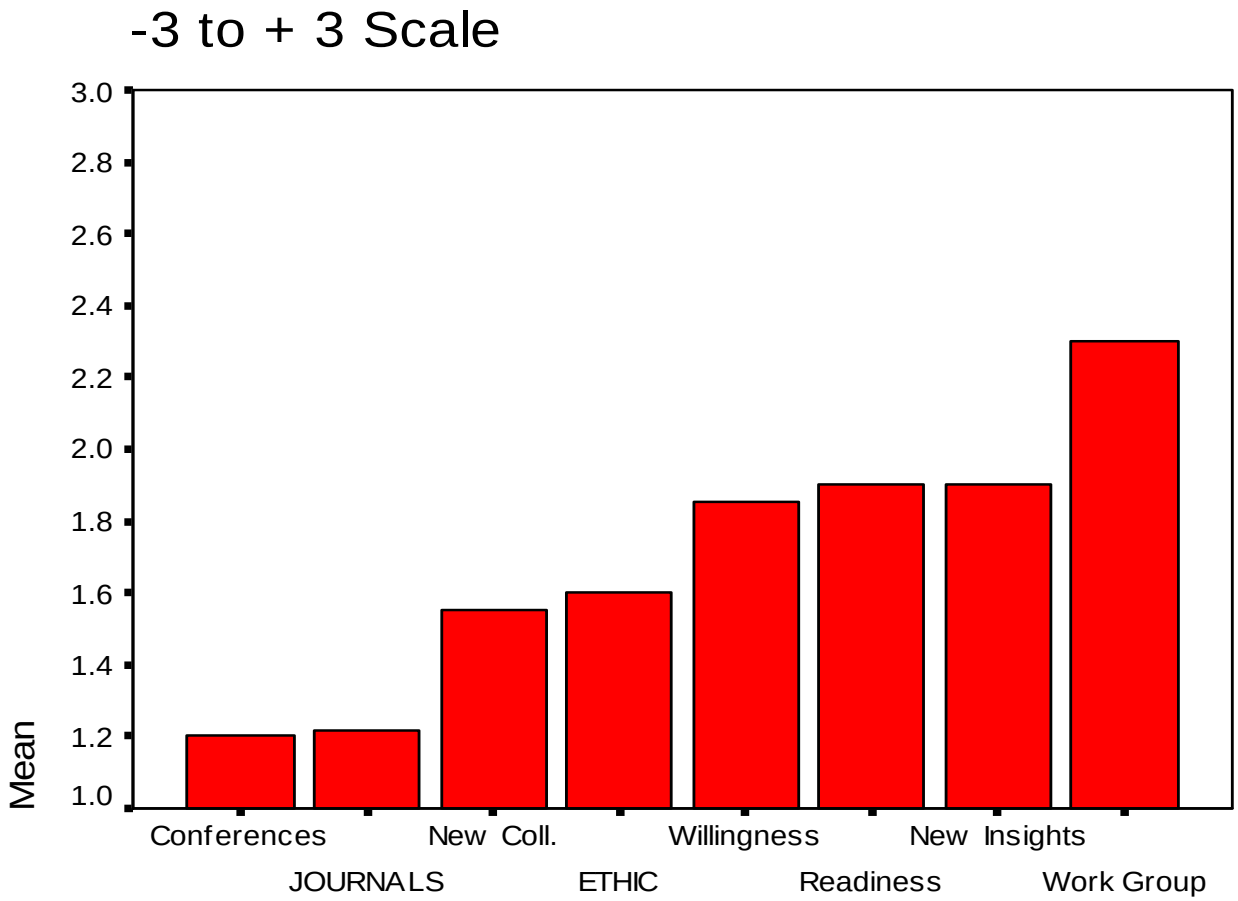
a. Attended conferences or Read journals outside your field

b. Readiness/willingness to collaborate with other TTURC investigators

c. Obtained new insights into your own research through discussion with others

d. Established links with your fellow TTURC colleagues that have led to or, may lead to future collaborative studies

Behavior Change Index Categories & Results



Participation in Working Groups Increased

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Semantic Differential Scale (SDS)

Semantic Differential Scale (SDS): assessed socio-emotional affective impressions about the Center. Sample anchor words included:

