

# Strategic Placement of Citations in the Development of Formal Scientific Arguments in Behavioral Neuroscience

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# Preview

- ▶ Behavioral Neuroscience is a research specialty that is both collaborative and international in scope
  - ▶ “Collaborative” as seen in multi-authored papers in the dataset
  - ▶ “International” as seen evident in citation practices of authors
- ▶ An unexpected finding is that that the specialty coheres through citations to specific methodologies rather than a fixed set of research problems
  - ▶ The methodological groupings, however, can be used to isolate certain research problem areas
- ▶ A structural analysis of scientific papers in this dataset reveals two types of “networks” in behavioral neuroscience
  1. **“Peer networks”** identified by journal article authors through the selection of citations associated with their choice of research problems
  2. **“Argumentation networks”** identified by authors through the selection of citations to defend their experimental findings
- ▶ Planners and policymakers incorporate citation metrics in assessing investment strategies
  - ▶ However, innovative metrics are needed to enhance “outcomes” and “impacts” analyses

# The Contemporary Policy Research Challenge: Metrics for a Logic Model

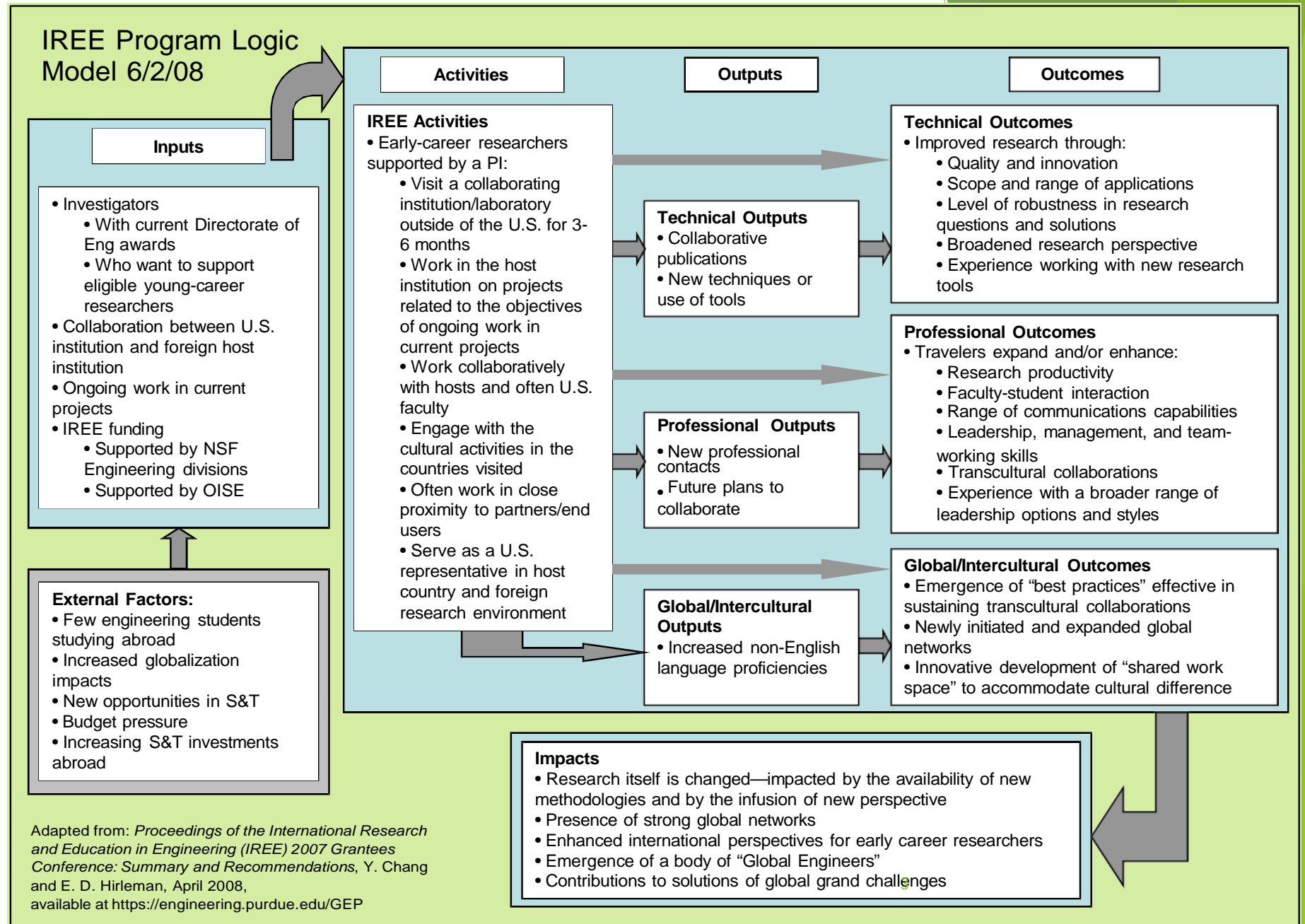
Excerpt from:

*Portfolio Evaluation of the National Science Foundation's Grants Program on "International Research and Education in Engineering" (IREE)*

IDA Document D-3727

Available at:

[http://nsf.gov/eng/eec/EEC\\_Public/STPIevaluationIREEfinal.pdf](http://nsf.gov/eng/eec/EEC_Public/STPIevaluationIREEfinal.pdf)



# The Psychology of Science

- ▶ The *psychology of science* has been defined as the study of scientific thought and behavior
- ▶ The PsySiP Project (Exploratory Analysis 2014)
  - ▶ What research do behavioral neuroscientists cite when constructing scientific arguments in journal publications?
  - ▶ Are there similarities/differences in citation practices across the corpus of behavioral neuroscience articles?
  - ▶ Is it possible to identify “peer networks” and/or “argumentation networks”?
  - ▶ Can these results be used to develop “outcomes” and “impact” metrics for policy and planning?

## *Handbook of the Psychology of Science* GJ Feist and ME Gorman, eds. (2013)

- ▶ Introduction and History
- ▶ Foundational Psychologies of Science (incl. children’s learning)
- ▶ Development and Theory Change (incl. scientific reasoning)
- ▶ Special Topics (incl. communication)
- ▶ Applied Psychologies of Science (incl. creativity and performance of research groups)

# The Long History of Philosophical, Historical, Rhetorical and Sociological Studies of Scientific Communication and Network Analyses

## ► Key authors include:

- SP Borgatti et al. on sociometry *Science* (2009)
- L Bormann and H-D Daniel on what citation counts measure *J of Documentation* (2008)
- DE Chubin on the concept of scientific specialties *The Sociology Quarterly* (1976)
- S Fuller et al. on the explanatory coherence of scientific justification (1989)
- N Gilbert and M Mulkey on scientific discourse (1984)
- W Glanzel and A Schubert on co-authorship and scientific networks (2004)
- AG Gross et al. on networks that establish acceptable argumentation practices *Social Studies of Science* (2000)
- N Mullins et al. on structural analyses of scientific papers (1988)
- F Suppe on the principal task of a scientific paper in presenting knowledge claims *Philosophy of Science* (1998)

