

Never Too Many Cooks: The Epistemic Value of Collegiality

Blaise Cronin
Indiana University

University of Washington, January
2009

Originary Authorship & Individual Genius

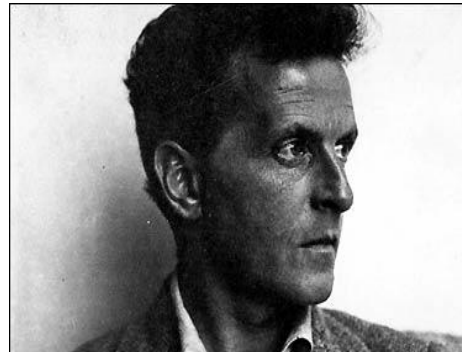
Robert Boyle



Grigory Perleman

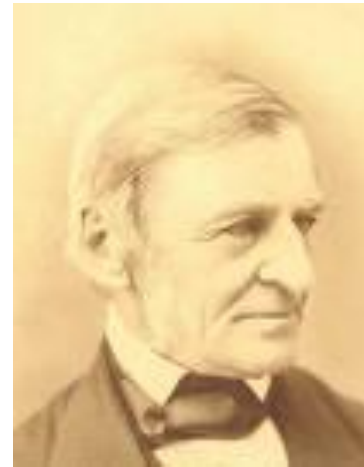


Ludwig Wittgenstein



Emerson vs. Donne

“Every great man is
an unique.”



“No man is an island
entire of itself ...”



Many Hands Make Light Work



Takashi Murakami's *Tan Tan Bo*

Names of the 25 assistants who worked on the three-panel painting are written on the back of the canvas



Gilbert & George

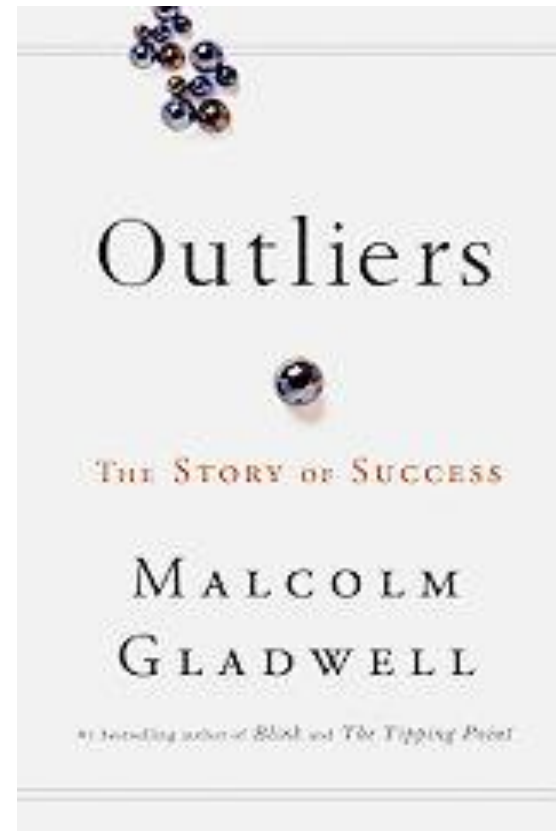
Creative coupling



You'll Never Walk Alone

No one -- not rock stars, not professional athletes, not software billionaires, and not even geniuses -- ever makes it alone.

Malcolm Gladwell, *Outliers*



“Invisible technicians”

(Shapin, 1994)

Robert Boyle and
*who?**

* Denis Papin



‘The Disappeared’

“Behind a prominent name, and behind a prominent institution, there is the world of the laboratory, the world of those who are scarcely mentioned in public.”

(Rheinberger, 1997)



Individual Genius or Teamwork?

Polymerase chain reaction (PCR)
“invented” by Kary Mullis at Cetus
Corp. Awarded 1993 Nobel Prize
for Chemistry

Some colleagues angered by
colleagues Mullis’s “fable” ...
“creation myth”.



Who Cloned Dolly?

Lead researcher admits
his role was overstated

Technicians complain
their contribution
ignored

The Guardian, 11/3/06, p.10

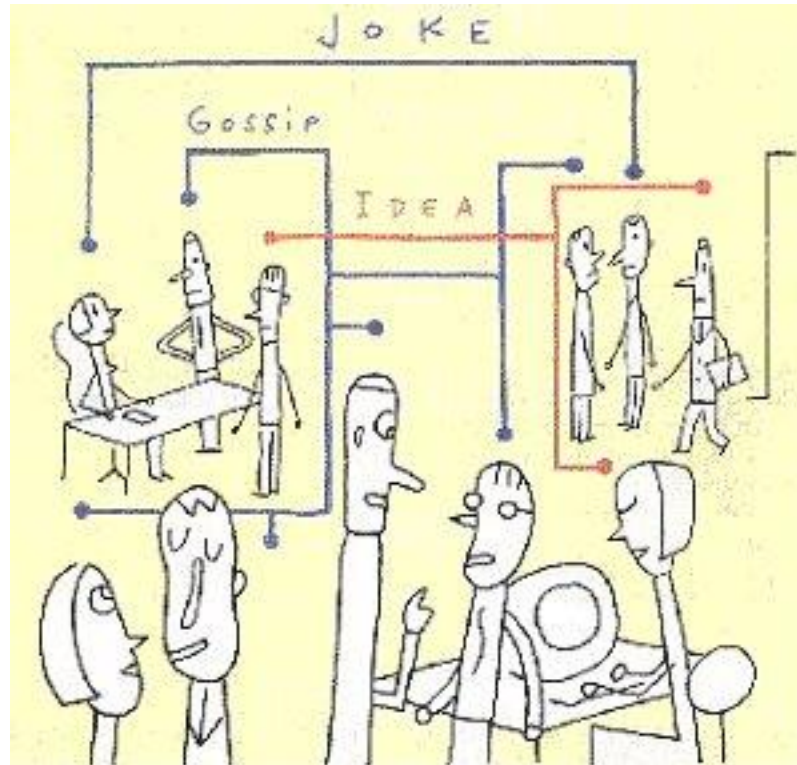


Reality Mining

Actors

Artifacts

Affect

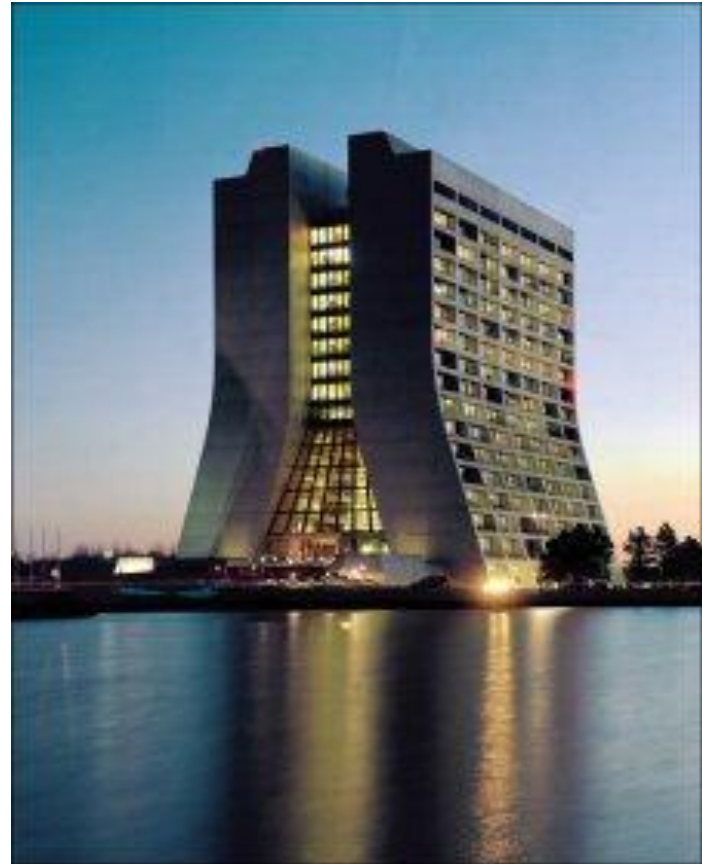


Longitudinal Double-Spin Asymmetry and Cross Section for Inclusive Jet Production In Polarized Proton Collisions at $\sqrt{s}=200\text{GeV}$