Satisfying/ Frustrating Supportive/ Non-Supportive

Exciting/ Unexciting Cooperative/ Competitive

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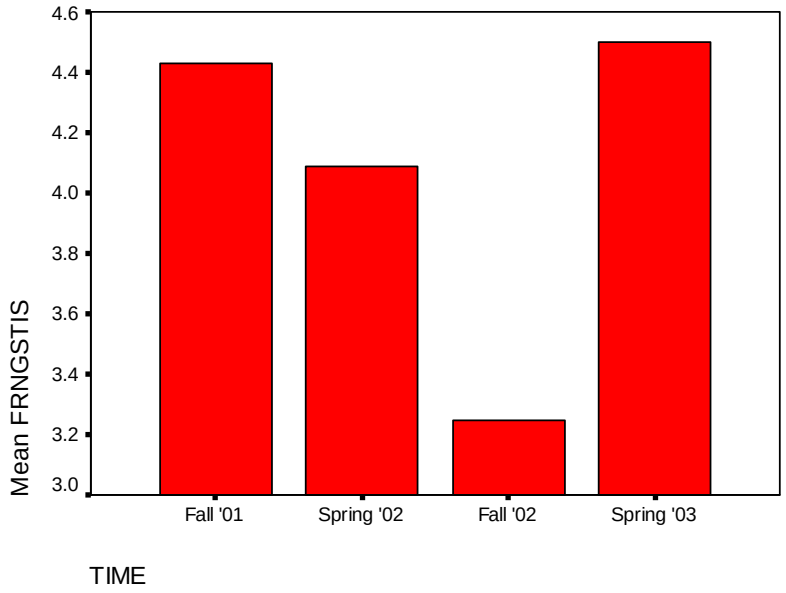
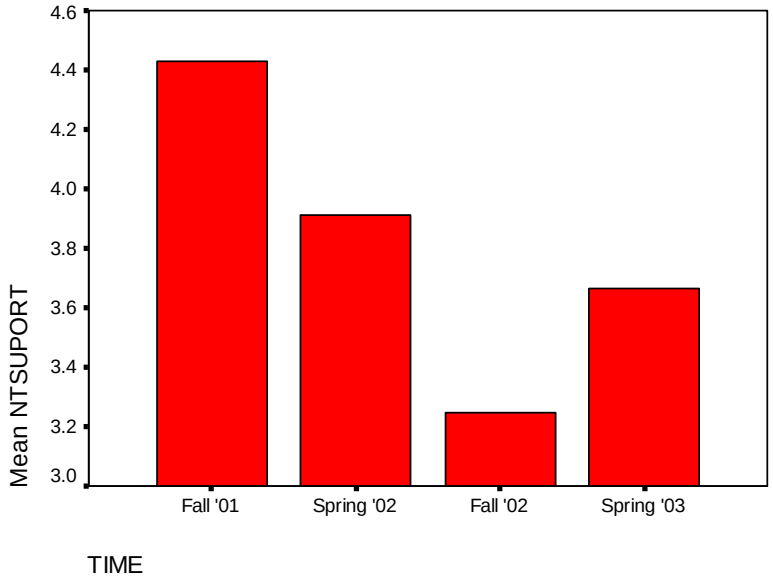
SDS Results: Changes in Feelings About Participation

Two examples of items from the semantic differential scale reflect changes in feelings about the UCI TTURC.

