Progress in learning theory through distributed collaboration

Andy J. Wills
Plymouth University

Formal learning theory is failing to live up to its full potential due to a lack of effective collaboration.

A formal model unambiguously specifies transformations from independent variables to dependent variables.

Wills & Pothos (2012)

Forward cue competition

Phase 1	Phase 2	Test
A+	AX+	X
B-	BY+	Y

A few formal learning thoeries

- Konorski (1948), Hebb (1949)
- Bush & Mosteller (1953)
- Rescorla & Wagner (1972), Mackintosh (1975)
- Pearce & Hall (1980), Wagner (1981), Pearce (1987), McLaren et al. (1989)
- Dickinson & Burke (1996), Schamjuk (1997)
- Kruschke (2001, 2006), Le Pelley (2004), Wagner (2008)
- Pearce & Mackintosh (2010), Esber & Haselgrove (2011)

Formal models allow unambiguous comparison of the relative adequacy of theories.

Little progress so far … because the comparisons have been too narrow.

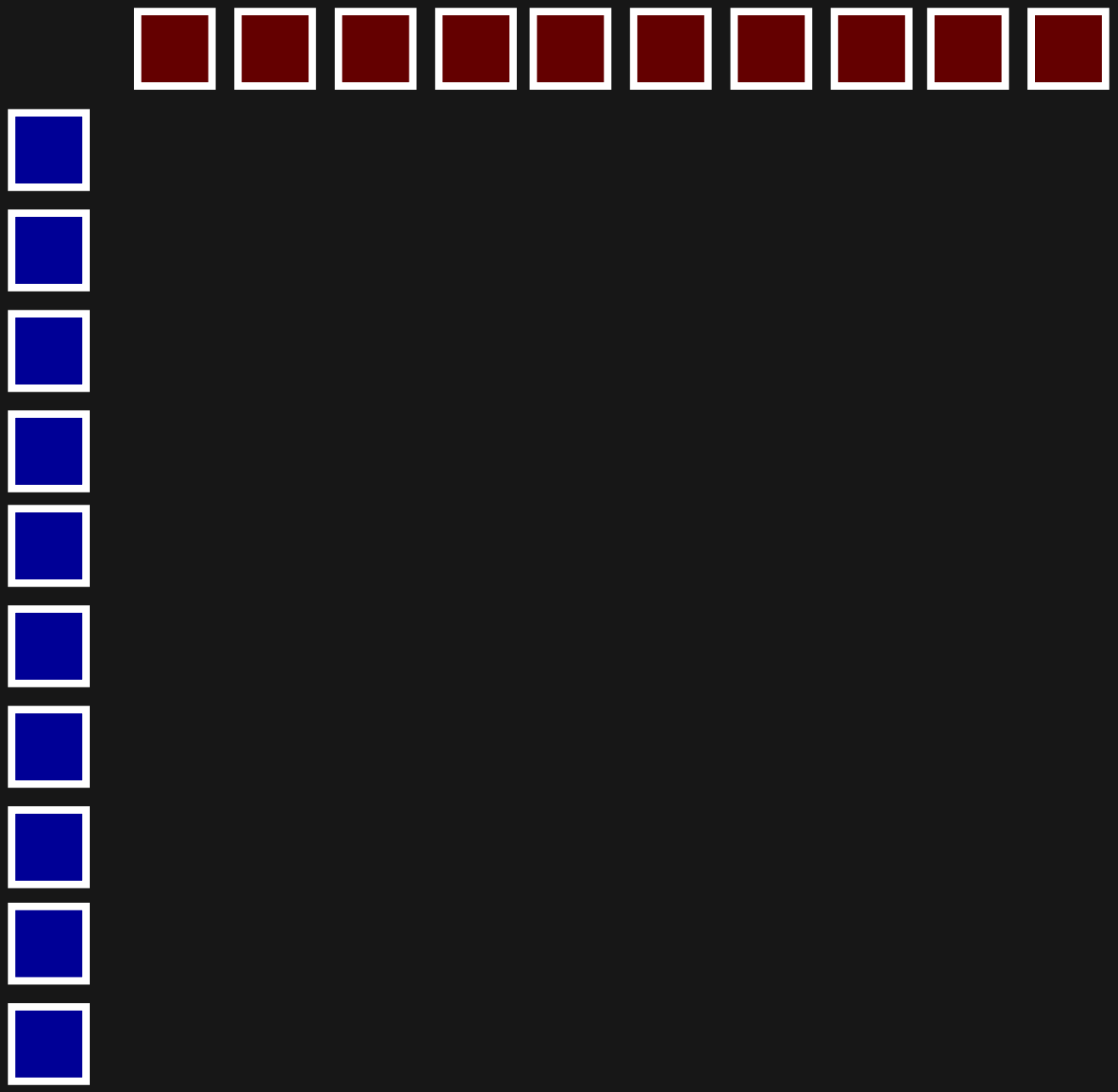
Wills & Pothos (2012)

