Switch cost:
A failed measure of executive control

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The paradigm

Do A   *AAAAAA*   Do B   *BBBBB*   Switch run

Do A   *AAAAAA*   Do A   *AAAAAA*   Stay run
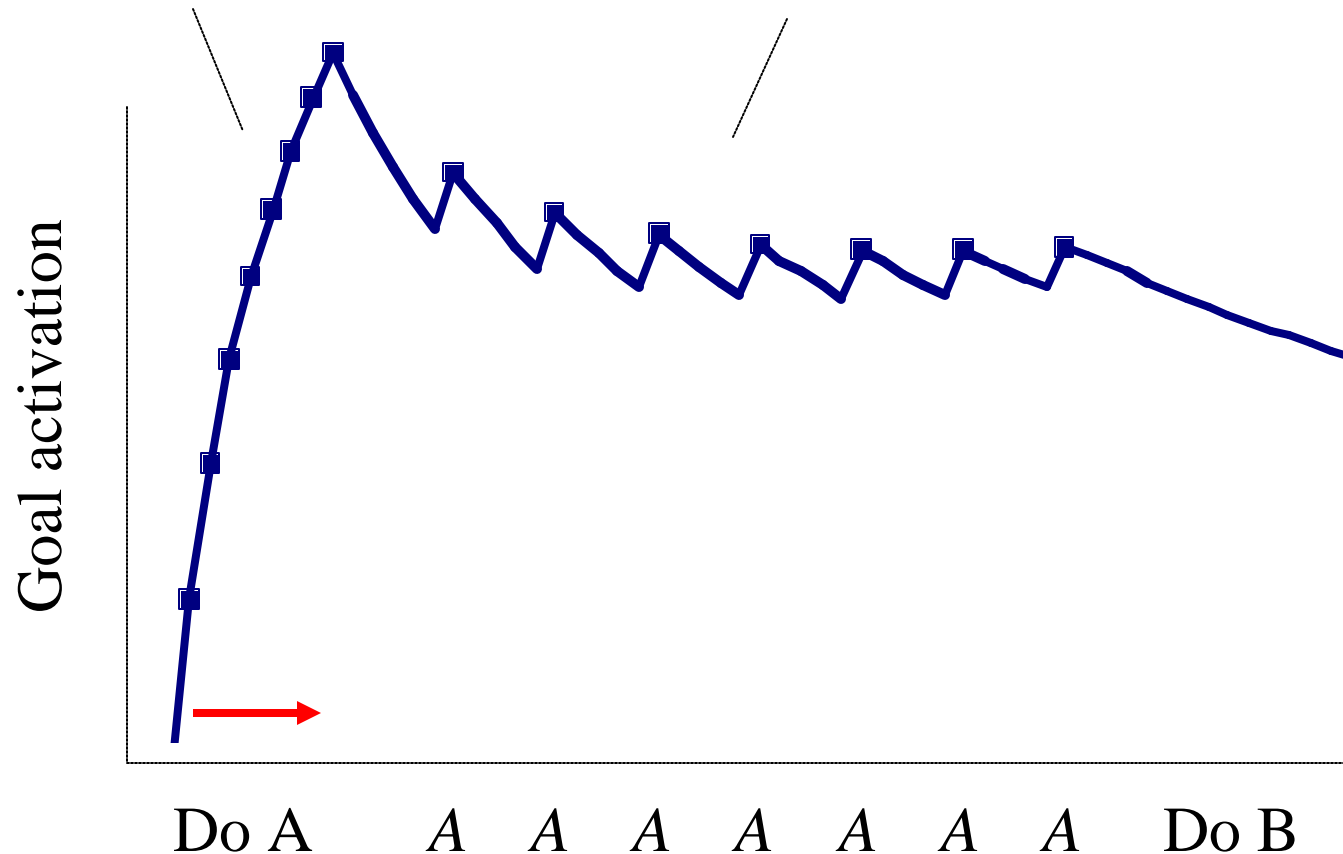
Activation model of executive control

