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The rise and fall and rise again? of associative processes in human contingency learning

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The rise...

- Dickinson, Shanks, & Evenden (1984)

The fall...

- Waldmann & Holyoak (1992):

  The results presented in this article clearly refute connectionist learning theories that subscribe to an associationistic representation of events as cues and responses (p. 233)

- Mitchell, De Houwer, & Lovibond (2009):

  Overall, therefore, we see no reason to postulate the existence of a link-formation system in addition to a propositional reasoning system (p. 194)

BUT conditions seem to apply...

- An analysis of the conditions under which inferential or associative processes control performance may be a more fruitful approach (e.g., Shanks, 2010)
  - How do these processes operate?
    - Associative-activational processes are fast whereas inferential processes are slow:

      The former invoke the transmission of activation or inhibition between representations, and the latter assume some calculus for combining and manipulating semantically interpretable symbols to yield rational inferences (Shanks, 2007, p.304)
  - Speeded tasks may favour an associative-activational control of performance

BUT conditions seem to apply...

- An analysis of the conditions under which inferential or associative processes control performance may be a more fruitful approach (e.g., Shanks, 2007)
  - How do these processes operate?
    - A verbal instruction can update knowledge if represented in a propositional format **BUT** cannot update the associative strength of a cue (see e.g., De Houwer, 2009 or Lovibond, 2003). Only trial-by-trial learning may update the associative strength of a cue
  - <u>Knowledge update by a verbal instruction may signal the operation of inferential processes</u>

And rise again...?

- Morís, Cobos, Luque, & López (2014; Experiment 4) showed that a verbal instruction affected performance in a contingency judgment task (*unspeeded* task) but it could not affect performance in an associative repetition priming task (speeded)

And rise again...?

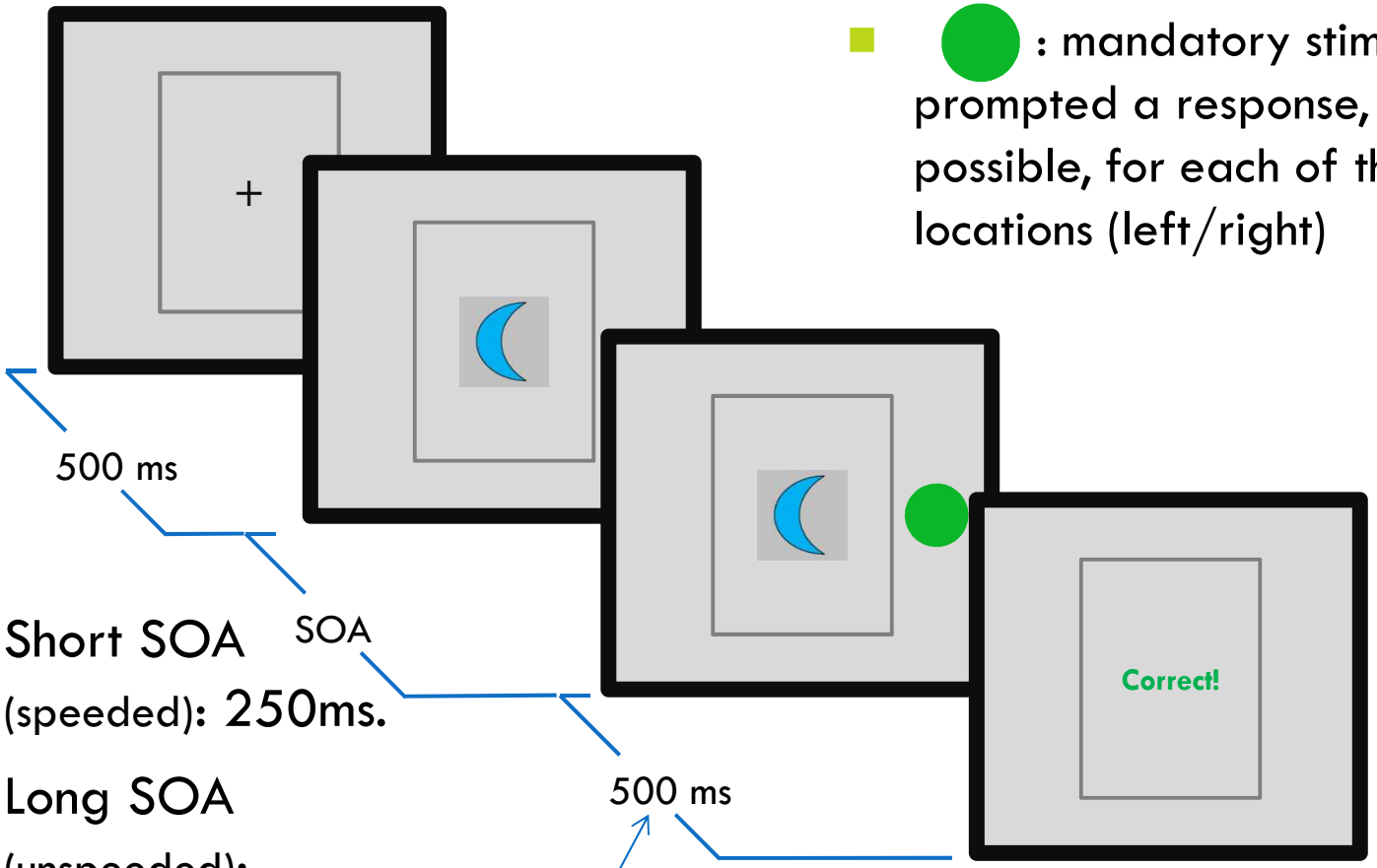
- **BUT...** again, there are conditions in which verbal instructions may control performance even in *speeded* contingency learning tasks (e.g., IAT, De Houwer & Vandorpe, 2010)
- **THUS...** maybe associative-activational processes play no role in contingency learning