Change from Frustrating to Satisfying

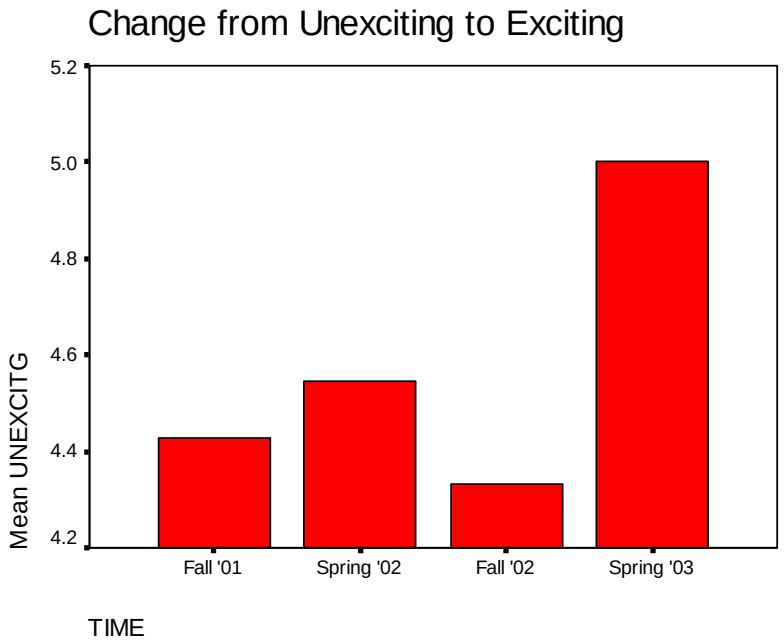


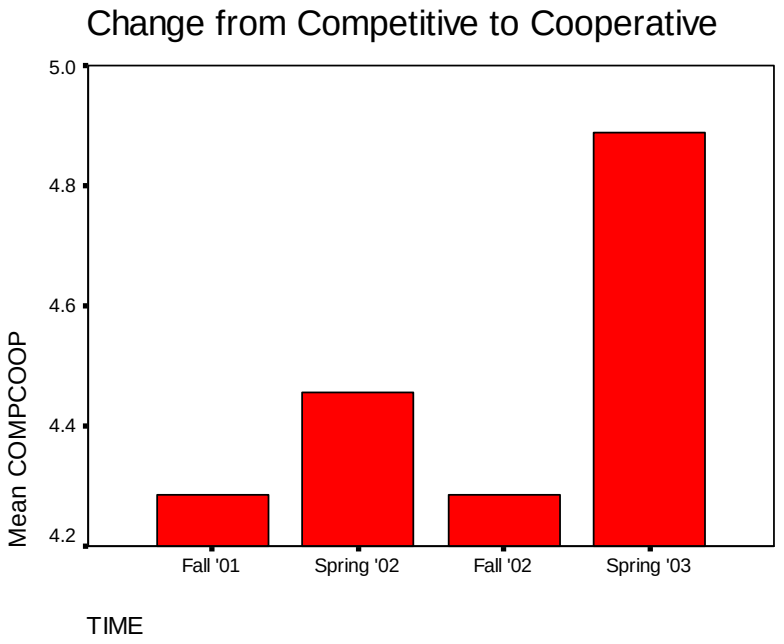
Change from Non-Supportive to Supportive



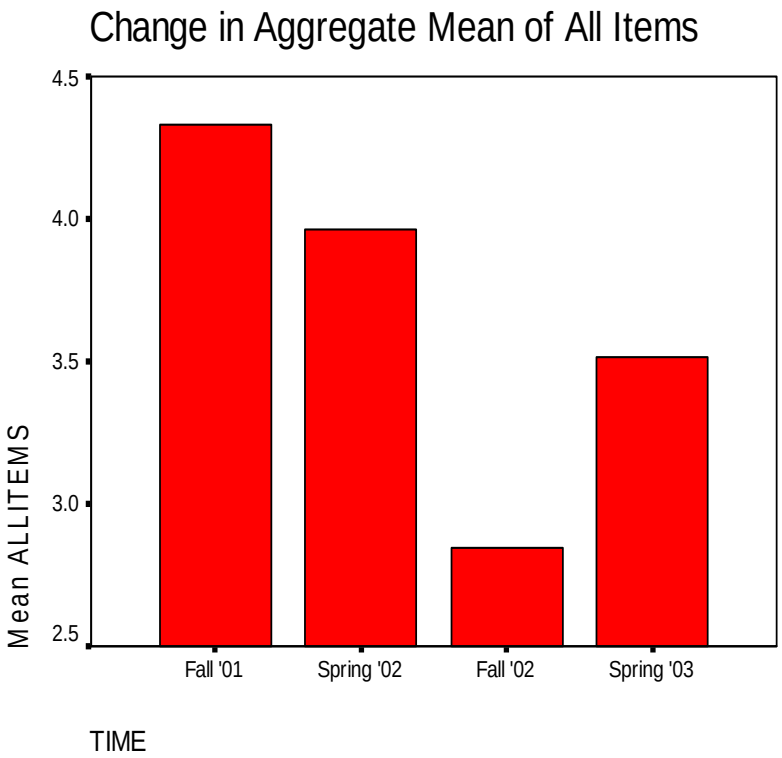
Changes in Impressions About Participating in the TTURC

Two examples of items from the semantic differential scale reflect changes in impressions about participating in the UCI TTURC.