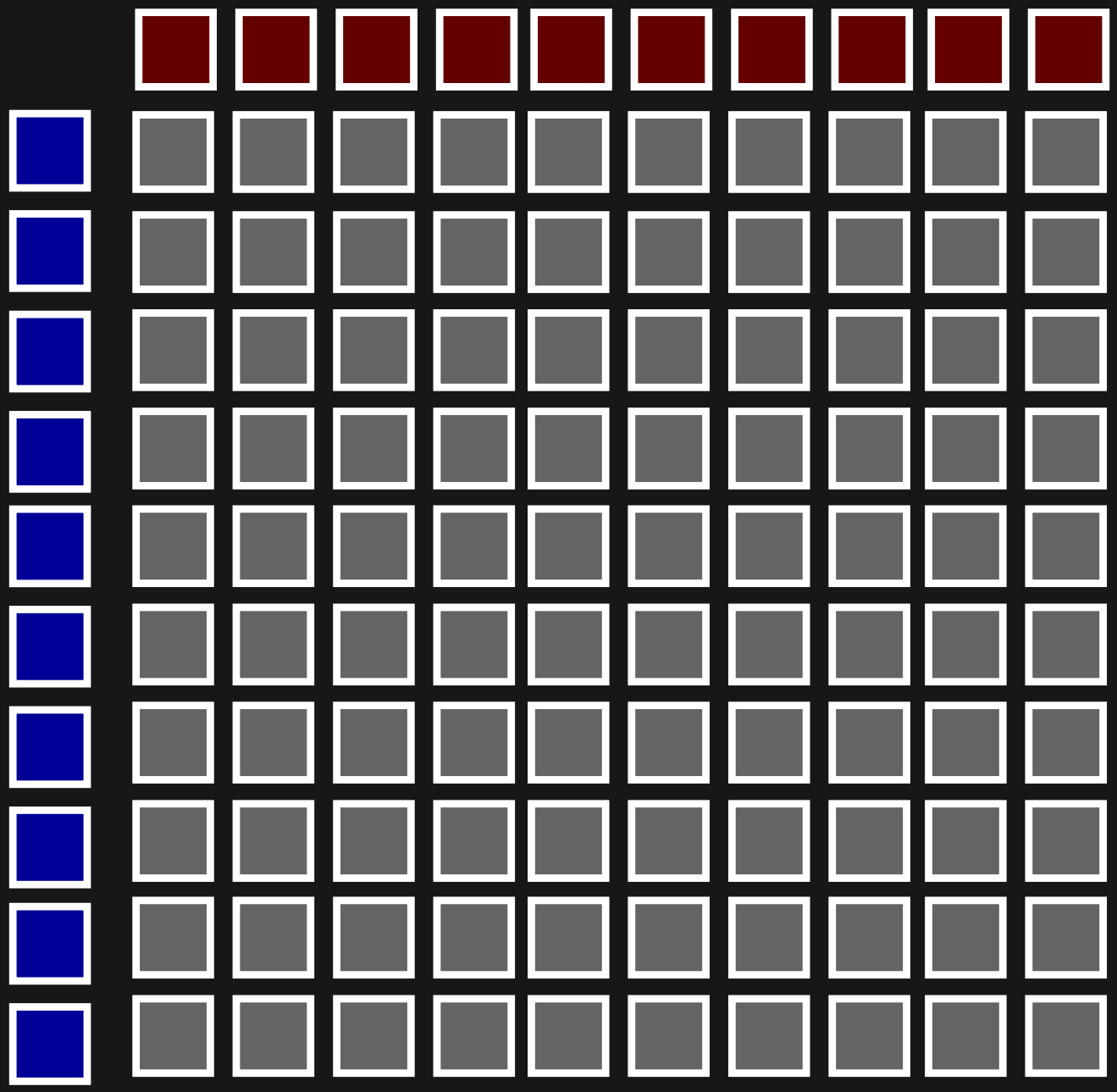
Compare models across a much broader set of phenomena (Wills & Pothos, 2012).