B.I. Abelev,50M.M. Aggarwal,30Z. Ahammed,45J. Amonett,20B.D. Anderson,20M. Anderson,6D. Arkhipkin,13
G.S. Averichev,12Y. Bai,28J. Balewski,17O. Barannikova,9L.S. Barnby,2J. Baudot,18S. Bekele,29V.V. Belaga,12
A. Bellingeri-Laurikainen,40R. Bellwied,48 F. Benedosso,28S. Bhardwaj,35A. Bhasin,19 A.K. Bhati,30
H. Bichsel,47J. Bielcik,50J. Bielcikova,50L.C. Bland,3S-L. Blyth,22 B.E. Bonner,36M. Botje,28J. Bouchet,40
A.V. Brandin,26 A. Bravar,3T.P. Burton,2 M. Bystersky,11R.V. Cadman,1 X.Z. Cai,39 H. Caines,50
M. Calderon de la Barca Sanchez,6J. Castillo,28 O. Catu,50 D. Cebra,6Z. Chajecski,29 P. Chaloupka,11
S. Chattopadhyay,45H.F. Chen,38 J.H. Chen,39 J. Cheng,43 M. Cherney,10A. Chikhanian,50 W. Christie,3
J.P. Coffin,18T.M. Cormier,48M.R. Cosentino,37J.G. Cramer,47H.J. Crawford,5D. Das,45S. Das,45S. Dash,15
M. Daugherty,42M.M. deMoura,37T.G. Dedovich,12 M. DePhillips,3 A.A. Derevschikov,32L. Didenko,3
T. Dietel,14 P. Djawotho,17S.M. Dogra,19W.J. Dong,7X. Dong,38 J.E. Draper,6F. Du,50 V.B. Dunin,12
J.C. Dunlop,3 M.R. Dutta Mazumdar,45V. Eckardt,24W.R. Edwards,22L.G. Efimov,12V. Emelianov,26
J. Engelage,5G. Eppley,36B. Erazmus,40M. Estienne,18P. Fachini,3R. Fatemi,23J. Fedorin,12P. Filip,13
E. Finch,50 V. Fine,3 Y. Fisyak,3J. Fu,49 C.A. Gagliardi,41L. Gaillard,2M.S. Ganti,45V. Ghazikhanian,7
P. Ghosh,45 J.E. Gonzalez,7Y.G. Gorbunov,10H. Gos,46 O. Grebenyuk,28 D. Grosnick,44S.M. Guertin,7
K.S.F.F. Guimaraes,37N. Gupta,19 T.D. Gutierrez,6B. Haag,6T.J. Hallman,3A. Hamed,48 J.W. Harris,50
W. He,17M. Heinz,50T.W. Henry,41S. Heppelmann,31B. Hippolyte,18A. Hirsch,33E. Hjort,22A.M. Hoffman,23
G.W. Hoffmann,42M.J. Horner,22H.Z. Huang,7S.L. Huang,38E.W. Hughes,4T.J. Humanic,29G. Igo,7P. Jacobs,22
W.W. Jacobs,17P. Jakl,11F. Jia,21H. Jiang,7P.G. Jones,2E.G. Judd,5S. Kabana,40K. Kang,43J. Kapitan,11
M. Kaplan,8D. Keane,20A. Kechechyan,12V.Yu. Khodyrev,32B.C. Kim,34J. Kireluk,23A. Kisiel,46E.M. Kislov,12
S.R. Klein,22A. Kocoloski,23D.D. Koetke,44T. Kollegger,14M. Kopytine,20L. Kotchenda,26V. Kouchpil,11
K.L. Kowalik,22M. Kramer,27P. Kravtsov,26V.I. Kravtsov,32K. Krueger,1C. Kuhn,18A.I. Kulikov,12A. Kumar,30
A.A. Kuznetsov,12M.A.C. Lamont,50J.M. Landgraf,3S. Lange,14S. LaPointe,48F. Laue,3J. Lauret,3A. Lebedev,3
R. Lednicky,13 C-H. Lee,34 S. LeHocka,12 M.J. LeVine,3 C. Li,38 Q. Li,48 Y. Li,43 G. Lin,50 X. Lin,49
S.J. Lindenbaum,27 M.A. Lisa,29F. Liu,49H. Liu,38J. Liu,36 L. Liu,49 Z. Liu,49T. Ljubicic,3 W.J. Llope,36
H. Long,7R. S. Longacre,3W.A. Love,3Y. Lu,49 T. Ludlam,3 D. Lynn,3G.L. Ma,39J.G. Ma,7Y.G. Ma,39
D. Magestro,29D.P. Mahapatra,15R. Majka,50L.K. Mangotra,19R. Manweiler,44S. Margetis,20C. Markert,42
L. Martin,40H.S. Matis,22Yu.A. Matulenko,32C.J. McClain,1T.S. McShane,10Yu. Melnick,32A. Meschanin,32
J. Millane,23 M.L. Miller,23N.G. Minaev,32S. Mioduszewski,41C. Mironov,20A. Mischke,28D.K. Mishra,15
J. Mitchell,36 B. Mohanty,45L. Molnar,33C.F. Moore,42D.A. Morozov,32M.G. Munhoz,37 B.K. Nandi,16
C. Nattrass,50T.K. Nayak,45J.M. Nelson,2P.K. Netrakanti,45L.V. Nogach,32S.B. Nurushev,32G. Odyniec,22
A. Ogawa,3V. Okorokov,26M. Oldenburg,22D. Olson,22M. Pachr,11S.K. Pal,45Y. Panebratsev,12S.Y. Panitkin,3
A.I. Pavlinov,48T. Pawlak,46T. Peitzmann,28V. Perevoztchikov,3C. Perkins,5W. Peryt,46S.C. Phatak,15
R. Picha,6M. Planinic,51J. Pluta,46N. Poljak,51N. Porile,33J. Porter,47A.M. Poskanzer,22M. Potekhin,3
E. Potrebenikova,12B.V.K.S. Potukuchi,19D. Prindle,47C. Pruneau,48J. Putschke,22G. Rakness,31R. Raniwala,35
S. Raniwala,35R.L. Ray,42S.V. Razin,12J. Reinnarth,40D. Relyea,4A. Ridiger,26H.G. Ritter,22J.B. Roberts,36
O.V. Rogachevskiy,12J.L. Romero,6A. Rose,22C. Roy,40L. Ruan,22M.J. Russcher,28R. Sahoo,15T. Sakuma,23
S. Salur,50J. Sandweiss,50M. Sarsour,41P.S. Sazhin,12 J. Schambach,42R.P. Scharenberg,33N. Schmitz,24
J. Seger,10I. Selyuzhenkov,48P. Seyboth,24A. Shabetai,20E. Shahaieiev,12M. Shao,38M. Sharma,30W.Q. Shen,39
S.S. Shimanskiy,12E.P. Sichtermann,22F. Simon,23R.N. Singaraju,45N. Smirnov,50R. Snellings,28G. Sood,44
P. Sorensen,3J. Sowinski,17J. Speltz,18 H.M. Spinka,1 B. Srivastava,33A. Stadnik,12 T.D.S. Stanislaus,44
R. Stock,14A. Stolpovsky,48M. Strikhanov,26B. Stringfellow,33A.A.P. Suaide,37E. Sugarbaker,29M. Sumner,11
Z. Sun,21 B. Surrow,23M. Swanger,10T.J.M. Symons,22 A. Szantode Toledo,37A. Tai,7J. Takahashi,37
A.H. Tang,3T. Tarnowsky,33D. Thein,7 J.H. Thomas,22A.R. Timmins,2 S. Timoshenko,26M. Tokarev,12
T.A. Trainor,47S. Trentalange,7R.E. Tribble,41O.D. Tsai,7J. Ulerly,33T. Ullrich,3D.G. Underwood,1G. Van
Buren,3 N. vanderKolk,28 M. vanLeeuwen,22 A.M. VanderMolen,25 R. Varma,16 I.M. Vasilevski,13
A.N. Vasiliev,32R. Vernet,18 S.E. Vigdor,17Y.P. Vijoyi,15S. Vokal,12S.A. Voloshin,48W.T. Waggoner,10
F. Wang,33G. Wang,7J.S. Wang,21X.L. Wang,38Y. Wang,43J.W. Watson,20J.C. Webb,44 G.D. Westfall,25
A. Wetzler,22C. Whitten Jr.,7H. Wieman,22S.W. Wissink,17R. Witt,50J. Wood,7J. Wu,38N. Xu,22Q.H. Xu,22