- **Easy solutions are not always good solutions!**

Experiment 1

- Will a verbal instruction influence performance depending on the time pressure, under the same test conditions of a contingency task?
  - Should the fast task facilitate an associative-activational control of performance, the verbal instruction will not produce much knowledge update.
  - The verbal instruction will produce significant knowledge update in the slow task as inferential processes will control performance

Cued-response task



- : mandatory stimulus that prompted a response, as quick as possible, for each of the two possible locations (left/right)

- Short SOA (speeded): 250ms.
- Long SOA (unspeeded): 1000ms.

(adjustable moving temporal window)

Experiment 1

SOA	Learning		Verbal instruction	Partial reversal		
Short (speeded) (250 ms)	72 x	A→ 1	"A goes now with 2"	Informed	7 x	A→ 2
		B→ 1		No change		B→ 1
Long (*unspeeded*) (1000 ms)		C→ 2		Uninformed		C→ 1
		D→ 2		No change		D→ 2

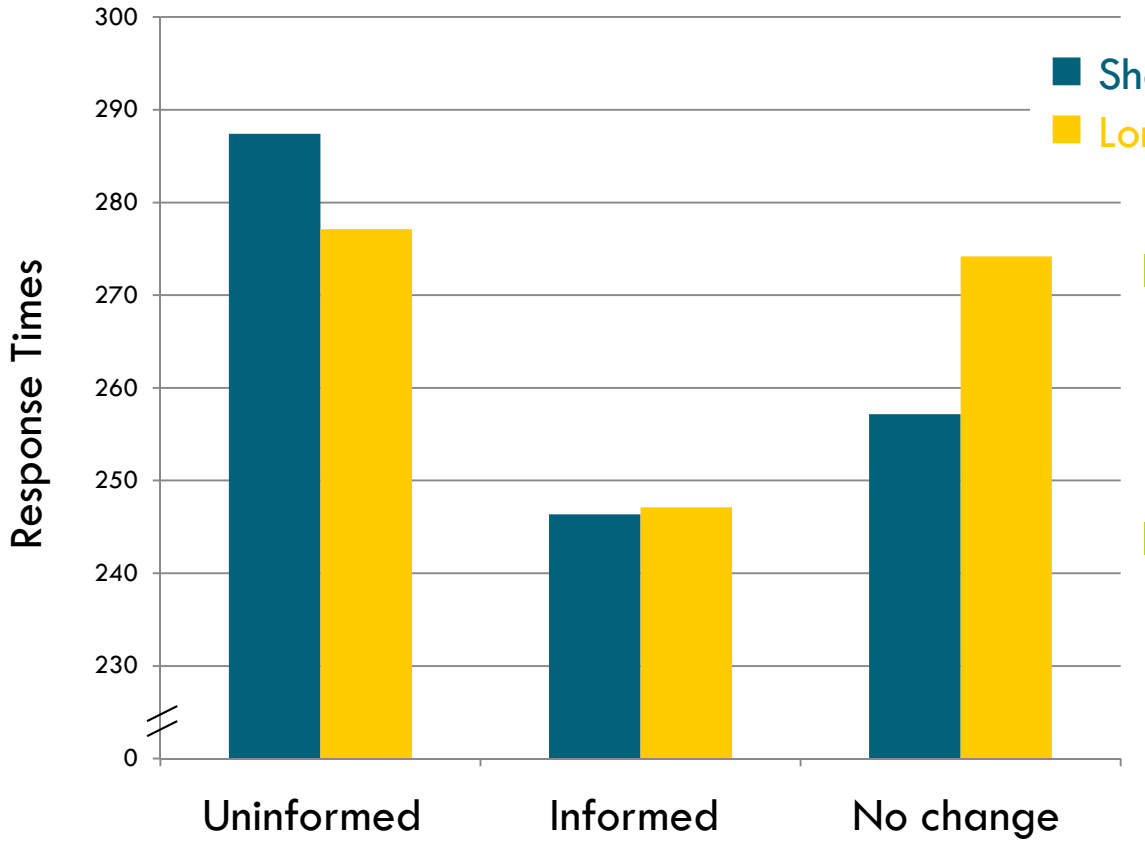
- **Short SOA**: According to an associative-activational control of performance, the verbal instruction will not be able to update the knowledge acquired:
  - Performance during *Partial reversal* should reflect the associative strength of the cues, as acquired during the *Learning* phase.