- For each new instructional cue, the system encodes a new goal chunk
- On each trial, the system retrieves a goal chunk for guidance
- Therefore, the most recent goal chunk better be the most active
- "Encoding" is an activation build-up process
  - Massed goal creations (every ~100 msec)

Activation model of executive control

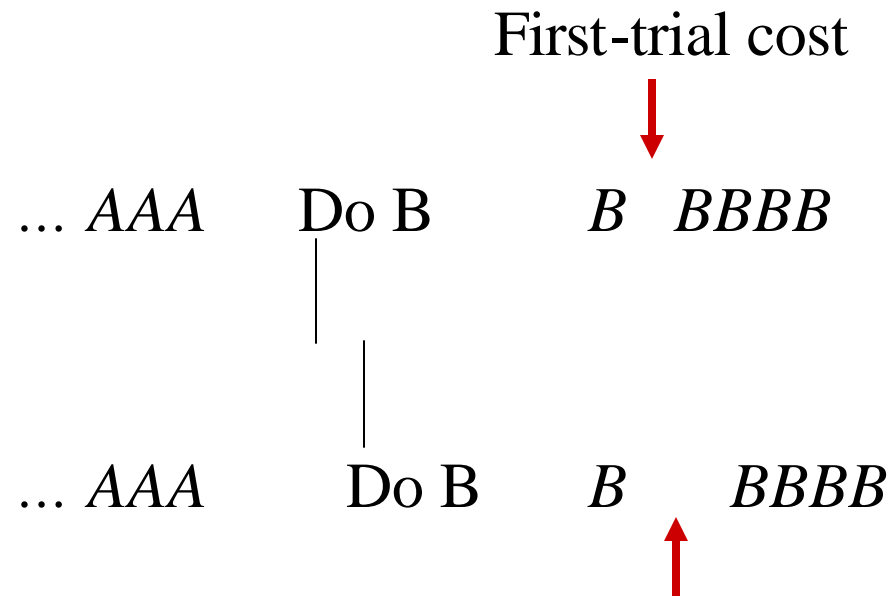Prediction: Activation buildup (in response to "Do A") takes time
Prediction: Switch vs. stay is irrelevant to executive control