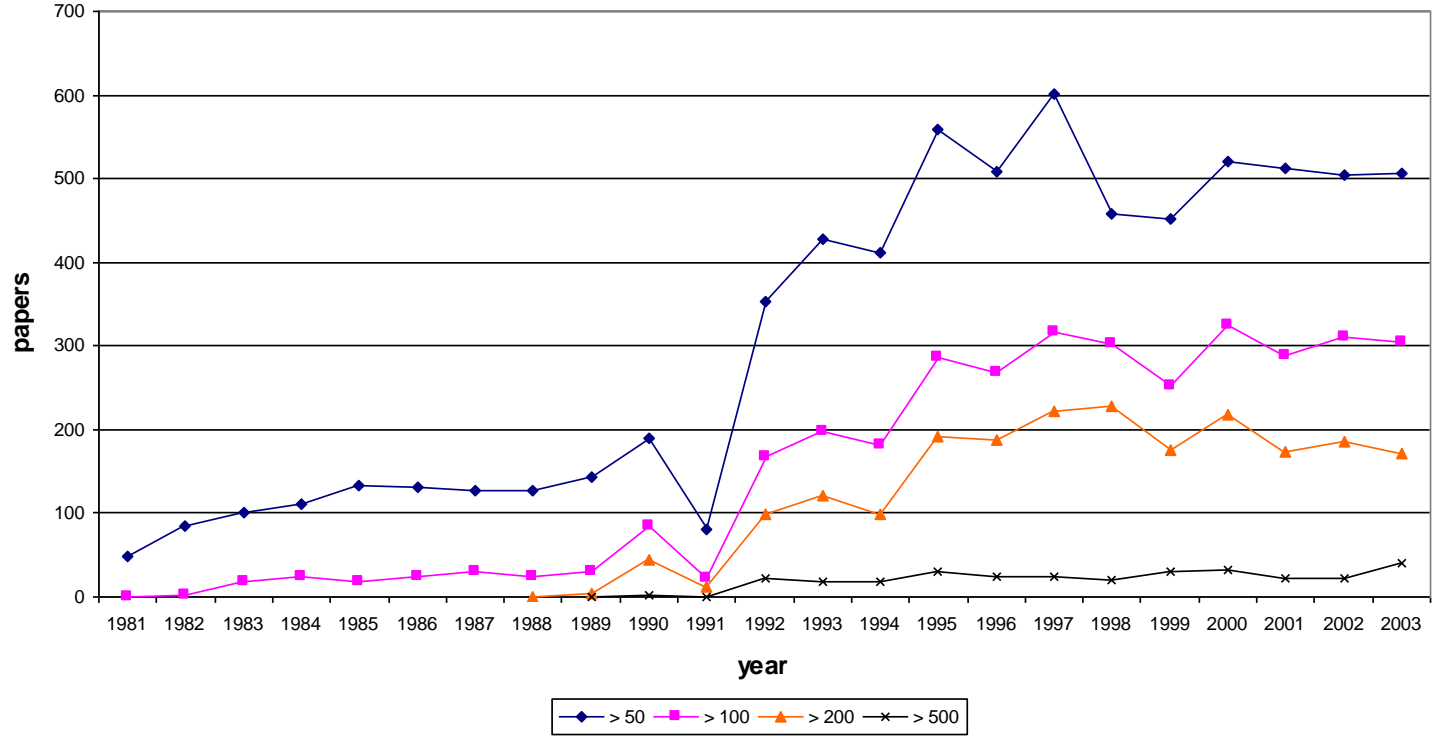
Big Science...Big Bylines

- * Division of labor
- * Returns to specialization
- * Opportunity cost of time



Hyperauthorship: Growth of Massively Multi-authored Papers

(source: ISI)



“How Many Cardiac Surgeons Does it Take to Write a Research Article?”

Modi et al. (2008)

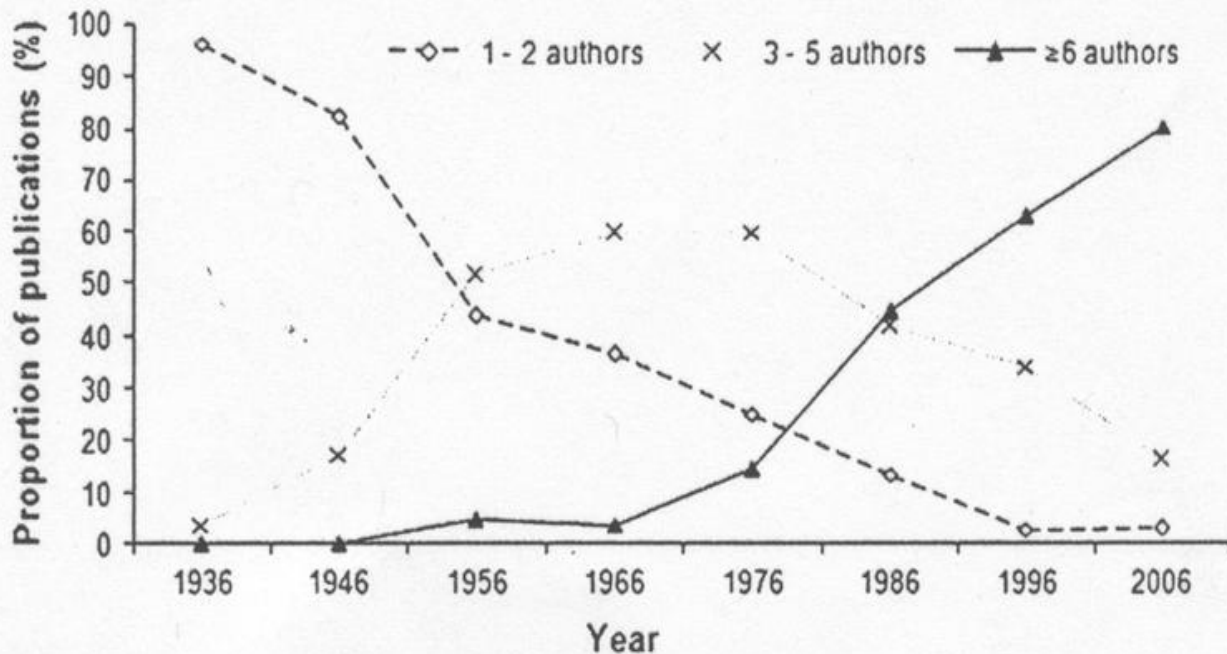
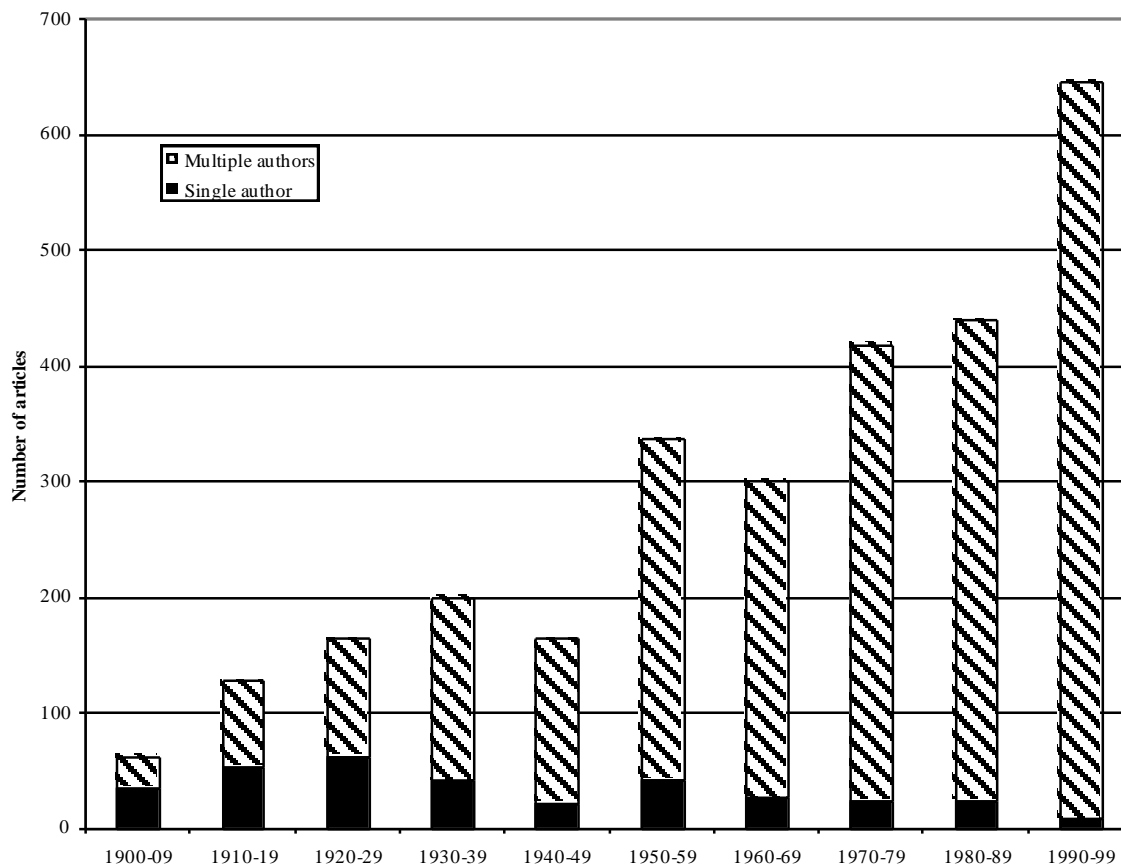
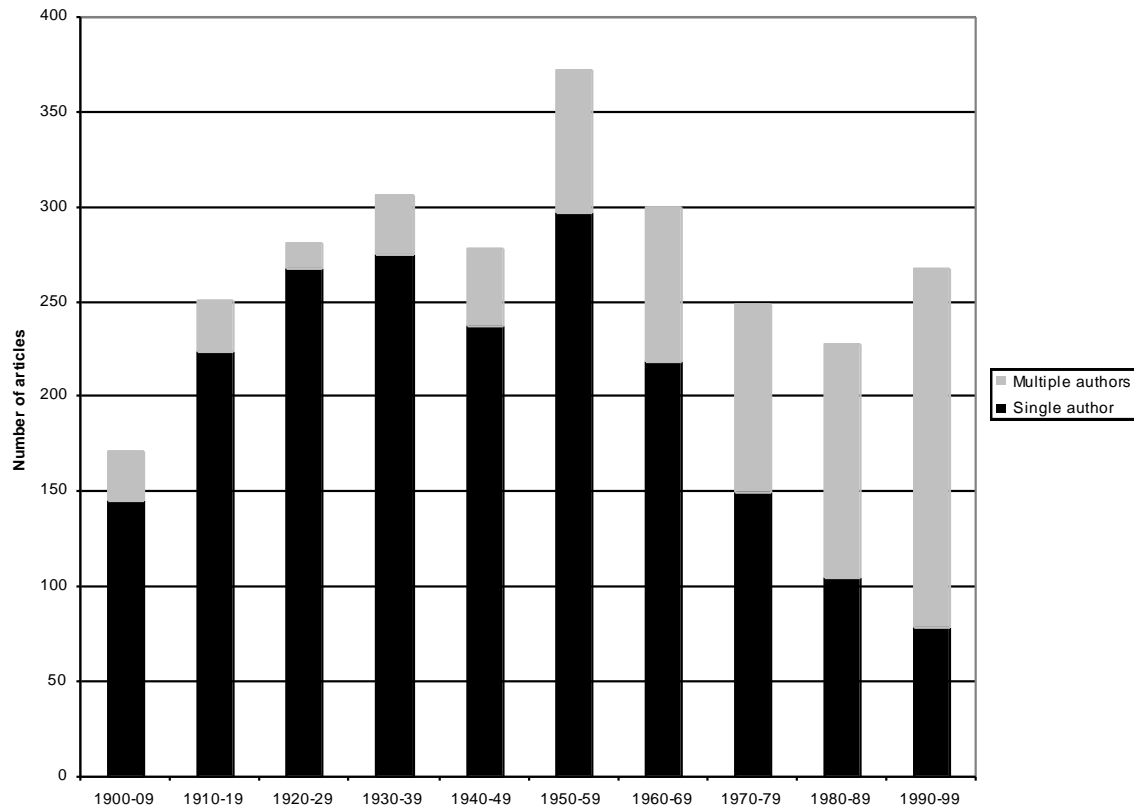