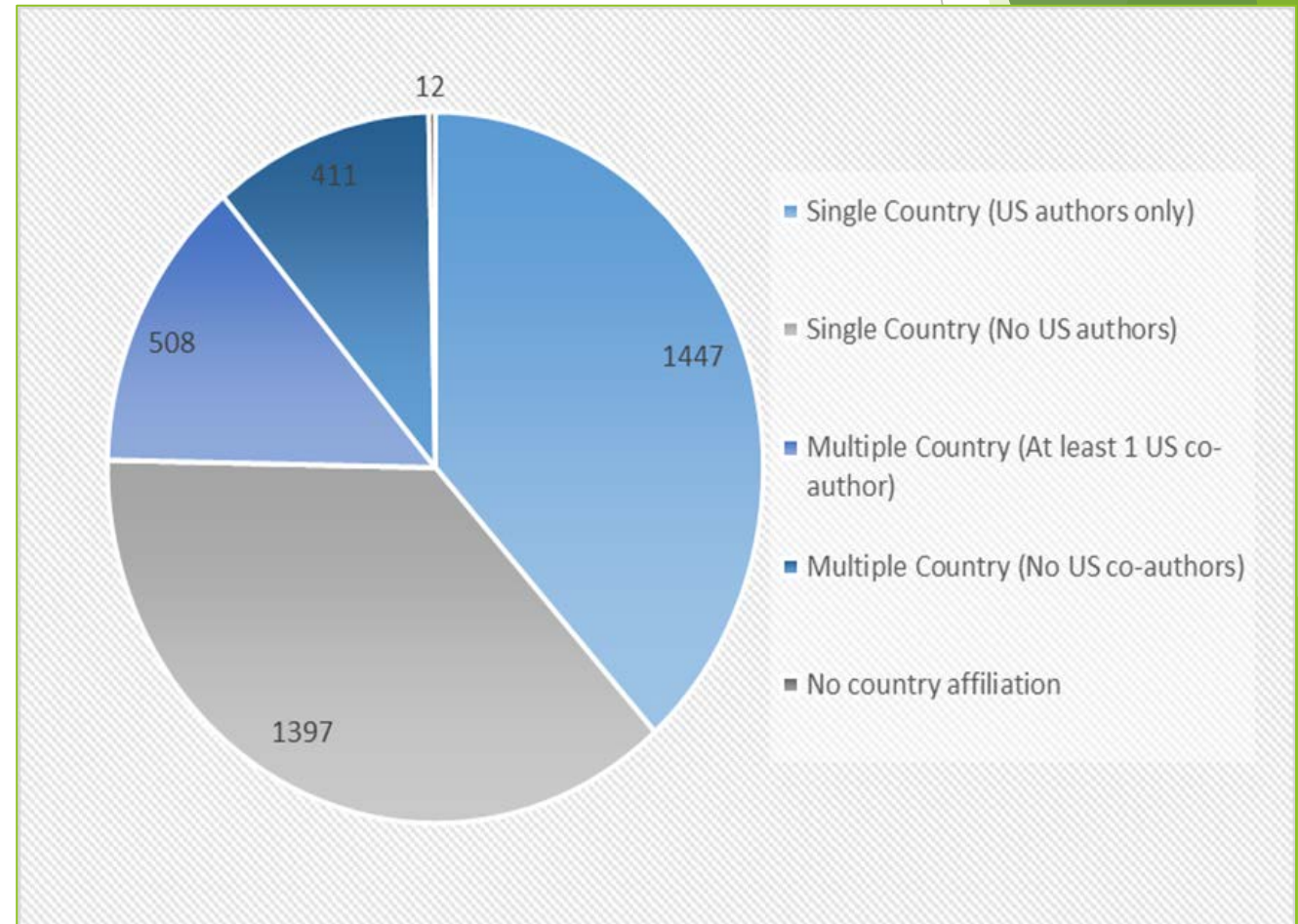
# Background: Behavioral Neuroscience 2012

- ▶ Journal of Cognitive Neuroscience (MIT Press)
- ▶ Neurobiology of Learning and Memory (Elsevier)
- ▶ Behavioral Neuroscience (APA, USA)
- ▶ Pharmacology, Biochemistry and Behavior (Elsevier)
- ▶ Cognitive Behavioral Neurology (Lippincott)

2007 - 2012:

- 3,800 Journal Articles
- 207,600 References

- ▶ From: The Role of "Thought Leaders" in the Advancement of Research in Behavioral Neuroscience (2012)
  - ▶ Available at:  
<http://independent.academia.edu/PamelaFlattau>