Manipulating preparation time

First-trial cost

... AAA   Do B   *B   BBBB*

... AAA   Do B   *B   BBBB*

Reducing preparation time should increase first-trial cost

First-trial cost
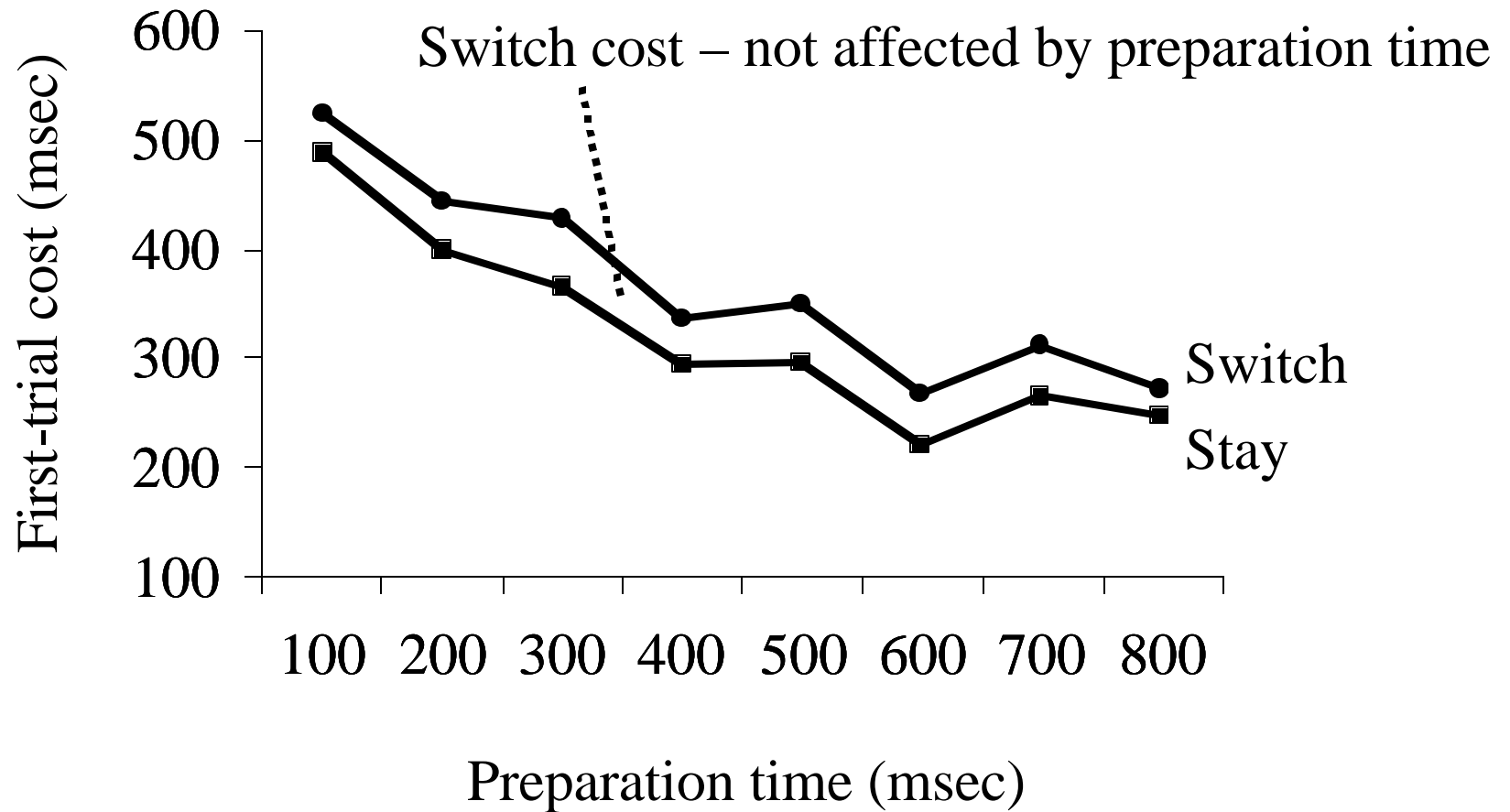
Many studies report otherwise

Study author(s)	Exper-iment	Start cost reported, not switch cost	Preparation manipulated within[a]	Dissipation-preparation confound	Pre-cued task sequences
De Jong (2000)	1, 2	*	*	*	
De Jong et al. (1999)	2	*	*	*	
Fagot (1994)	3	*	*		
Garavan (1998)	2		*		
Goschke (2000)	1		+	*	*
Ivry & Hazeltine (2000)	1, 2		*	*	*
Koch (2001)	4		*		
Kramer et al. (1999)	2, 3	*			
Kray & Lindenberger (2000)	1	*			
Mayr & Keele (2000)	4		*	*	
Meiran (1996)	1, 4, 5		*	*	
Meiran (1996)	2, 3		*		
Meiran (2000a)	1, 2		*	*	
Meiran (2000b)	1		*	*	
Meiran et al. (2000)	2, 3, 4		*		
Rogers & Monsell (1995)	3	*	*	*	
Sohn & Anderson (2001)	1, 2		+		*
Tornay & Milan (2001)	1, 2		+	*	

Note: [a] – "within" = within participants, with "*" = randomized and "+" = blocked.

