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Towards Bridging the Gap Between Conditional and Syllogistic Reasoning

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Syllogistic and Conditional Reasoning Domains

Syllogisms

Two statements interrelating three terms defined by:

- **Quantifiers** – All (A), Some (I), Some … not (O), No (E)
- **Order of terms/Figure**

Figure 1	Figure 2	Figure 3	Figure 4
A-B B-C	B-A C-B	A-B C-B	B-A B-C

Syllogism IA1:

Some Artists are Beekepers.

All Beekepers are Chemists.

What, if anything, follows?

Conditionals

Statements of the form „If X then Y“ (usually) describing causal relationships

- Four **inference forms** - Modus Ponens (MP), Modus Tollens (MT), Affirming the Consequent (AC), Denying the Antecedent (DA)

	MP	MT	AC	DA
Premise 1	$X \rightarrow Y$	$X \rightarrow Y$	$X \rightarrow Y$	$X \rightarrow Y$
Premise 2	X	$\neg Y$	Y	$\neg X$
Conclusion	Y	$\neg X$	X	$\neg Y$

Belief Bias (Syllogisms), Suppression Effect (Conditionals)

- Syllogisms typically investigated with respect to effects caused by task structure
  - Task content often selected to be neutral and equally believable
- When presented with everyday contents, humans neglect logical validity of conclusions but accept ones that coincide with their beliefs and background knowledge → **belief bias**[1]

- Conditional research very often focused on content
  - Effect of background knowledge on acceptance patterns of logically (in-)valid conditional inferences
- Introducing additional information in form of disablers and alternatives prevents people from accepting certain inferences → **suppression effect**[2]

→ How specific are the additional content effects to the conditional domain?

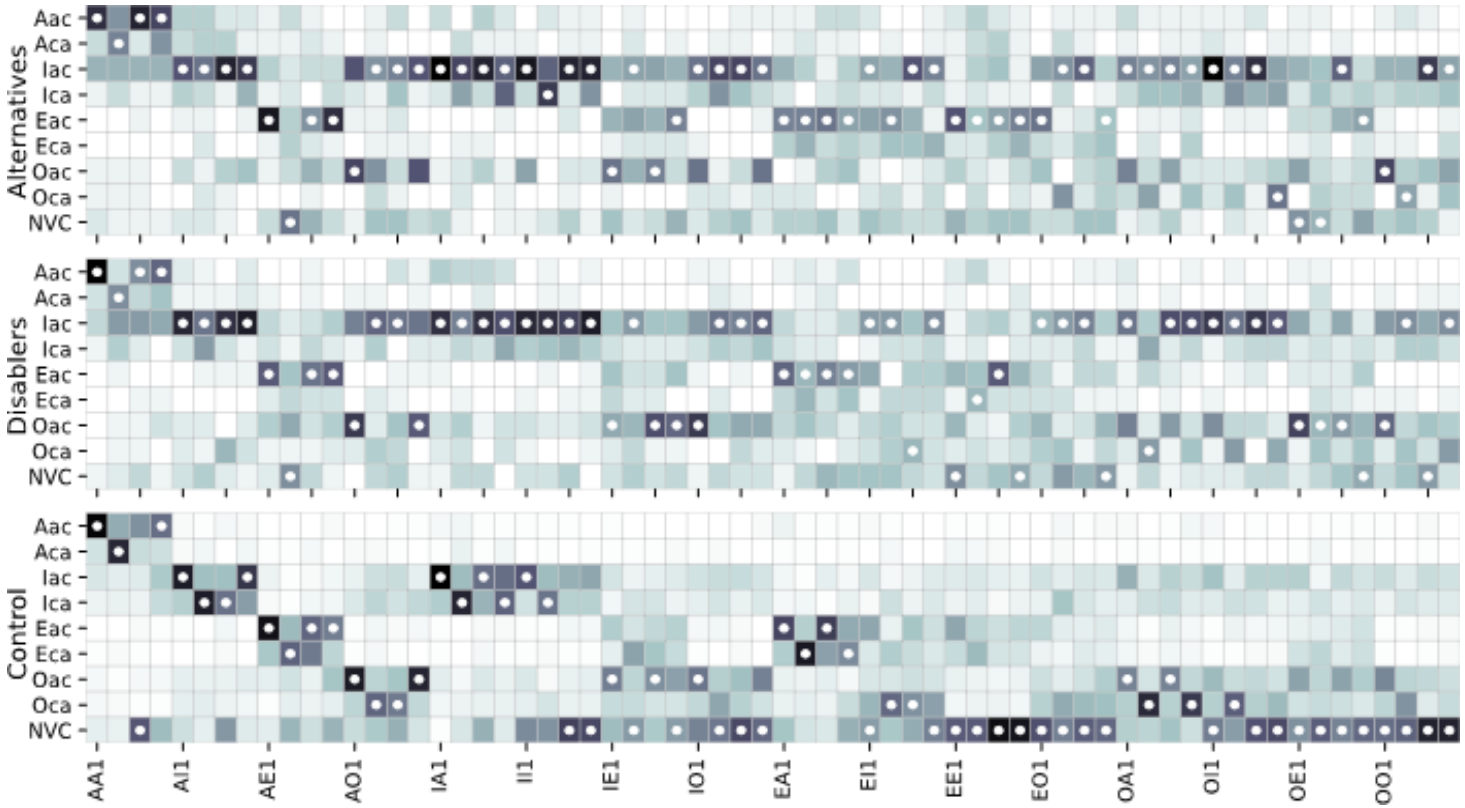
→ Do they extend to syllogistic domain and to which extent?

