The Role of Logical Structure and Premise Believability in Belief Revision

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Belief Revision

Belief revision occurs when one moves from one belief state to another after encountering some data that are inconsistent with one's initial belief set. Experiments in belief revision have demonstrated that the initial logical structure of an argument affects how reasoners revise their beliefs. When arguments for changing beliefs are made in a logical form, the typical finding is that the major premise is revised more frequently than the minor premise. This is evident when the modus ponens (MP) inference is contradicted (if p then q; p; therefore, q), while there is no clear preference when the modus tollens (MT) inference is contradicted (if p then q; not q; therefore, not p) (Dieussaert, Schaeken, De Neys, & d'Ydewalle, 2000; Elio & Pelletier, 1997; Politzer & Carles, 2001). Others have reported a different finding: reasoners revise belief in the major and minor premises equally often in MP problems, but prefer to disbelieve the minor premise in MT problems (Revlin & Calvillo, 2002; Revlin, Cate, & Rouss, 2001). In three experiments, we explore possible explanations for these two different patterns of results.

Three possible explanations for the inconsistent results are the types of major premises, the revision alternatives presented to participants, and the prior believability of the major premises. The major premises used by Elio and Pelletier (1997), Dieussaert et al. (2000), and Politzer and Carles (2001) were conditional (if p then q) and somewhat neutral in believability. Participants in these experiments were allowed to express uncertainty toward premises. The major premises used by Revlin et al. (2001) and Revlin and Calvillo (2002) were universal quantifiers (all p are q) and considerably more believable. Participants in these experiments were forced to decide, with certainty, to disbelieve the major or minor premise.

In Experiment 1, we assigned 80 introductory psychology students from the University of California, Santa Barbara into four groups. Logical structure (MP or MT) and type of major premise (conditional or quantifier) were between-participants variables. The major premise revision rates are presented in Table 1. The rates for both quantifiers and conditionals were similar to those found by Revlin et al. (2001). Logical structure had a significant effect, type of major premise did not, and the two variables did not interact. This ruled out the use of different major premise types as an explanation for the different previous findings.

In Experiment 2, we assigned 50 participants to two groups and presented them with MP and MT problems like in Experiment 1, but gave them the revision alternatives used by Politzer and Carles (2001). As seen in Table 1, logical structure had a reliable effect on revision rates and the major premise revision rates were similar to those of Revlin et al. (2001), ruling out the use of different revision alternatives as an explanation for the inconsistent results.

Table 1: Major premise revision rates by logical structure.

	MP	MT
Experiment 1: Conditional	0.329	0.044
Experiment 1: Quantifier	0.263	0.107
Experiment 2	0.465	0.123
Experiment 3: Low believability	0.751	0.701

In Experiments 1 and 2, the major premises used were highly believable. In Experiment 3, we gave 47 participants either MP or MT problems with major premises of low-believability. The results, as seen in Table 1, were similar to those of Elio and Pelletier (1997). There was a preference to revise belief in the major premise in both MP and MT problems and there was no effect of logical structure.

Experiments 1 and 2 ruled out the use of different types of major premises and revision alternatives explanations for the varying results in the literature. Experiment 3 showed that believability of the major premise is a likely source of the different patterns of results, demonstrating the need for models of belief revision to include initial premise believability to account for how reasoners revise beliefs.

References

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