Cyclical Variation in Affect Over Four Time Points



Assessment of Intellectual Themes

Intellectual Themes: assessed content of qualitative surveys and interviews. Sample items included:

a. Have your collaboration efforts involved linking concepts or methods?

b. What is the status of the collaborative integration?

c. Do you think this integration will lead to a tangible product? If so, what kind?

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Charting The Intellectual History of a Research Organization

Evolution of Intellectual Themes

- Which ideas were present at the outset of the TTURC?
- Which ideas were dropped in subsequent years?
- Which new ideas emerged later in the project?
- Which initial ideas were modified over time?
- Which ideas were integrated with previously separate ideas?

Emergent Intellectual Themes

a. Synergistic effects of acetaldehyde and nicotine as components of smoke.

b. Effects of nicotine on critical periods of fetal or adolescent development.

c. Effects of advertising on brain response, activation and addiction circuits.

d. Smoking context variability (e.g. at home and alone vs. at school and with friends).

e. Response inhibition linked to orbital frontal and prefrontal cortex circuits.

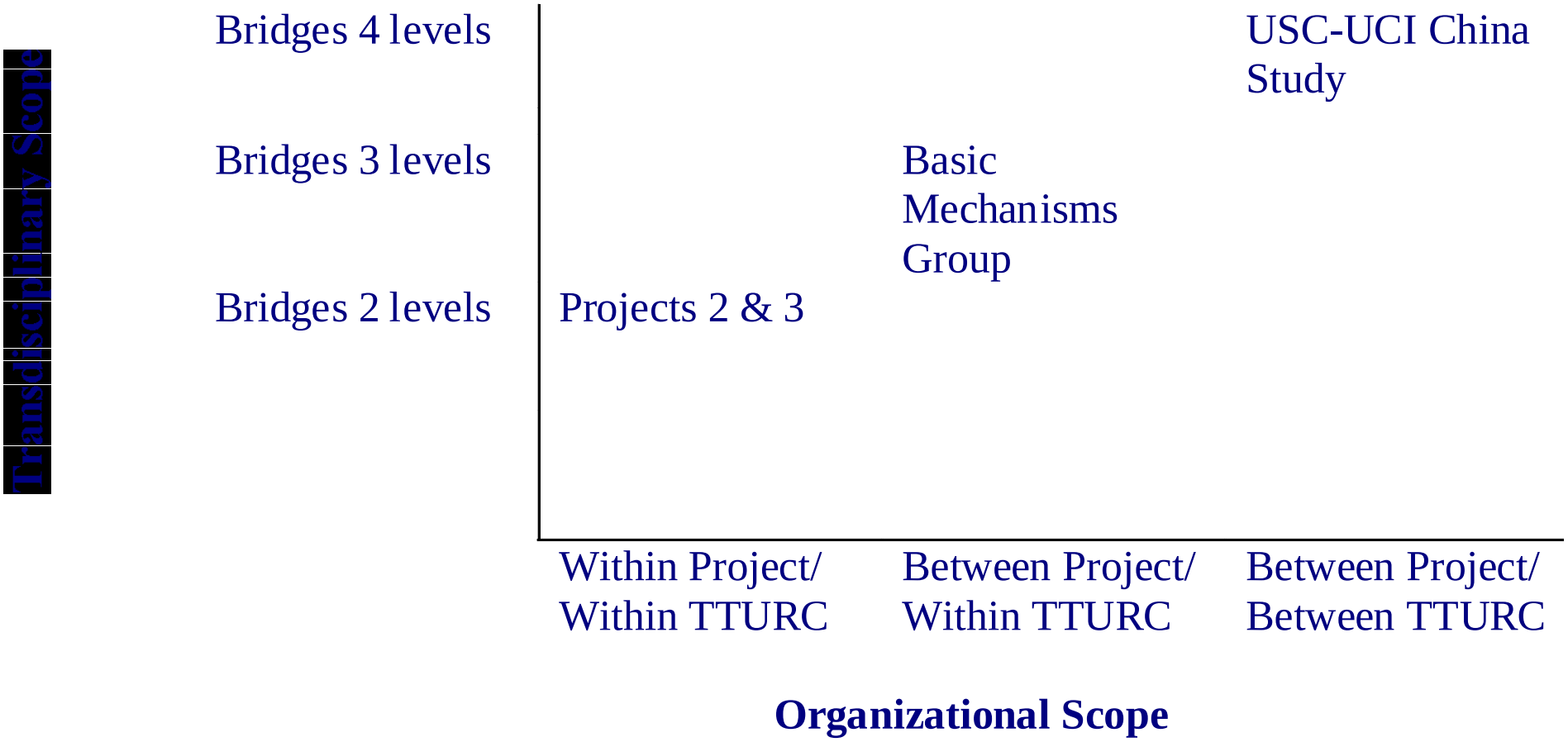
f. Neural networks as a model for understanding drug influences on adolescent brains.