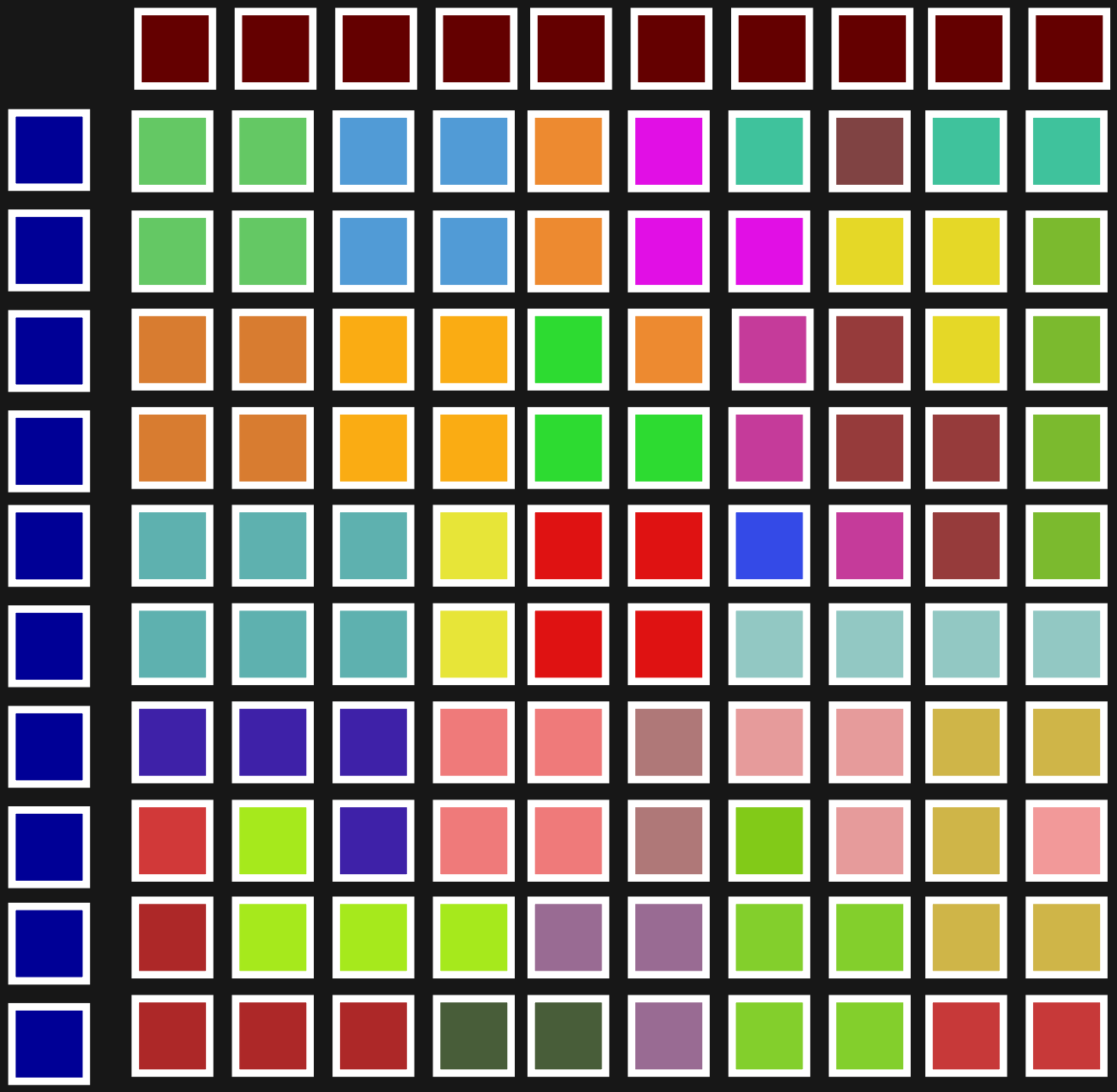
Unachievable by any individual or small group.