Implications
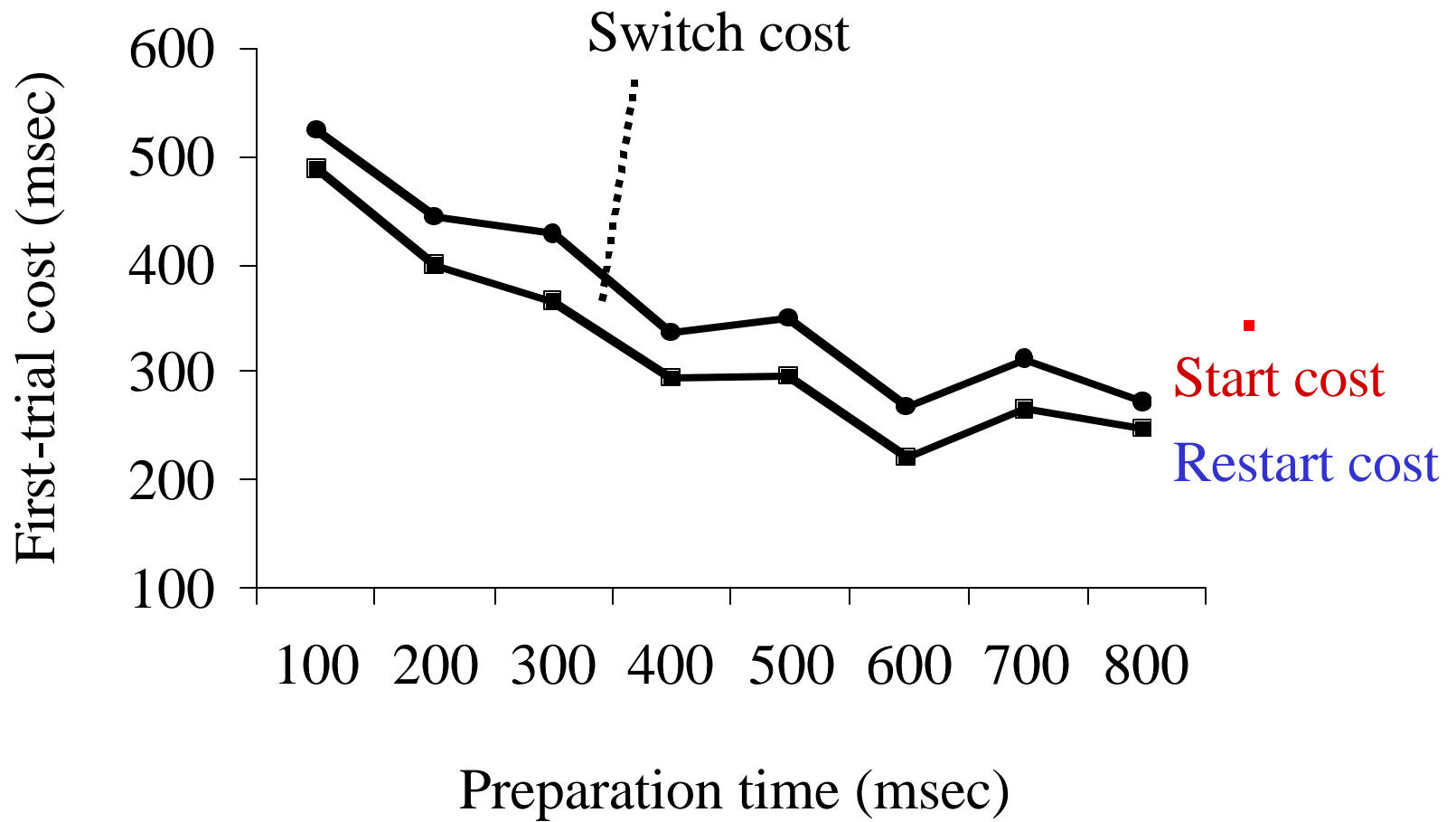
… for the alternating-runs paradigm

schematically:

*AAAABBBBAAAABBBB*

empirically:

A AAAB BBBA AAAB BBB

Start cost

Start cost = residual preparation + switch cost (+ other overheads?)