g. Understanding manifest and latent functions of TTURC Cores (e.g. how cores influence TDSC) and, how judging TDSC requires a long-term perspective.

Criteria for Categorizing Intellectual Themes

- Transdisciplinary Scope (levels of analysis bridged)
- Organizational Scope (of collaboration across teams)
- Which researchers are working together on the theme?
- Externally rated novelty, potential impact of ideas
- Number and quality of the distal products associated with each "*vector of collaboration*"

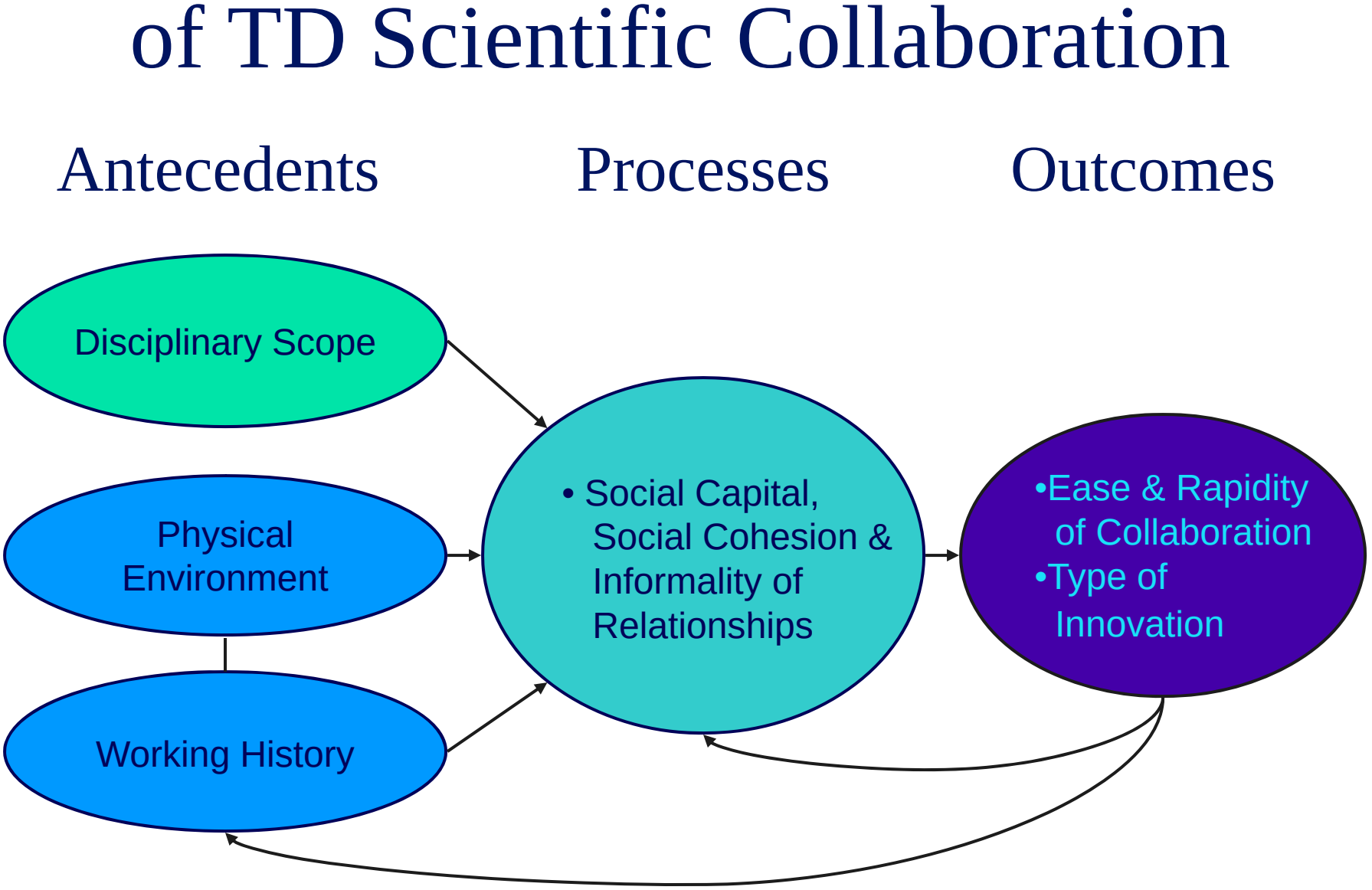
Transdisciplinary and Organizational Scope of Intellectual Integration