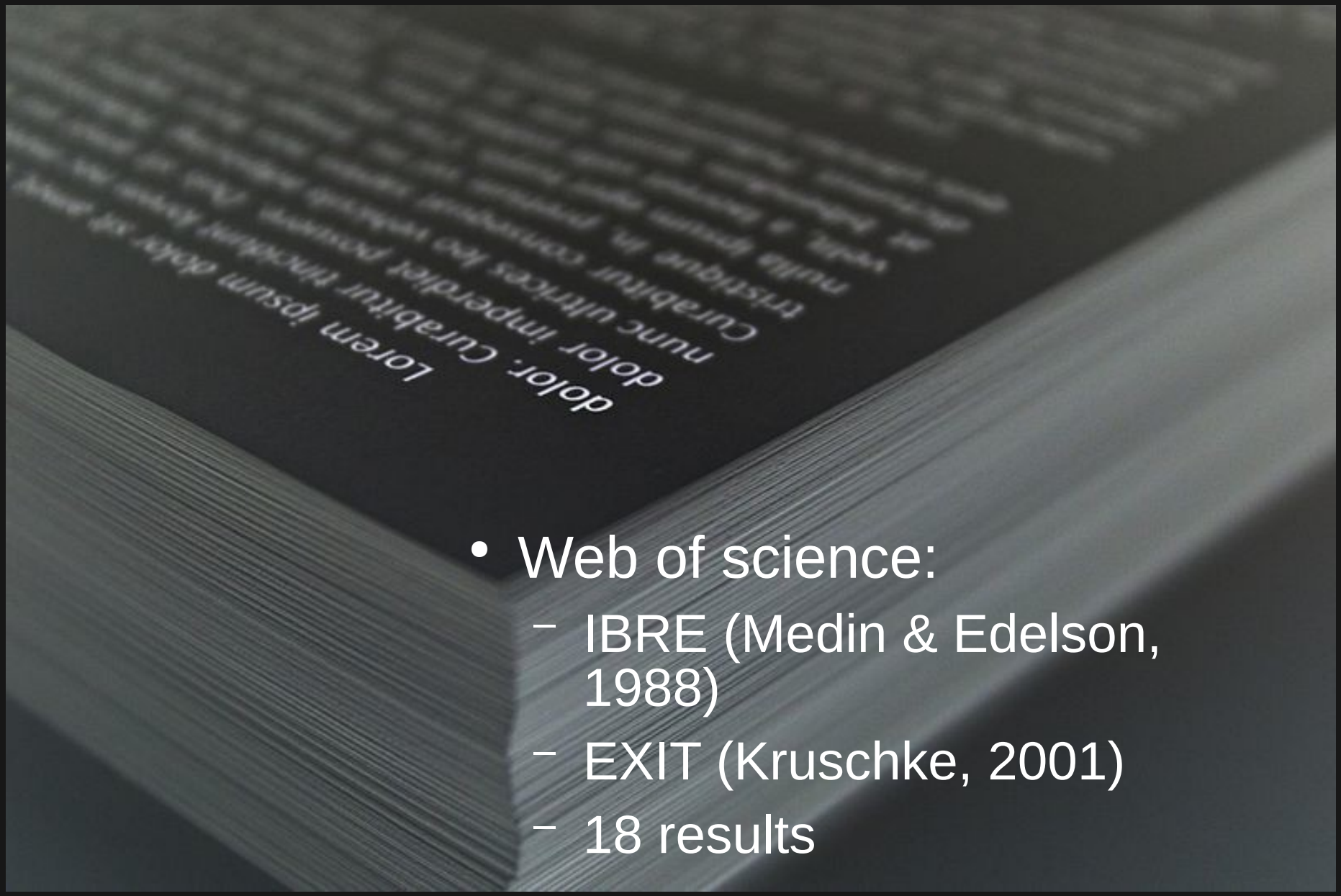
Framework for efficient distributed collaboration has been lacking.

