Acquiring the meaning of conditionals

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Background

- Children acquire conditionals later than other complex constructions, for reasons that are poorly understood. [1-2]
- One possibility is because conditionals have multiple meanings:[3]

E.g. [If you go out without an umbrella]*p*, [you will get wet]*q*.

Table 1. A truth value table of conditionals indicating the relevant state of affairs and interpretation.

p	q	p → q	State of affairs	Interpretation
1	1	1	p & q	conjunction
1	0	0	p & ¬q	
0	1	1	¬p & q	Conditional
0	0	1	¬p & ¬q	biconditional

- Prior research with **school-aged children** and **adolescents** suggests a consistent order of development of the different interpretations.
  - *Conjunction* is the earliest acquired interpretation, followed by the *biconditional*, while the *conditional* interpretation is achieved only by a subset of highly educated adults. [4-7]
- However, due to contradictory findings across studies, the exact age of acquisition of each interpretation remains unclear. [6]

Current Study

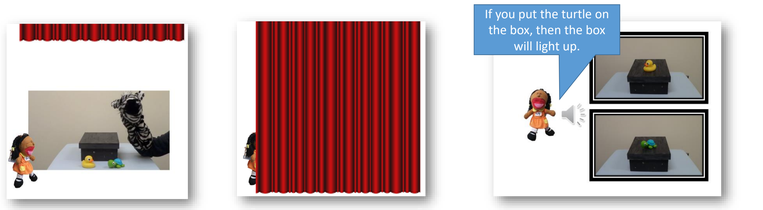
- How do young children (preschoolers) interpret conditionals?
  - At what age do the different interpretations arise?
- Simpler experimental paradigm that allows us to test conditional interpretations in younger (preschool-aged) children.

Methods

Participants

19 **3-year-olds** (M = 3;8, range = 3;0-3;11); 23 **4-year-olds** (M = 4;5, range = 4;0-4;10); 20 **5-year-olds** (M = 5;5, range = 5;0-5;11); 23 **6-year-olds** (M = 6;6, range =6;0-6;11); 22 **Adults**

Procedure



Ms. Zebra has a duck and a turtle. She will show her friend Sally how the lightbox works behind the curtain.

[curtain falls]
Sally watch carefully!

I have these two pictures. Only one of them shows what Sally saw. Sally, can you give us the clue? [Audio] What did Sally see?

3 within-subjects conditions

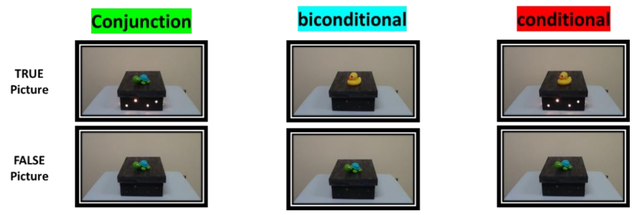


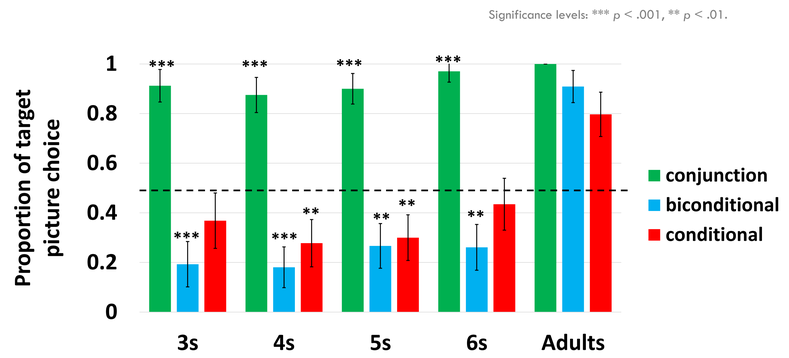
Table 2. Truth value table for the conditional sentence *If you put the turtle on the box, then the box will light up*.

p	q	p → q	State of affairs	Interpretation
1	1	1	Turtle on & box light on	conjunction
1	0	0	Turtle on & box light off	
0	1	1	Turtle off (i.e., duck on) & box light on	conditional
0	0	1	Turtle off (i.e., duck on) & box light off	biconditional

Predictions

conjunction > biconditional > conditional

Results



- Interpretation (Conjunction vs. Biconditional & Conditional): β= -5.75, *SE*= 0.94, *z*= -6.1, *p*<.001
- Interpretation (Biconditional vs. Conditional): β= 1.84, *SE*= 0.65, *z*= 2.83, *p*= 0.005
- Age (6s vs. younger): β= 1.07, *SE*= 0.54, *z*= 2.00, *p*= 0.046

Table 3. Number of children who passed or failed the task per interpretation type.

	Conjunction		Biconditional		Conditional	
	Passers	Failers	Passers	Failers	Passers	Failers
3s	18	1	4	17	8	11
4s	23	1	2	22	5	19
5s	19	0	5	15	5	15
6s	22	1	7	16	8	15

Note: Passers = 2/3 or 3/3 trials correct. Failers = 0/3 or 1/3 trials correct

Conclusion

- **Adults** were successful in **all three interpretations** of conditionals.
  - Unlike prior research, [4] in our simpler paradigm, adults performed well even in the hardest, conditional interpretation.
  - Numerical differences across conditions point to a consistent order of processing difficulty for each type of interpretation. [3]
- However, **children's** interpretations were **non-adult like** even at age 6.
  - 3- to 6-year-olds understood the **conjunctive interpretation** but largely failed with the biconditional and conditional interpretations.
  - Surprisingly, children were **more successful with the conditional** than the biconditional interpretation.
  - Patterns of individual performance indicate particularly **protracted development** of the mature understanding of conditionals. [4-7]

References

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