“Readiness” for TDSC

- Simple vs. complex administrative structure
- Institutional support for TD work
- Access to shared office and research space
- Center directors and team members share a strong commitment to TD work
- Leadership and interpersonal styles of center members support collaboration
- Team members share a history of working together on prior collaborative projects

USC-UCI Comparative Model of TD Scientific Collaboration



Alternative Pathways Toward Transdisciplinary Collaboration

- *Low level of readiness* for TDSC ⟶ steps taken to reduce barriers to collaboration ⟶ high levels of collaborative activity over the long-term
- *High level of readiness* for TDSC ⟶ high levels of collaborative activity over a relatively short timeframe

Qualities of Transdisciplinary Scientific Collaboration

Social Integration	Scientific Integration: Low	Scientific Integration: High
Social Integration: Low	Social and Scientific Non-Integration	Asocial Scientific Integration
Social Integration: High	Social Support Without Scientific Integration	Socially Supported Scientific Integration

UCI TTURC Retreats

June 2000

January 2001

Transdisciplinary Ethic

1. Inclusive thinking
2. Broad-gauged, contextual research
3. Methodological pluralism
   - Qualitative and quantitative approaches
   - Lab-based and non-experimental methods
4. Optimism and stamina in the pursuit of transdisciplinary research goals
5. Open-minded stance
6. Cultivation of goodwill and tolerance

Overview of Recent Findings

Over the past four time points, the Behavioral Change Index demonstrates an increases in TD behaviors. The greatest behavioral changes occurred in working with other research groups, developing new TD insights, having a readiness and a willingness to participate in TD collaboration.

Over the past four time points, the Semantic Differential Scale reflects cyclical variations in feelings and impressions about participating in the UCI TTURC. The most recent large increase may be due to reactions to a positive report from a national Board of Scientific Advisors (BSA).

Qualitative Interviews and Surveys reflect an integration of TD concepts across working groups For example, discussions about designing a study of aggressiveness in animals that would be analogous to human measures of hostility are underway.

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Summary and Discussion

These data suggest…

1) Cyclical variation in affective socio-emotional attitudes

2) Progress in TD integrative activities despite affective ups and downs

3) TTURCs may facilitate development of TD ideas and outcomes that would not have occurred otherwise

4) Whether midterm markers of transdisciplinary idea integration predict sustained collaboration and longer-term impacts on science, public policy, and community health remains to be examined in future research

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Implications of the TTURC Study for Active Living Research

Key Considerations

- Cost Effectiveness of Geographically Dispersed Teams vs. Place-Based Centers

- Tension Between Novelty and Routinzation of Transdisciplinary Research Projects

- Need to Develop Reliable Criteria for Evaluating the Scientific and Policy Outcomes of TD Research

UCI TTURC Website

http://www.tturc.uci.edu

Transdisciplinary Core B

Typology of Community Assets for Health Promotion

Material Resources

- Economic Capital
- Natural Capital
- Human-Made Environmental Capital
- Technological Capital

Human Resources

- Social Capital
- Human Capital
- Moral Capital

(Stokols, Grzywacz, McMahan, & Phillips, 2003)

Traditional and Transdisciplinary Criteria Used to Evaluate Outcomes

Traditional Criteria:

- Quantity of Research Products
- Quality of Research (Innovation, Impact on a Field)

Transdisciplinary Criteria:

- Integrative Scope of the Research
- Quality of Integration

Cost-Effectiveness Criteria

- Scientific Impact of TD vs. non-TD Research
- Public Health Impacts of TD vs. non-TD Research