Figure 2. Changing patterns of publications with 1 to 2, 3 to 5, and 6 or more authors with time.

Journal of the American Chemical Society 1900-1999, Single- & Multi-Author Papers



Psychological Review 1900-1999, Single- & Multi-Author Papers



Of Mice & Men, Money & Machines

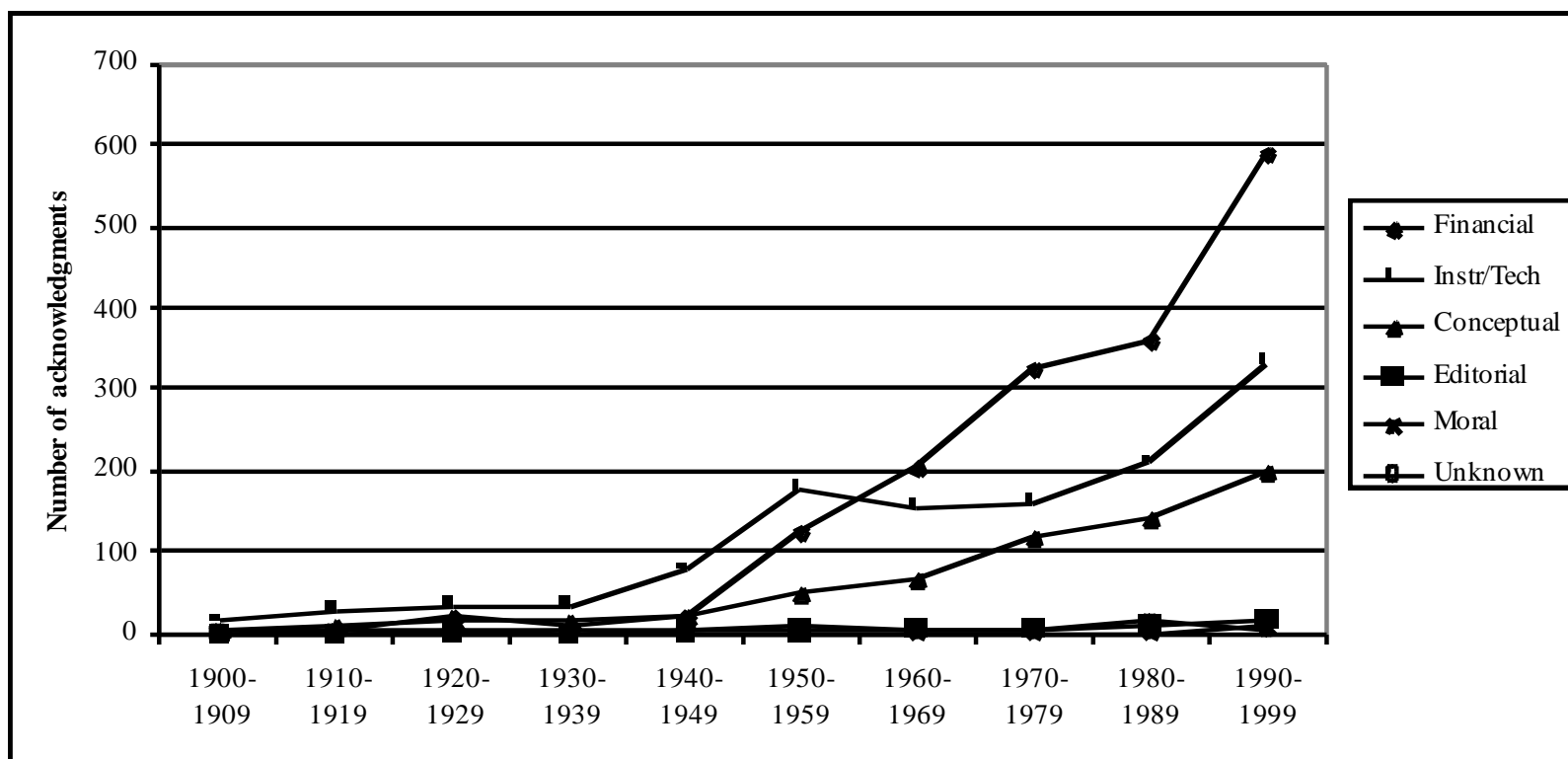
We greatly appreciate the **pioneering work** of S. Gluecksohn-Waelsch **in analyzing liver-specific gene expression in normal and mutant mice** and for stimulating our interest in this system; we also thank her for **providing albino lethal mice**. We are indebted to W.W. Franke, H. Denk, and C. Kuhn for **immunohistochemical analyses of normal and mutant mouse tissues**; E. Schmid for advice in the **nuclear run-on transcription technique**; H. Weiher for **injecting mice**; S. Suhai for **computer analyses**; and A.F. Stewart and E. Schmid for **providing data** prior to publication. We thank W. Landschultz and S.L. McKnight, J.P. Hoeffler and J.F. Habener, G.S. McKnight, S. Morris, S. Manara Shediak, C. Noda, M. Danielsen, G. Ringold, and R. Cortese for **providing plasmid clones**, and R. Leach for **providing the cell lines** 7AD-7 and 7AE-27. We are also grateful for G. Kelsey, A. Nordheim, A.F. Stewart, and U. Strähle for their **critical reading of the manuscript**, and C. Schneider for excellent **secretarial assistance**. This work was **supported by** the Fonds der Chemischen Industrie and the Deutsche Forschungsgemeinschaft (SFB 229 and Leibniz Programm).