# Behavioral Neuroscience is International in Scope: 2012

## Single-Author Papers

- USA
- England
- Canada
- Japan
- Taiwan
- Wales
- Germany
- Mexico

## Multi-Author, Same Country

- USA
- Canada
- Germany
- England
- Brazil
- Japan
- China
- France
- Netherlands
- Australia

## Multi-Author, Multi-Country Pairings

- Canada/USA
- Germany/USA
- France/USA
- England/USA
- Italy/USA
- Israel/USA
- Germany/Netherlands
- India/USA
- England/Germany
- Netherlands/USA
- Switzerland/USA
- Japan/USA
- Austria/Germany
- Belgium/France
- England/Netherlands

Paxinos, G (Australia)

Friston, KJ (UK)

McGaugh, JL (USA)

Dehaene, S (France)

Frye, CA (USA)

Corbetta, M (USA)

Kutas, M (USA)

Talairach, J (France)

Roosendaal, B (Netherlands)

Maren, S (USA)

Friederici, AD (Germany)

Bouton, ME (USA)

Swerdlow, NR (USA)

Squire, LR (USA)

Davis, M (USA)

Koob, GF (USA)

Fanselow, MS (USA)

Naatanen, R (Finland)

Oldfield, RC (UK)

Grill-Spector, K (USA)

# Behavioral Neuroscience Referencing Practices Vary by Country Grouping: 2012

Same Country, US Only	Same Country, Not US
Paxinos, G	Paxinos, G
Frye, CA	Friston, KJ
Swerdlow, NR	Kutas, M
Bouton, ME	McGaugh, JL
Maren, S	Corbetta, M
Koob, GF	Dehaene, S
Fanselow, MS	Rooszendaal, B (t)
Rudy, JW	Oldfield, RC
Holland, PC	Friederici, AD
McGaugh, JL	Kim, JJ
Kim, JJ	Robinson, TE
Robinson, TE	Levin, ED
Levin, ED	Eimer, M
Spear, LP	File, SE
Eichenbaum, H	Izquierdo, I
Salamone, JC (t)	Grill-Spector, K
Rescorla, RA	Rizzolatti, G (t)
Packard, MG	Robinson, TE
Talarirach, J	Davis, M (t)
*	Zarrindast, MR
	Morris, RGM (t)
	Cahill, L

Multi-Country, At Least 1 US
Dehaene, S
Salamone, JD
Talairach, J
Friston, KJ
Corbetta, M (t)
Paxinos, G
Arias, C
Friederici, AD (t)
Grill-Spector, K
Squire, L
Bell, RL
Adolphs, R (t)
Cabeza, R (t)
Rolls, ET
Naatanen, R (t)
Rooszendaal, B
Eichenbaum, H (t)
Oldfield, RC (t)
Petrides, M
Vuilleumier, P (t)
Zatorre, RJ

Multi-Country, No US
Friston, KJ
Naatanen, R
Pulvermiller, F
Koelsch, S
Dehaene, S
Kutas, M
Rizzolatti, G
Corbetta, M (t)
Friederici, AD (t)
Paxinos, G
Oldfield, RC
Schachter, DL(t)
Talairach, J
Luck, SJ (t)
Price, CJ (t)
Rugg, MD
Hagoort, P (t)
Grill-Spector, K (t)
McGaugh, JL
Vuilleumier, P



# The PsySiP Project in Behavioral Neuroscience: 2014

## ▶ Method

### ▶ Document selection

- ▶ 200 papers drawn from corpus of behavioral neuroscience journal publications (2007 - 2012, 5 English-language journals)

### ▶ Partitioning documents for analysis

- ▶ Text leading up to “Method” and text following “Discussion”
- ▶ Reference lists

### ▶ Coding strategy

1. Does the reference list contain papers by any of the “Top 20” authors in the dataset or in the country-grouping list of “Top 20 authors”?
2. What is the first appearance in the text of each of those references?