Experiment 1

SOA	Learning		Verbal instruction	Partial reversal		
Short (speeded) (250 ms)	72 x	A→ 1	"A goes now with 2"	Informed	7 x	A→ 2
		B→ 1		No change		B→ 1
Long (*unspeeded*) (1000 ms)		C→ 2		Uninformed		C→ 1
		D→ 2		No change		D→ 2

- **Long SOA**: According to an inferential control of performance, the verbal instruction will be able to update the knowledge acquired:
  - Performance during *Partial reversal* should reflect to a lesser extent the knowledge acquired during the *Learning* phase.

Results



- Short SOA:
  - No change < Uninformed
  - Informed=No change
- Long SOA:
  - No change=Uninformed
  - Informed<No change/ Uninformed

Cue x SOA: F(2,166)=5.686; p.=.004

Discussion

- Both, associative-activational and inferential processes appeared to control performance:
  - RTs reflected to a greater extent the knowledge acquired during the *Learning* phase in the Short SOA group than in the Long SOA group (i.e., less knowledge update in the Short than in the Long SOA group)
- **BUT...** even in the Short SOA group, performance was sensitive to a verbal instruction:
  - Informed=No change

Discussion

- Will this sensitive performance to a verbal instruction be reflecting a genuine knowledge update of what was learnt during the *Learning* phase?
  - If so, the knowledge acquired during the previous *Learning* phase would have a unique propositional format **AND THUS**, no need to postulate an associative-activational process

Experiment 2

- Does this sensitive performance to a verbal instruction mean genuine knowledge update or, alternatively, fast responses to a verbal instruction that is active in working memory as shown in e.g., speeded Go-No go and Stop-signal tasks?

Experiment 2

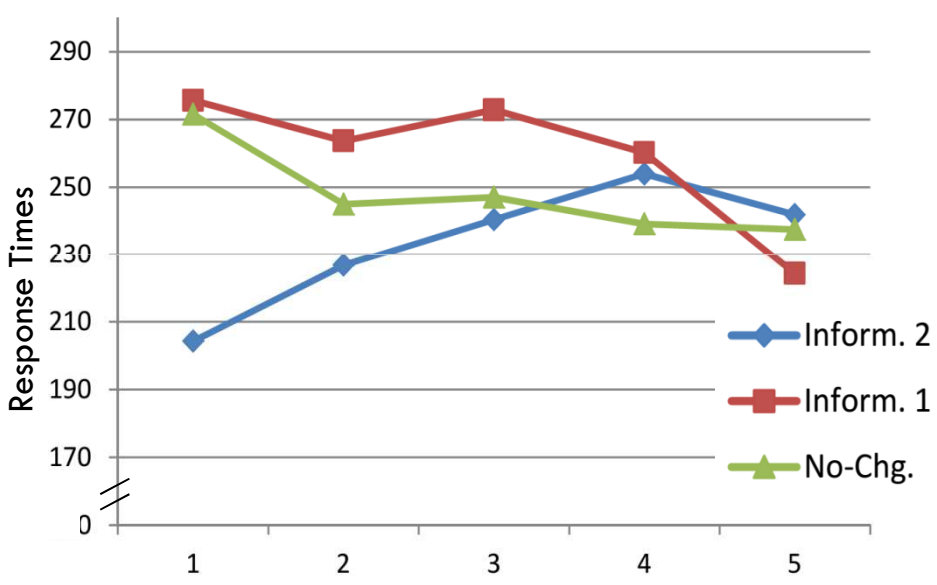
- Using the same cued-response task:

SOA	Learning	Instr. 1	Partial reversal			Instr. 2	Partial reversal (Cont.)		
Short (250 ms)	A→ 1	"A goes now with 2"	Inform. 1	2 x	A→ 2	"C goes now with 1"	Inform. 1	5 x	A→ 2
	B→ 1		No-chg.		B→ 1		No-chg.		B→ 1
Long (1000 ms)	C→ 2		No-chg.		D→ 2		Inform. 2		C→ 1
	D→ 2						No chg.		D→ 2

- If Instr. 1 produces a genuine knowledge update, RTs to Inform. 1=No-chg. during *Partial reversal (Cont.)*
- Alternatively, Instr. 1should have been replaced in working memory by Instr. 2 and thus, RTs to Inform. 1>No-chg.

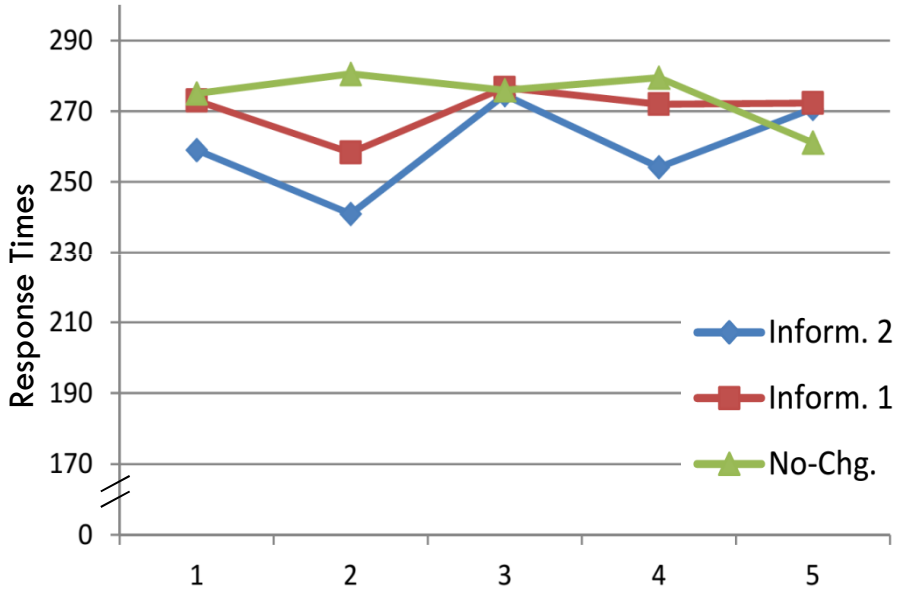
Results

- Short SOA



  - Inform. 1>No-chg.
  - Inform. 2<No-chg.

- Long SOA



  - Inform. 1=No-chg.
  - Inform. 2<No-chg.

Cue x SOA x Trial: F(8,143)=2.789; p.=.007

Discussion

- No genuine knowledge update seems to have occured in the Short SOA group:
  - Only in the Long SOA group the first verbal instruction had a durable effect: Inform. 1 cue= No Chg. cue
  - In the Short SOA group Inform. 1cue >No Chg. cue
- Not surprisingly, RTs to Inform. 2 in both SOA conditions (while the verbal instruction was active in working memory) produced short RTs

Conclusion

- Associative-activational and inferential processes appeared to have controlled performance:
  - Experiment 1. SOA had a different impact on the control of performance produced by verbal instructions, suggesting different representational formats
  - Experiment 2 served to show that low RTs to Informed cues in the Short SOA group of Experiment 1 did not reflect a genuine knowledge update produced by a verbal instruction but its activation in working memory

Conclusion

- Our data remain silent about how the knowledge acquired during the initial *Learning* phase has taken place (whether associatively or by means of inferential processes)
- In any case, and importantly, such knowledge was retrieved during the *Partial reversal* phase by means of associative-activation processes in the speeded task
- Thus, the dismissal of these processes in contingency learning tasks may be regarded as premature: probably, a too easy solution

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Thanks!

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