RUPPERT, S., BOSCHART, M., BOSCH, X., SCHMID, W., FOURNIER, R.E.K. and SCHÜTZ, G. Two genetically defined *trans*-acting loci coordinately regulate overlapping sets of liver-specific genes. *Cell*, 61(5), 1990, 895-904.

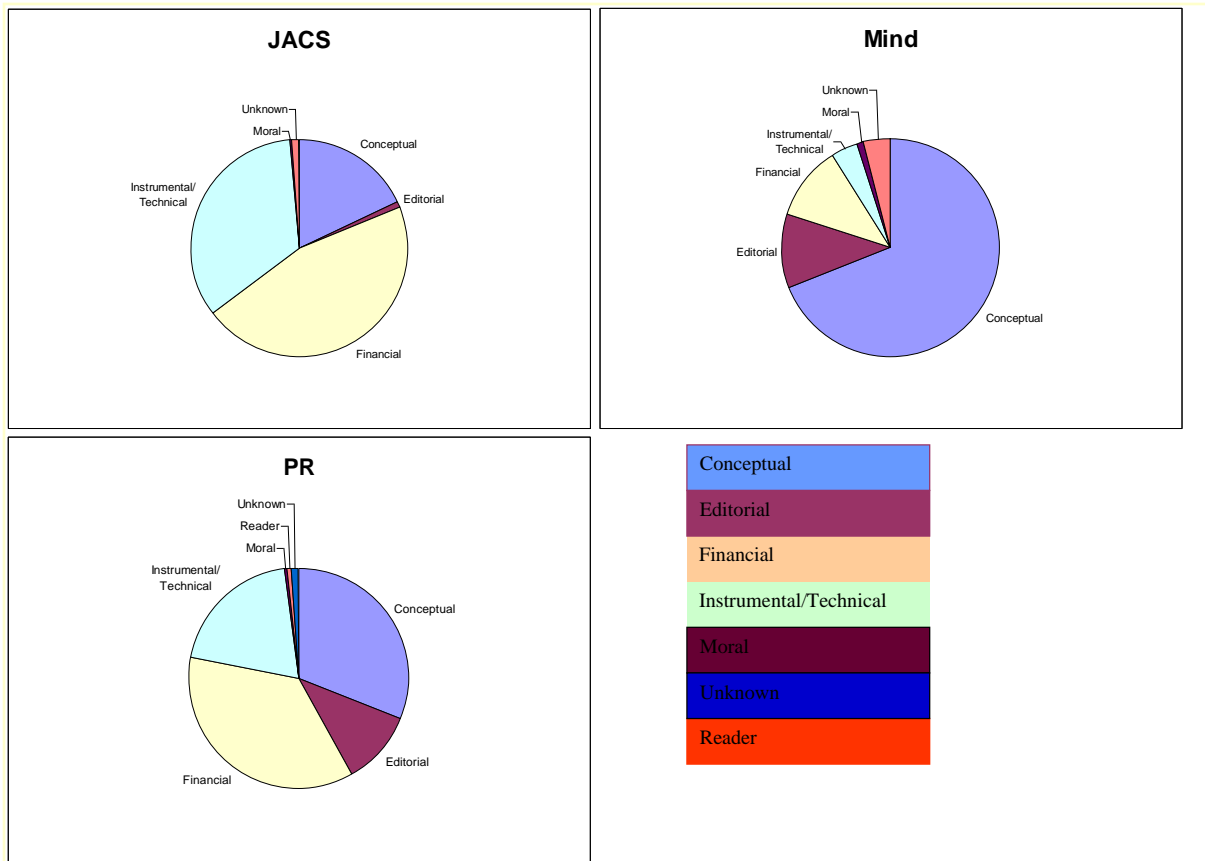
The Socio-materiality of Science

This work was conducted in part in the laboratory of [Eric Wieschaus](#), and we thank him for his generous support. This work was also catalyzed by [Juan Pablo Couso](#), [Alfonso Martinez-Arias](#), and [Eli Knust](#), who shared their insights into *Ser* function in wing formation and generously provided *Drosophila* strains and reagents necessary for this work. We thank [Kathy Vorwerk](#) and [Angela Sebring](#) for the P element transformation of *UAS-fng* and for Figure 4G, respectively; [Julie Gates](#), [Wendy Norris](#), and [Roel Nusse](#) for additional reagents; [John Fallon](#), [Henry Roehl](#), [Seth Blair](#), [Lisa Nagy](#), and [Grace Panganiban](#) for comments on the manuscript; [Steve Paddock](#) for assistance with microscopy and imaging; and [Jamie Wilson](#) for preparing the manuscript. K. D. I. was a Helen Hay Whitney Fellow and is now supported by the New Jersey Commission for Cancer Research. This work was supported by National Institutes of Health grant 5R01-HD22780 to Eric Wieschaus and by the Howard Hughes Medical Institute to S. B. C.

