The early 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

p & q   ¬p & ¬q   ¬p & c

➢ 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!

If you put the turtle on the box, then the box will light up.

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

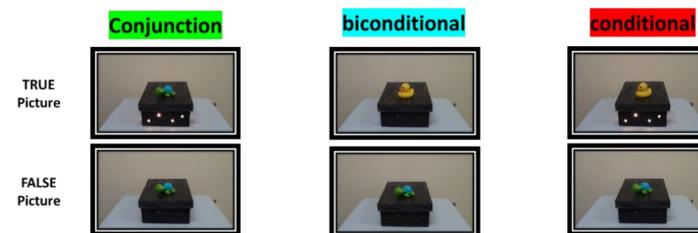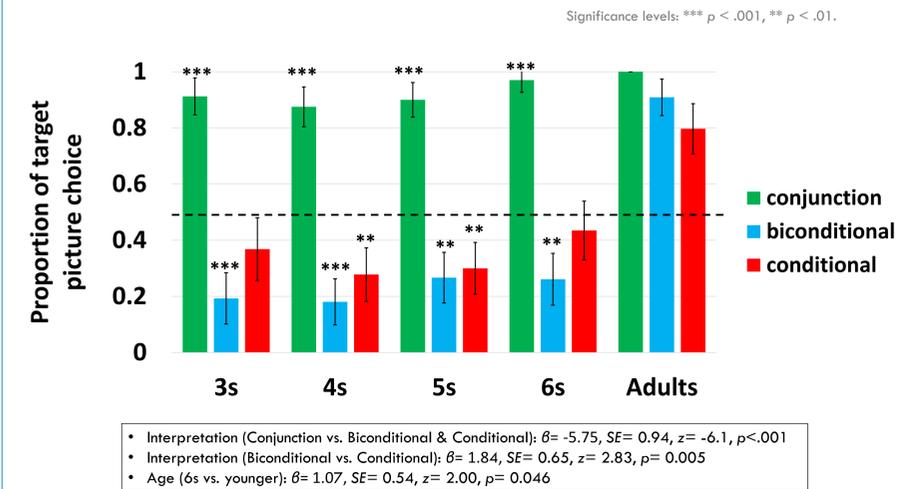**Table 2.** Truth value table for the conditional sentence *If you put the turtle on the box, then the box will light up.*

| 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

Significance levels: *** p < .001, ** p < .01.

• 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

Alternative reasoning strategies

"go with mentioned toy" (p is true) OR "go with lit box" (q is true)
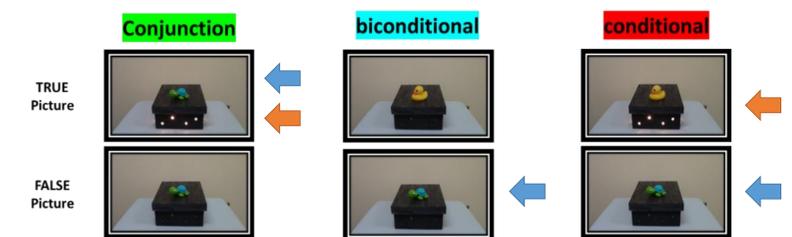
Conclusion

➢ **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.

➢ 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, possibly due to simpler reasoning strategies.

➢ Similarly to prior research, results show particularly **protracted development** of the mature understanding of conditionals. [4-7]
  • But children's difficulties with some interpretations may be task-dependent. [7]

References

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