	R-W (1972)	Pearce (1987)	EXIT	...	...
D & B (1996)	0	0	NT	.	.
M & E (1988)	0	0	1	.	.
...	.	.	.	.	.
...	.	.	.	.	.









- Web of science:
  - IBRE (Medin & Edelson, 1988)
  - EXIT (Kruschke, 2001)
  - 18 results

Canonical **I**ndependently **R**eplicated **P**henomenon

Modelling non-real results:

- wastes time.
- distorts relative adequacy assessments.

Restrict relative adequacy comparisons to independently replicated phenomena.

Attempts to replicate are rare, and often unsuccessful.

Maes et al. (2016). The elusive nature of the blocking effect: 15 failures to replicate. *JEP: Gen.*

“The full set of all the blocking experiments in rodents that any of the authors of the current paper have ever executed ... consists of the experiments reported here plus the experiments reported by Beckers et al. (2006) and Wheeler et al. (2008). If we repeat the Bayesian meta-analysis ... now including the 11 blocking effects contained in those earlier reports ... we obtain a BF > 100, which clearly indicates that blocking is a real phenomenon” (p. 37).

What counts as a replication?

- As close to direct as the literature will allow.
- Ordinal success.
- Boundary conditions.

CIRP separate empirical phenomena from interpretations.

Model implementations are often not publicly available.

This leads to a substantial waste of effort … but **catlearn** is beginning to change this.

ALCOVE, COVIS, DIVA, Rescorla-Wagner

catlearn

http://catlearn.r-forge.r-project.org/

Framework for distributed collaboration in the formal modelling of psychological processes.

General Public License

Why R?

- non-linear optimization
- familiar environment
- easy to learn
- integrated documentation

Slow?

- often instantaneous
- Model implementations can be compiled for speed (e.g. C++, FORTRAN)

catlearn

http://catlearn.r-forge.r-project.org/

catlearn is a documented open archive of

- Model implementations (as stateful list processors)
- CIRP
- Simulations

Efficient progress in the formal modelling of learning requires a technical framework for distributed collaboration.

catlearn provides a free and open-source framework.

Collaboration and cultural change.

Acknowledgements

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Further reading

Wills, A.J., O'Connell, G., Edmunds, C.E.R., & Inkster, A.B. (2017). Progress in modeling through distributed collaboration: Concepts, tools, and category-learning examples. *Psychology of Learning and Motivation.*

Coming in Oct 2017: **catlearn** v. 0.5. ATRIUM, Bush-Mosteller, MB/MF, and much more!

Installation instructions: http://catlearn.r-forge.r-project.org/