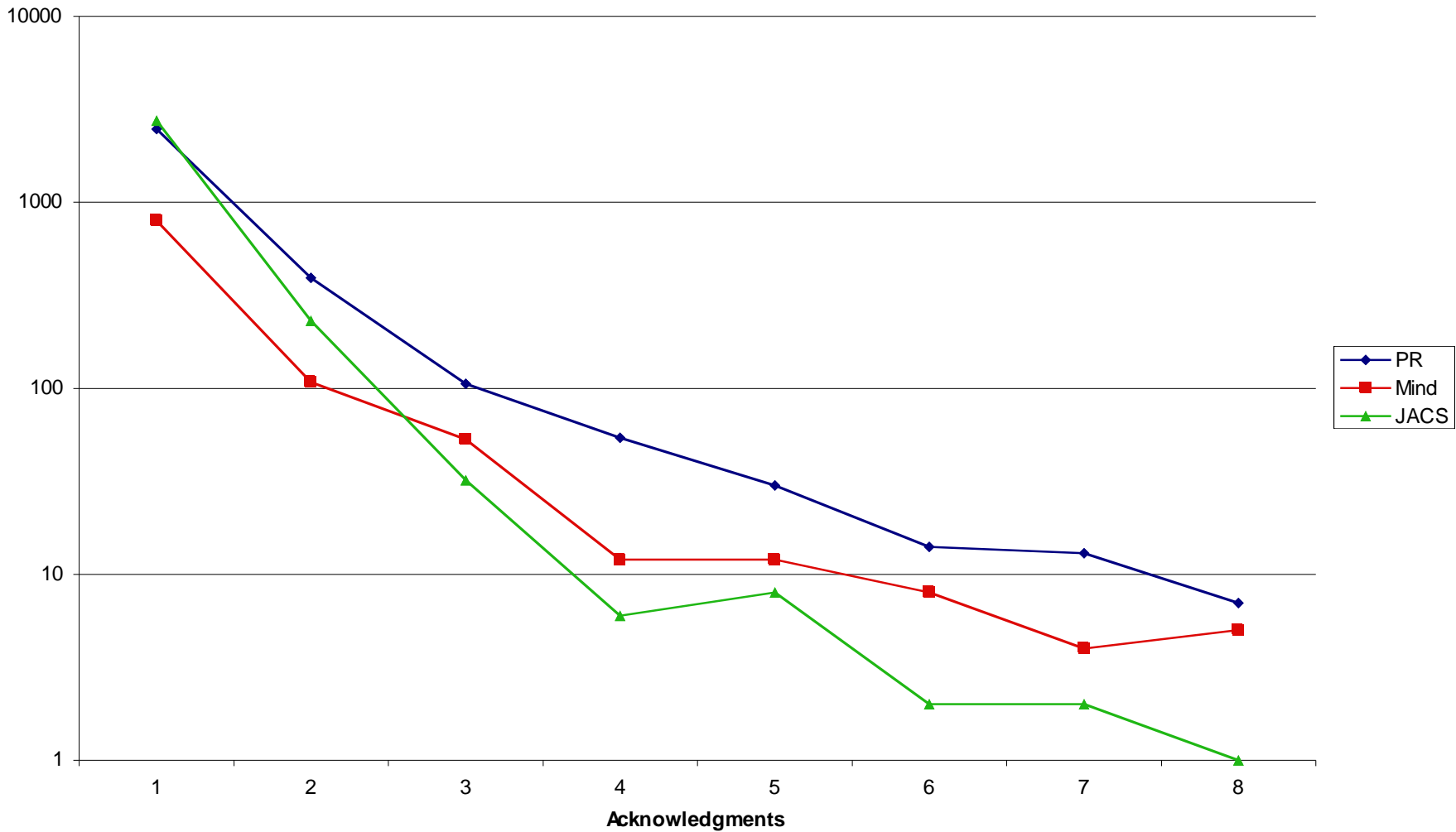
JACS 1900-1999: Acknowledgment Trends



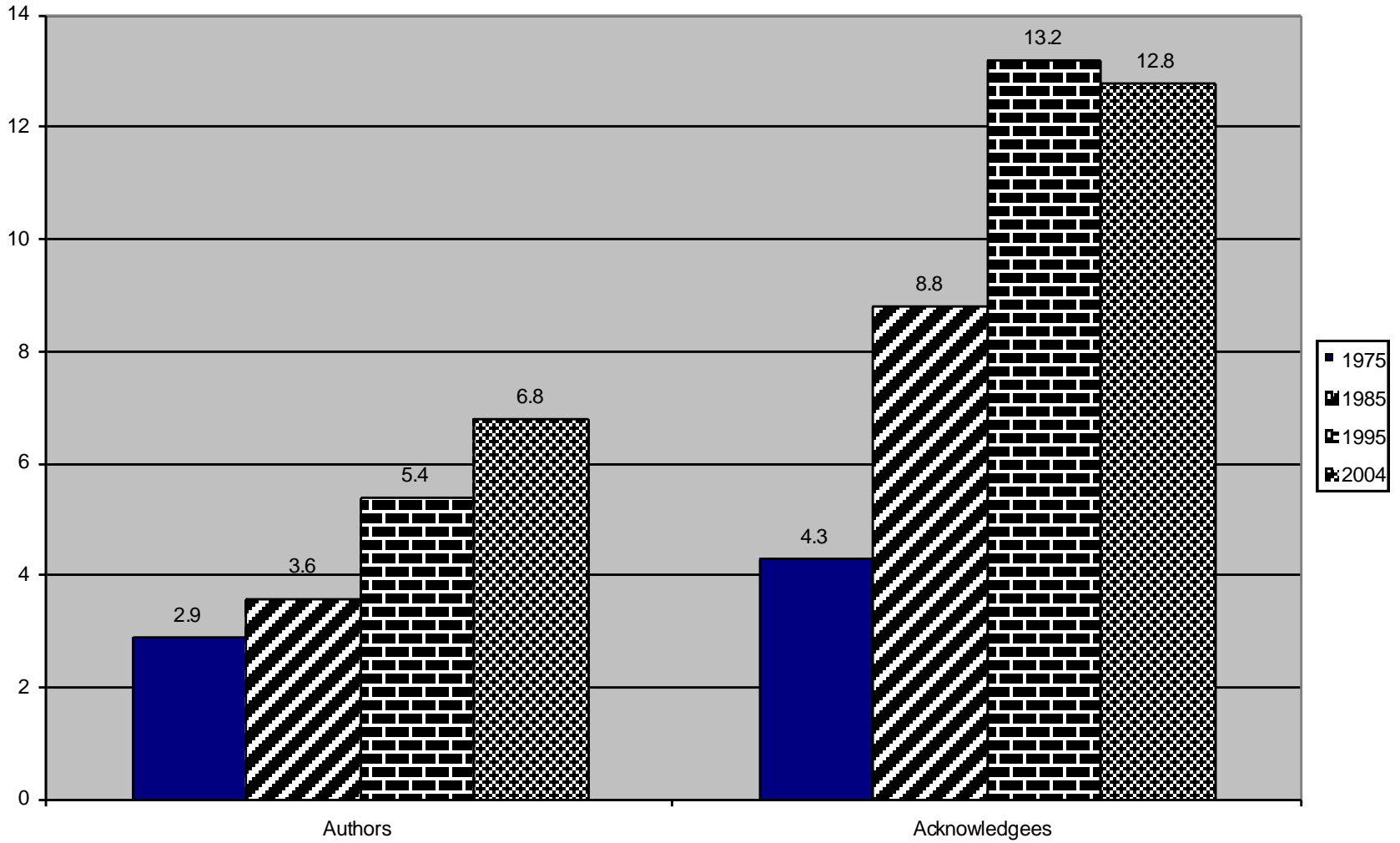
Distribution of Acknowledgments in Three Disciplines



Frequency of Acknowledgments



Average Number of Authors/Acknowledgees



Eminences Grises

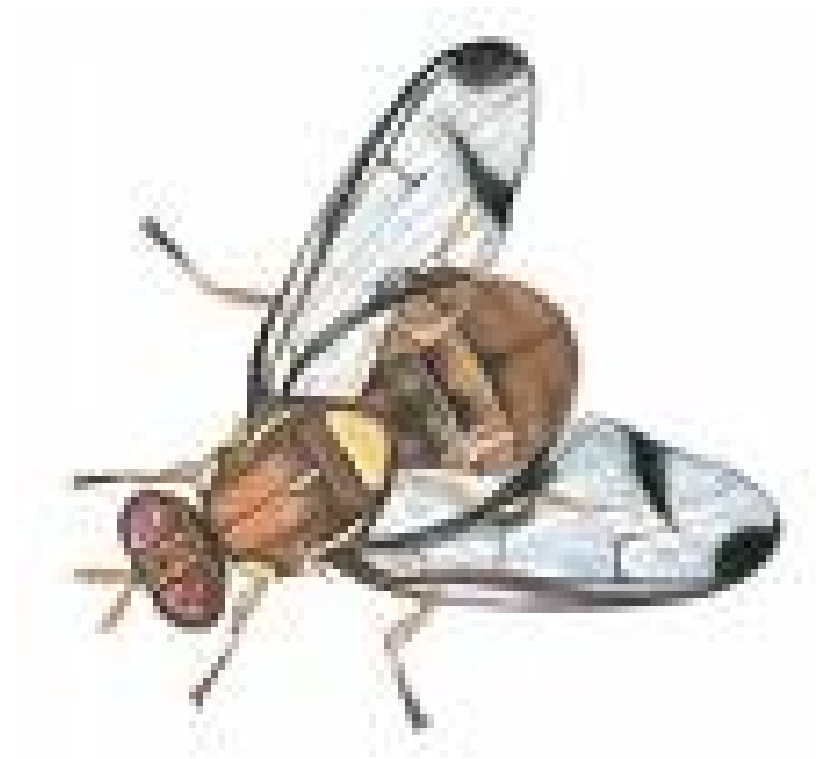
Table 2. Number of citations to the most acknowledged individuals (Giles & Council, 2004)

<u>Author</u>	<u>Acknowledgments</u>	<u>Citations</u>
Oliver Danvy	268	847
Oded Goldreich	259	3,277
Luca Cardelli	247	3,847
Tom Mitchell	226	3,336
Martin Abadi	222	3,507
Phil Wadler	181	3,780
Moshe Vardi	180	3,786
Peter Lee	167	1,790
Avi Wigderson	160	2,566
Matthias Felleisen	154	1,622
Benjamin Pierce	152	1,484
Noga Alon	152	2,640
John Ousterhout	152	3,693
Frank Pfenning	148	1,639
<u>Andrew Appel</u>	<u>144</u>	<u>2,064</u>

Moral economy in *Drosophila* genetics

(see Robert Kohler, 1999)

Sharing of fly stocks
Elaborate exchange system
Reciprocity & disclosure
Equal & open access
Communal work ethic
Mutual aid & civility



A Common Pool Resource

Sharing of information, know-how, and wisdom among researchers and groups who are working in biology & biological engineering.

