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# Issues in Reasoning about Iffy Propositions: A Meta-analysis of Thinking about what is True, Possible or Irrelevant in Reasoning from or about Propositions.

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We present a meta-analysis of truth-table evaluation tasks, in which people evaluate contingencies as (in)consistent with a proposition or making it true or false. There is a clear need for this review. In recent literature overgeneralizations based on a biased subset of studies have been presented as ‘fact’ and used to argue against mental-models theory (Johnson-Laird & Byrne, 2002). Given that critics got the facts wrong, the critiques are suspect and in need of a critical revision.

Consider <if A then C> conditionals. They express relations between an Antecedent <A> and a Consequent <C>. Both can be either true or false, implying we have four possible truth contingencies: TT<A and C>, TF<A and not-C>, FT<not-A and C>, and FF<not-A and not-C>. These cases are referred as TT, TF, FT and FF (‘T’: Truth or ‘F’: Falsity of, respectively, the antecedent/consequent).

In truth-table evaluation tasks, people evaluate the four truth-contingencies. In some tasks, people reason *from* conditionals. One judges whether contingencies are possible or impossible given that the conditional is true. In other tasks, one is instructed to reason *about* conditionals. One does not know if the conditional is true and has to judge whether the contingencies make <if A then C> true or false, or are irrelevant to its truth-value. These “three-option” tasks all include ‘irrelevant’ as a 3<sup>rd</sup> response alternative.

Figure 1 depicts adult truth-table task evaluation performance with content-neutral indicative <if A then C> conditionals. Hence, it does not include non-adult, non-evaluation tasks with non-neutral and/or, non-<if,then> conditionals. (See, Schroyens, 2007, for the complete list of studies and detailed results). About ten studies could also not be included because they presented insufficient information about the exact evaluation of the truth-contingencies. Studies using implicit referencing do not use ‘not’ to convey falsity/denial; instead they use a specific instance of the contrast-class of the negated object to establish denial (e.g., any letter that is not an A). Explicit FF cases make use of explicit negations (i.e. ‘not’; as in ‘not A and not-2’). It is clear from Figure 1 that the implicitness effect and the task effect are only observed on false-antecedent cases (FT and FF). Combined over FF and FT we have a respectable task-format effect ( $F(1,37) = 53.3703$ ,  $Mse = .031$ ,  $p < .0001$ ) and a sizable implicitness effect ( $F(1,37) = 16.614$ ,  $Mse = .031$ ,  $p < .001$ ). These effects are not obtained with true-antecedent cases ( $F$ 's < 1.1).

Looking at only acceptance rates, we do not know whether task-format effects reflect a shift towards ‘false’ or ‘irrelevant’ judgments of cases deemed ‘possible’ in two-option tasks. We are similarly still ignorant about the exact nature of implicitness effects in three-option tasks. There are only two implicit two-option tasks; we therefore only discuss the more reliable responses rates on explicit two-option tasks. The TF(Possible) and FF(Possible) rates are

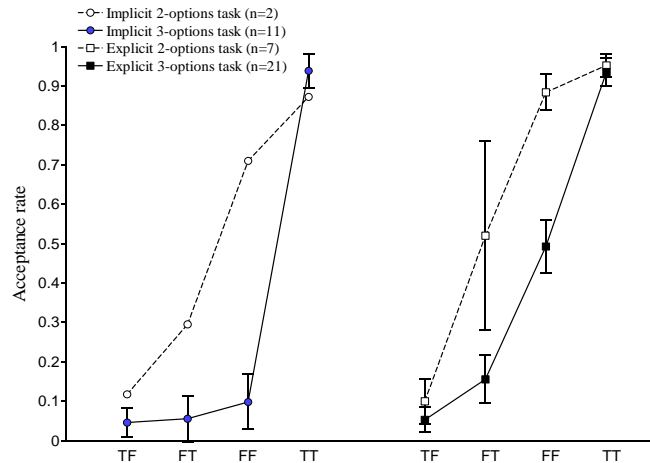


Figure 1: Truth-contingency acceptance rates as a function of reference type (Implicit vs. Explicit) and task format (two vs. three-option format).

.520 and .884. The task-format effect on explicit FF cases, .884 vs. .493 ( $d = .391$ ) is almost completely explained by the .389 selection rate of FT(Irrelevant); the comparable FT(Impossible) and FF(False) rates remain stable across the two explicit tasks; .116 vs. .118. The picture seems somewhat more complicated for FT. The task-format effect on explicit FT, .520 vs. .155( $d = .364$ ), is mostly explained by the .271 FT(Irrelevant) selection rates. Part of the task effect seems captured by a slight increase in FT(Impossible) versus FF(False): .480 vs. .573 ( $d = .097$ ).

The .494 vs. .098 implicitness effect on FF ( $d = .396$ ) is captured by a .389 vs. .737 ( $d = .348$ ) increase of irrelevancy judgments of implicit FF cases. The implicitness-effects on FT (.156 vs. .055;  $d = .101$ ) reflect a similar shift toward irrelevant judgments for implicit cases (.271 vs. .434).

**Conclusion** The truth-table task literature shows it is wrong of mental-models critics to state false-antecedent cases are judged irrelevant by a majority. All arguments based on a presumed majority of irrelevant responses are therefore fallacious. Only implicit FF cases in three-option tasks are judged irrelevant in a majority of cases. Critiquing theories on the basis of a biased sample of studies (for which mental-models theory by itself has an account), is not an example of theoretical rigor and exactitude.

## References

Schroyens (2007). Thinking about what is true, possible and irrelevant in reasoning from or reasoning about conditional propositions. Paper submitted for publication, University of Gent, Gent, Belgium. [http://www.schroyens.com/schroyens\(2007\).pdf](http://www.schroyens.com/schroyens(2007).pdf)