# Implicit cues to logic? *Not so fast*

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## INTRODUCTION

**Logical intuition & Conflict detection** (De Neys, 2012)
Even when they give a heuristic response, reasoners appear to have intuitive **access to the logically valid response**, as evidenced by **slower response times** (RTs) and **lower levels of confidence** on Conflict compared to Consistent inferences.

For the following Affirmation of the consequent (AC) inference, the conclusion is **invalid** but **believable**, as there is a **conflict** between logical validity and believability:

All flowers have petals.
Roses have petals.
Roses are flowers.

If the conclusion is **unbelievable**, both logical validity and believability are **consistent**:

All cars have motors.
Airplanes have motors.
Airplanes are cars.

Since even **young children can often recognize that these inferences are invalid** (Markovits, 2000), conflict detection should show clear results. However, **empirical results are inconsistent**.

**Matching hypothesis** (Kosourikhina & Handley, 2025)
Because people tend to interpret AC inferences as biconditionals (if and only if), **conflict inferences should rather be unbelievable + invalid**, which predicts a **reverse detection effect**.

**Semantic activation** (Markovits, 2014)
The intuitive response for these inferences is an attempt to **activate alternative antecedents** (cases of non-A that are B).

**If an alternative is activated, the conclusion is intuitively rejected; otherwise the conclusion is intuitively accepted.**

## METHOD

### HYPOTHESES

**Study 1**: When there are **few available alternatives**, the intuitive response is to accept the conclusion, so **conflict is for invalid and unbelievable inferences** (reverse detection). Therefore, **RTs will be longer and confidence lower** when the conclusion is rejected on consistent inferences than when it is accepted on conflict inferences.

**Study 2**: When there are **many available alternatives**, the intuitive response is to reject the conclusion, so **conflict is for invalid and believable inferences**. Therefore, **RTs will be shorter and confidence higher** when the conclusion is rejected on consistent inferences compared to accepted conclusions on conflict inferences.

### DESIGN

**Two studies**: One using 20 inferences with **few** available alternative antecedents, one using 20 inferences with **many**.

For each study, participants are randomly assigned to one of two lists each containing **5 consistent** and **5 conflict** inferences (counterbalanced to avoid material repetition).

### PARTICIPANTS

**Study 1:**
**100 participants**
Recruited from Prolific:
45 F, 54 M, 1 other,
Age *M* = 36.14.

**Study 2:**
**100 participants**
Recruited from Prolific:
54 F, 46 M
Age *M* = 35.82.

### MATERIALS

**40 categorical inferences:**
- All **invalid** AC form
- 20 with few alternatives, 20 with many
- **Half conflict** conclusion believability with logical validity, **half are consistent.**

**Dependent measures:**
- Response time (RT), in seconds
- Confidence: **Feeling of rightness** (FOR; Thompson et al., 2011)

| | Few (Study 1) | Many (Study 2) |
|---|---|---|
| **Consistent** | All animals have legs.<br>Dogs have legs.<br>Dogs are animals. | All dogs have legs.<br>Labradors have legs.<br>Labradors are dogs. |
| **Conflict** | All animals have legs.<br>Chairs have legs.<br>Chairs are animals. | All dogs have legs.<br>Cats have legs.<br>Cats are dogs. |

### ANALYSES

- RTs: **Generalized linear mixed model** with gamma distribution and log link, lme4 package.
- FOR: **Cumulative link mixed model**, ordinal package.
- Post-hocs: **Estimated marginal means** with Tukey adjustment, emmeans package

## RESULTS

***Table 1.*** Estimated marginal means (EMM) and standard errors (SE) for RTs according to inference type when participants give the heuristic response.

| Responses | Consistent rejected | | Conflict accepted | |
|---|---|---|---|---|
| **Inference type** | *EMM* | *SE* | *EMM* | *SE* |
| **Few (study 1)** | 10.13 | .704 | 8.34 | .608 |
| **Many (study 2)** | 7.84 | .541 | 10.79 | .876 |

***Table 2.*** Estimated marginal means and standard errors for FOR ratings according to inference type when participants give the heuristic response.

| Responses | Consistent rejected | | Conflict accepted | |
|---|---|---|---|---|
| **Inference type** | *EMM* | *SE* | *EMM* | *SE* |
| **Few (study 1)** | 3.54 | .049 | 4.03 | .048 |
| **Many (study 2)** | 5.27 | .345 | 4.47 | .357 |

## CONCLUSION

As seen in Tables 1 and 2, **results confirm hypotheses.**

**Study 1**: With few available alternatives, **RTs are longer and FOR lower** when rejecting consistent inferences (invalid + unbelievable) vs accepting conflict inferences.

**Study 2**: With many available alternatives, **RTs are shorter and FOR higher** when rejecting consistent inferences (invalid + believable) vs accepting conflict inferences.

### DISCUSSION

- Results for Study 1 are consistent with a **matching hypothesis** but inconsistent with a **formal logical intuition**, while results for Study 2 are consistent with a **formal logical intuition** but inconsistent with a **matching hypothesis**.

- "Logical" intuition in this case may be better explained by the **intuition that activation of potential alternatives is useful**. Actual conflict detection depends on **whether alternative antecedents (on invalid inferences) are actually activated** or not.

### REFERENCES

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