1 Evans, J.S.B.T., Barston, J.L., & Pollard, P. (1983). On the conflict between logic and belief in syllogistic reasoning. *Memory & Cognition, 11*(3), 295-306.
2 Byrne, R. (1989). Supressing Valid Inferences With Conditionals. *Cognition, 31, 61- 83.*

Experiment

- Participants presented with all 64 syllogisms → select which of the 9 responses follows
- Contents adapted from conditional experimental contents focusing on influence of disablers and alternatives[2,3]

Conditional	Adapted Syllogism
If the apples are ripe, then the apples fall from the tree.	All apples fall from the tree. All fruits that fall from the tree are ripe.



Response Distribution

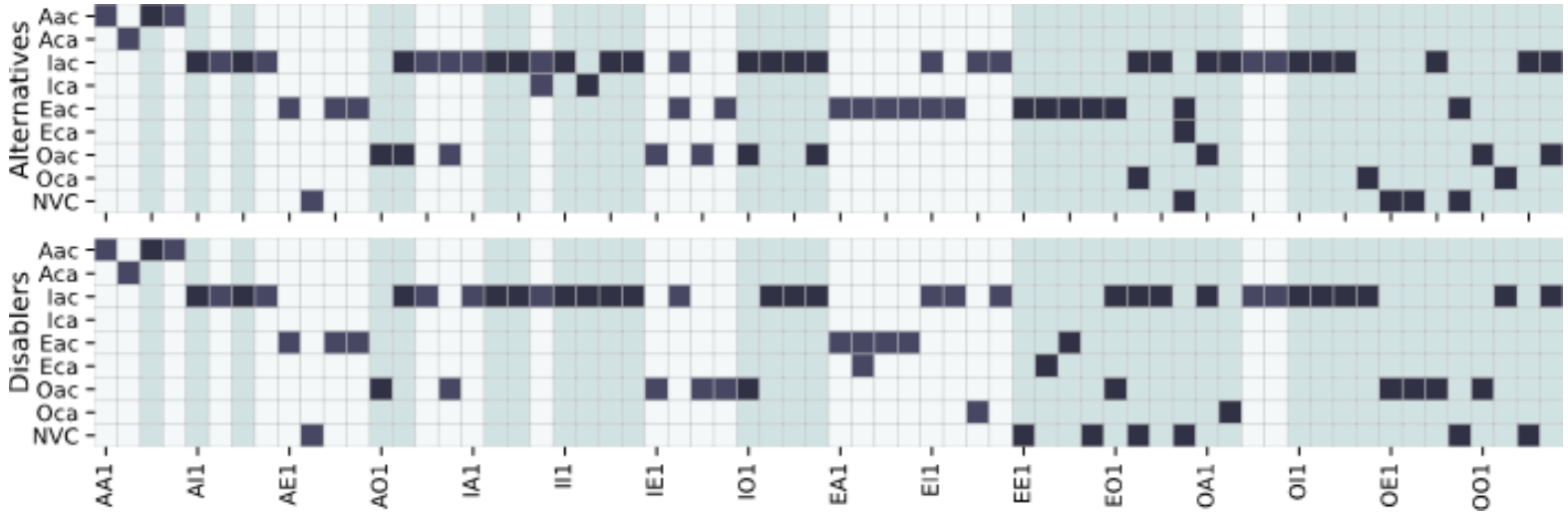
2 De Neys, W., Schaeken, W., & D'Ydewalle, G. (2002). Causal conditional reasoning and semantic memory retrieval: A test of the semantic memory framework. *Memory & Cognition, 30*(6), 908-920.
3 Verschueren, N., Schaeken W., & D'Ydewalle, G. (2005). Everyday conditional reasoning: A working memory-dependent tradeoff between counterexample and likelihood use. *Memory & Cognition, 33*(1), 107-119.

Results

- Neutral content in control data → reasoners tend to answer with NVC most frequently
- Belief bias effect in the alternatives and disablers:
  - A shift towards I-conclusions
  - Significantly suppressed NVC answers
- Both conditions show these effect → either an effect of the content or of the specific task designs
- Not manifesting as the conditional suppression effect!

		Valid			Invalid		
		ΔM	U	p	ΔM	U	p
A	Alt	5	2037.0	$< .01$	6.54	3936.0	$< .01$
	Dis	1.35	1468.0	.95	2.82	3088.0	.16
I	Alt	12.46	2029.0	$< .01$	20.69	3823.0	$< .01$
	Dis	12.85	2009.0	$< .01$	18.59	3724.0	$< .01$
E	Alt	-3.72	1408.0	.76	3.94	2640.0	.71
	Dis	-7.11	1333.5	.45	1.74	2638.0	.7
O	Alt	-9.97	978.0	$< .01$	-4.97	2361.0	.14
	Dis	-1.86	1545.0	.59	0.07	2750.0	.96
NVC	Alt	-3.78	279.0	.14	-26.21	95.0	$< .01$
	Dis	-5.23	230.0	.02	-23.22	120.0	$< .01$

Differences between means of percentages of selected responses in the alternatives and disablers of our study and a neutral dataset with respective Mann-Withney-U tests



Most frequently selected responses