- Start cost is a confounded measure
- And it's all you get from alternating runs!
  - Alternating-runs studies are uninterpretable
  - So is the model by Gilbert and Shallice (2002)

Activation model of perseveration

$\ln\left[\dfrac{n}{\sqrt{T}}\right]$

Goal activation

60 trials, retrieving the same goal chunk
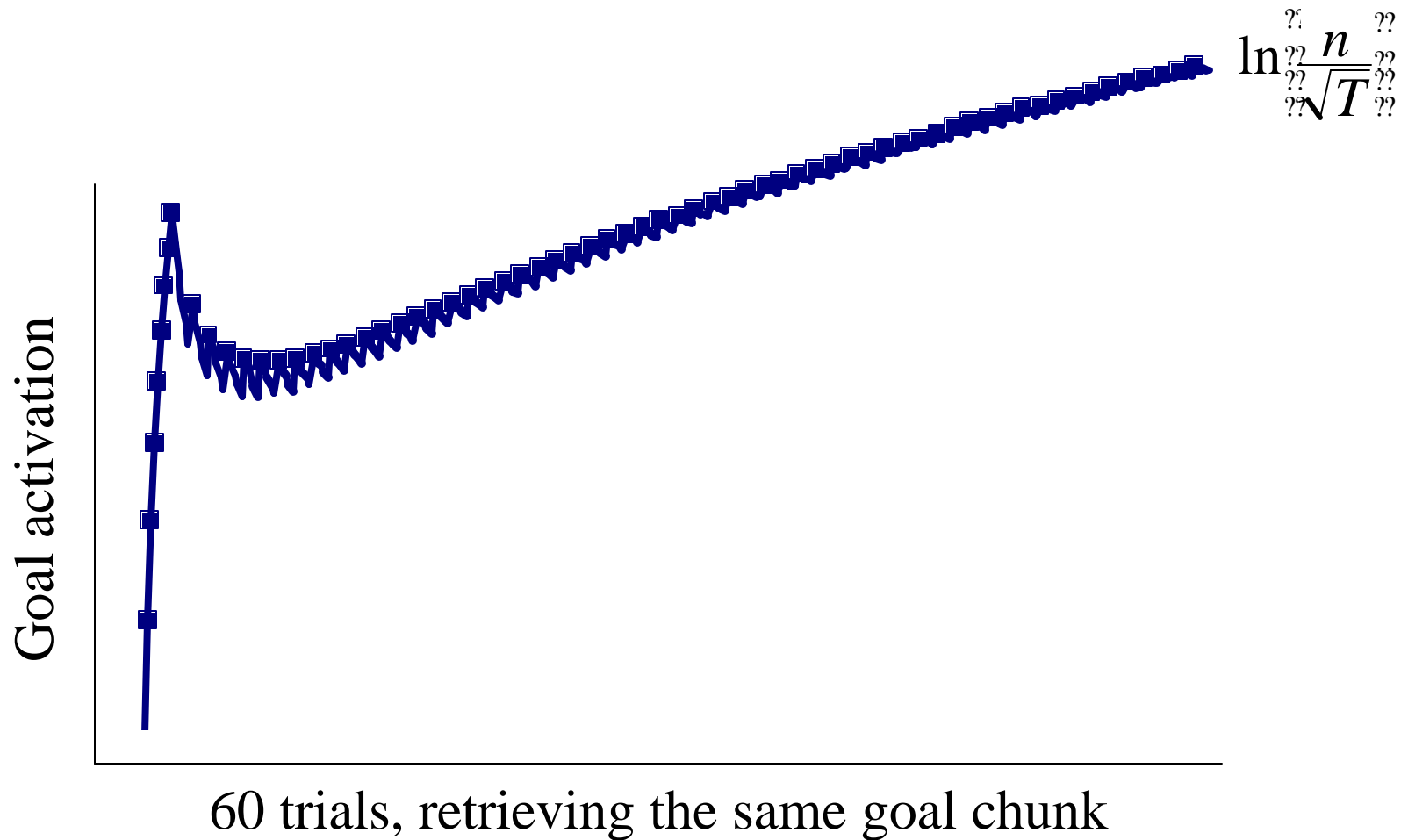
Conclusions

- A direct measure of executive control is time to encode a goal — <u>any</u> goal

  – An indirect measure is "within-run slowing"
  (Altmann & Gray, 2002)

- The alternating-runs paradigm says little about switch cost

  – Offers only start cost, which is confounded

- Switch cost says little about executive control

  – Isn't affected by preparation time