<http://openwetware.org/>



OpenWetWare
Lab Notebooks

New features include:

- Dynamic calendars**
Create or view entries with a click
- Local search**
Search within your lab notebook
- Improved navigation**
Jump between entries with ease

New!
One-click setup

The advertisement features a central graphic of a white notebook with a blue DNA double helix on its cover and a yellow pencil resting on top. A yellow circular badge with the text 'New! One-click setup' is positioned at the bottom left of the graphic area.

Citizen Science

Christmas Bird Count

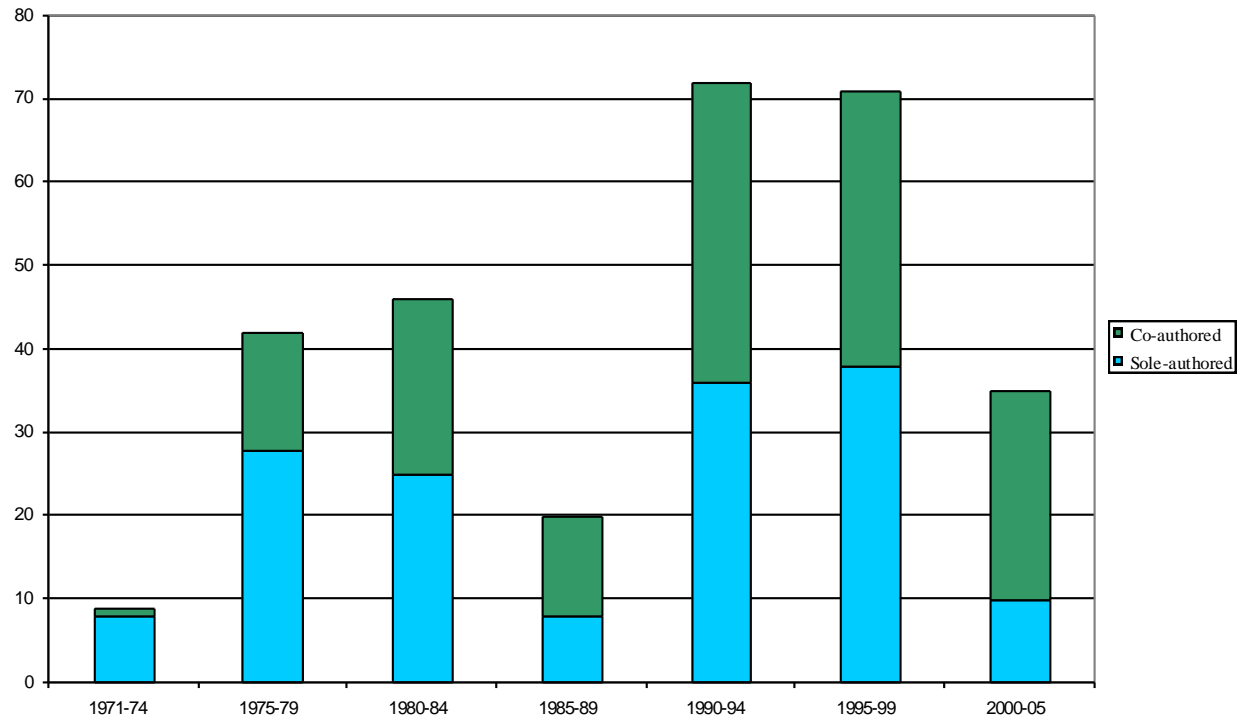
"Count Circles," which focus on specific geographical areas. Each circle is led by a Count Compiler.



Rob Kling 1971-2005



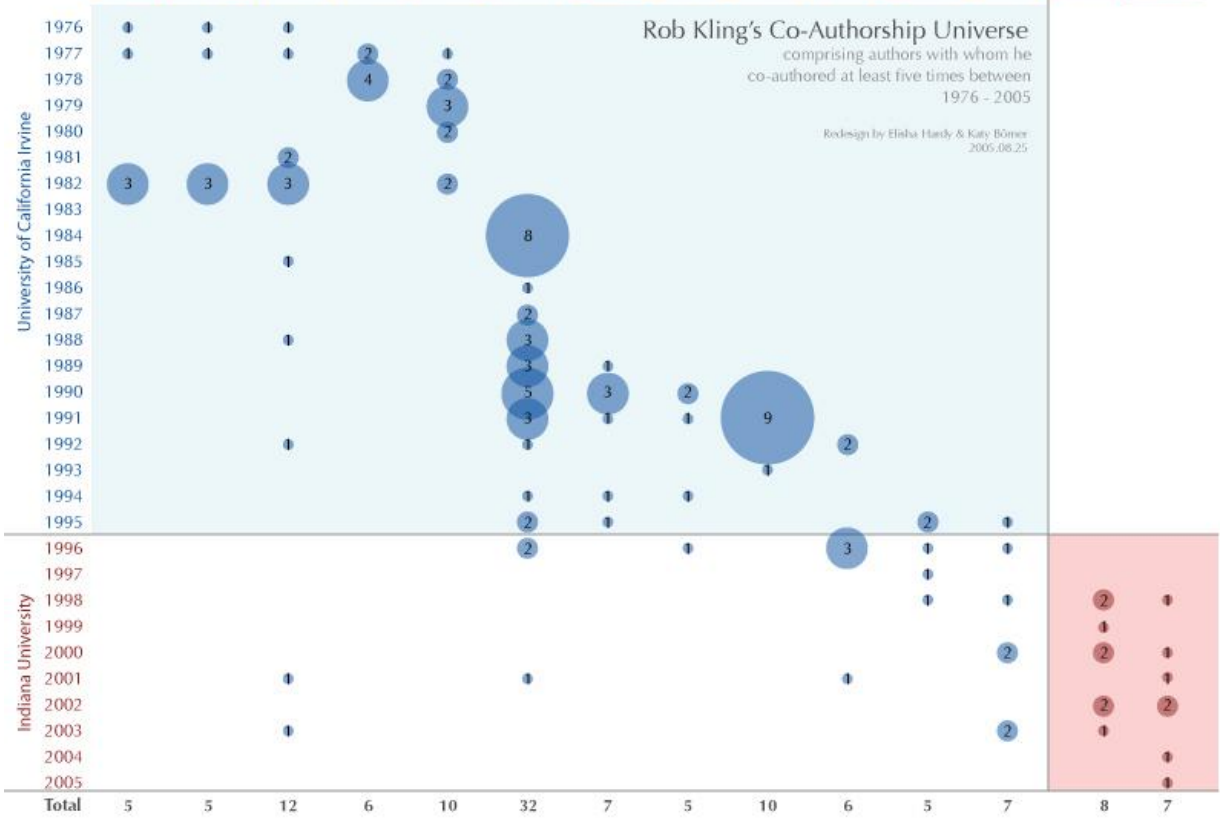
RK's Single/Multiple Authorship



Let the Credits Roll

“This paper builds on ideas which I've developed over the last decade. But they have been deepened by some recent events, such as the *CTF* report. They were also sharpened through a lecture and followon discussion with colleagues at the University of Toronto, including **Ron Baeker**, **Andy Clement**, **Kelley Gottlieb**, and **Marilyn Mantei**. **Rick Weingarten** suggested that I write a brief position paper reflecting those ideas. At key points, **Peter Denning** and **Peter Neumann** provided helpful encouragement and sage advice. I also appreciate the efforts of numerous other friends and colleagues to help strengthen this paper through their comments and critical assistance. The paper is immeasurably stronger because of the prompt questions and suggestions that I received in response to an evolving manuscript from the following people: **Mark Ackerman**, **Jonathan P. Allen**, **Bob Anderson**, **Lisa Covi**, **Brad Cox**, **Gordon Davis**, **Phillip Fites**, **Simson Garfinkel**, **Les Gasser**, **Sy Goodman**, **Beki Grinter**, **Jonathan Grudin**, **Pertti Jarvinen**, **John King**, **Heinz Klein**, **Trond Knudsen**, **Kenneth Kraemer**, **Sharyn Ladner**, **Nancy Leveson**, **Lars Matthiesen**, **Colin Potts**, **Paul Resnick**, **Larry Rosenberg**, **Tim Standish**, **John Tillquist**, **Carson Woo** and **Bill Wulf**.”