### ▶ Creating a record of findings

- ▶ Inventory with unique ID for each paper and details regarding [first] author
- ▶ Y/N record of citations
- ▶ Excel file record of citation counts for each document



# Analysis 2: An example of “Peer Networks”

	<b>Paxinos</b>	<b>Talairach</b>	<b>Friston</b>
Paxinos			0.11
Friston	0.03	0.09	0.22
McGaugh	0.22		
Dehaene		0.45	0.22
Corbetta	0.03	0.09	0.11
Kutas		0.09	
Rooszendaal	0.13		
Maren	0.13		0.11
Friederici		0.09	
Bouton	0.06		0.11
Squire	0.16	0.09	
Davis	0.06		
Koob	0.06		
Fanselow	0.09		0.11
Grill-Spector		0.09	

# Analysis 3: An example of “Argumentation Networks”

	<b>Paxinos</b>	<b>Talairach</b>	<b>Friston</b>
Paxinos			
Friston	0.04	0.25	0.20
McGaugh	0.29		
Dehaene		0.25	0.10
Corbetta		0.38	0.30
Kutas			
Rooszendaal	0.08		
Maren	0.25		0.20
Friederici			
Bouton			0.11
Squire	0.80		
Davis			0.10
Koob	0.04		
Fanselow	0.21		0.10
Grill-Spector		0.13	

# Current Analysis: Differences in Peer v. Argumentation Networks Through Cognitive Linguistics Research

Gp.	Jrnl	Yr	IstAuthor	Transcription First Paragraph
A	pbb	7	levin	Pre-pulse inhibition (PPI) is a phenomenon of sensorimotor plasticity in which the motor response to a startling sensory stimulus is inhibited by a preceding sensory stimulus of a lower intensity ( <b>Swerdlow...1999</b> ).
				PPI in the current study was cross-modal, with an acoustic pre-pulse and a tactile startle to compare with the unimodal acoustic PPI used in the majority of studies.
				PPI is impaired in a variety of a variety of clinical states, including most prominently schizophrenia ( <b>Braff...Swerdlow...2001; Geyer...Swerdlow...2001</b> ).
				Drug interaction studies can be used to help determine the neural bases of sensorimotor plasticity underlying PPI and to help develop new therapeutic treatments for people with deficits in sensorimotor adaptation.

# Towards the Development of “Outcomes” and “Impacts” Metrics in Behavioral Neuroscience

## NIH embraces bold, 12-year scientific vision for BRAIN Initiative (2014)

The following scientific goals were identified as high priorities for achieving this vision:

- ▶ *Identify and provide experimental access to the different brain cell types to determine their roles in health and disease.*
- ▶ *Generate circuit diagrams that vary in resolution from synapses to the whole brain.*
- ▶ *Produce a dynamic picture of the functioning brain by developing and applying improved methods for large-scale monitoring of neural activity...*

## US National Science Foundation Participates in White House Brain Research through Advancing Innovative Neurotechnologies (BRAIN) Initiative (2013)

*NSF's goal is to enable scientific understanding of the full complexity of the brain, in action and in context, through targeted, cross-disciplinary investments in research, technology, and workforce development. Understanding the Brain activities promise innovative and integrated solutions to challenges in our ability to predict how collective interactions between brain function and our physical and social environment enable complex behavior.*





# Metric Development Strategy: PsySiP 2014 - 2019

## Outcomes

- ▶ Broadened research perspective
- ▶ Experience in working with new tools
- ▶ Transcultural collaborations
- ▶ New and/or expanded global networks
- ▶ Innovative development of “shared workspace” to accommodate transcultural collaborations

## Impacts

- ▶ Availability and infusion of new methodologies
- ▶ Strong global networks
- ▶ Enhanced international perspective for “early career” scientists
- ▶ Contributions to the solution of grand global challenges

**PsySiP Approach:**  
Extend current behavioral neuroscience studies  
Incorporate other emerging research specialties in the behavioral sciences