Rob Kling. Organizational analysis in computer science. *TIS*, 1993.



RK's Citation Identity, 1972-2005 (N=11,333)

<u>Top-20 Names</u>	<u>Times Referenced</u>
Kling, R.	1315
Kraemer, K.L.	239
Iacono, S.	220
Dutton, W.H.	126
King, J.L.	117
Danziger, J.	109
Laudon, K.C.	102
Scacchi, W.	99
Simon, H.A.	77
Rule, J.	76
Gerson, E.	75
Markus, M.L.	63
Attewell, P.	56
Lucas, H.C.	53
Mowshowitz, A.	53
Jewett, T.	52
Orlikowski, W.J.	52
Dunlop, C.	50
Sterling, T.	50
Strauss, A.	50

RK's Top-20 Acknowledged Entities by Decade

1972-84

NSF
 Kraemer, K.L.
 Gerson, E.M.
 Dutton, W.H.
 Gasser, L.
 Danziger, J.
 King, J.L.
 Rittenhouse, R.
 Armer, P.
 Freeman, P.
 Galler, B.
 Hoffman, L.
 Iacono, S.
 McCracken, D.
 Rule, J.
 Ashenhurst, R.
 Becker, H. S.
 Crabtree, P.
 Dewey, R.
 Fagin, H.
 and 16 more

1985-1994

13 NSF
 11 Allen, J.P.
 10 King, J.L.
 9 Poster, M.
 8 Zmuidzinas, M.
 7 Attewell, P.
 6 Iacono, S.
 4 Beuschel, W.
 3 Brennan, J.
 3 Kraemer, K.L.
 3 Laudon, K.
 3 Lepore, S.
 3 Wieckert, K.
 3 Dowdy, L.
 3 Grudin, J.
 2 Star, L
 2 George, J
 2 Jewett, T.
 2 Kaiser, K
 2 Covi, L.
 and 4 more

1995-2005

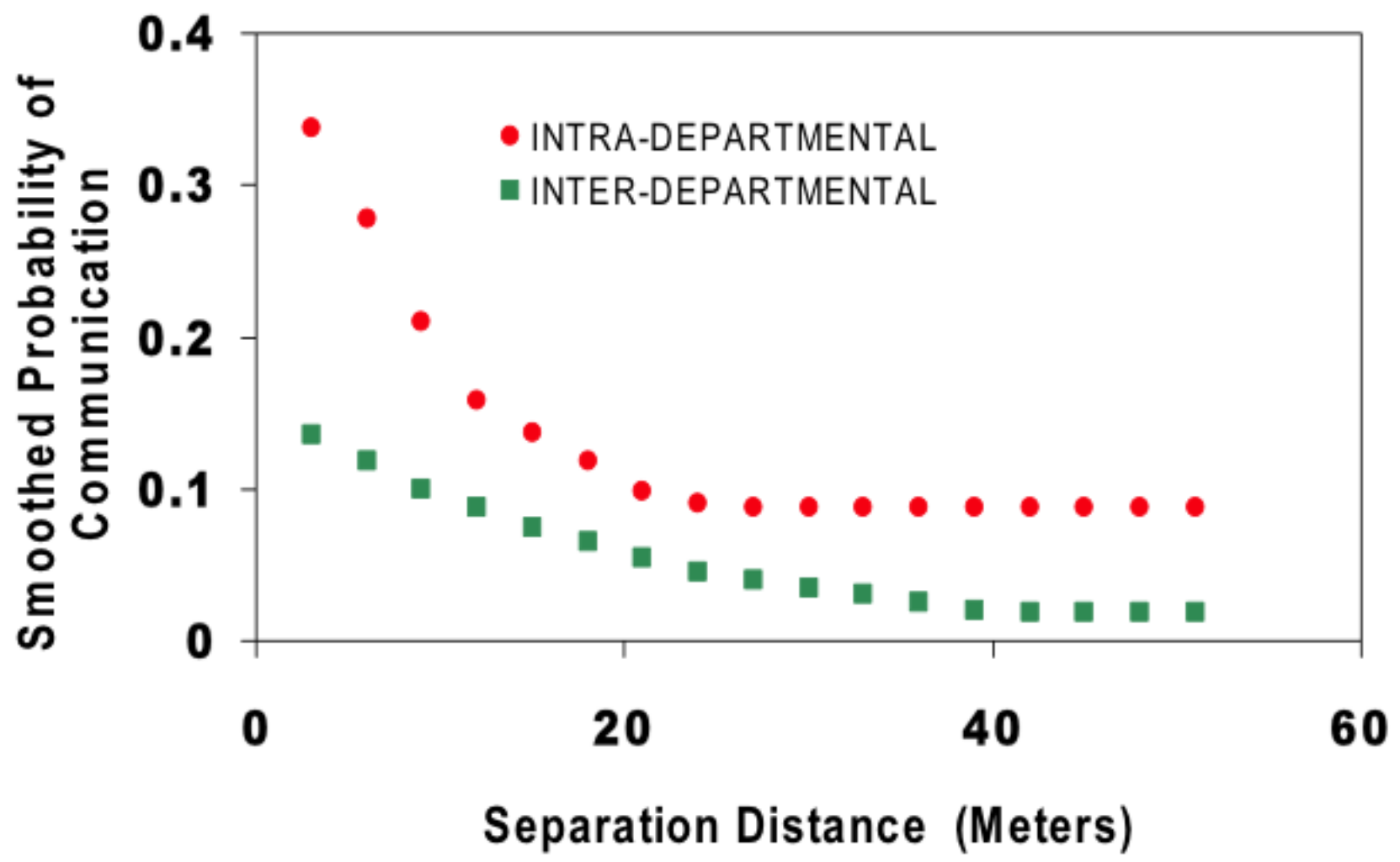
21 Agre, P. 10
 12 Poster, M. 8
 8 Cronin, B. 7
 8 Iacono, S. 6
 8 Lewison, M. 6
 7 NSF 6
 7 Fortuna, J. 5
 6 Grudin, J. 5
 6 Lamb, R. 5
 6 Crawford, H. 4
 6 Davenport, E. 4
 6 Elliott, M. 3
 6 Friedlander, A. 3
 5 McKim, G. 3
 5 Ross, S. 3
 5 Sawyer, S. 3
 4 Ackerman, M. 2
 4 Allen, J.P. 2
 4 Arms, B. 2
 3 Beuschel, W. 2
 and 20 more

Cronin Ōso-authorship* universe, 1982-2008

	Vickers	Martyn Arenas	Vila-Belda	Gudim	Tudor-Silovic	Davenport	McKenzie	Weaver	Overfelt	Rosenbaum	Snyder	Shaw	Crawford	Atkins	McKim	LaBarre	Meho	
1982	1																	
1983	2	1																
1984		2																
1985			2															
1986				1			1											
1987				2			4											
1988		1					7											
1989		3			1		2											
1990		1			1		5											
1991					1		5											
1992					1			2	1									
1993						1	2	2		1								
1994			1			1			4	1								
1995						1		1			1							
1996						2		2		1					3			
1997						1				1	1			1	1			
1998						1				1	1		1					
1999						1						1	3	1				
2000						3						1		1				
2001						3												
2002												2						
2003												1				1		
2004												1				2		
2005																1		
2006																	1	
2007												1					1	
2008																	1	
<i>Total</i>	3	3	5	3	3	4	38	4	4	7	5	3	7	4	3	4	4	3



Intradepartmental and Interdepartmental Communication and Physical Separation



Kling's World

- Core set of 'trusted assessors'
- Intense 'cognitive partnerships'
- Nuclear group of 'recitees'
- 'Glocalization'
- Reach and rootedness
- Pedestrian interaction and hyper-networking

Evolving Economy of Authorship

Diverse forms of contributorship, influence and impact



Many digital footprints, thumbprints...

