**Experiment 3**

**Participants**

We tested 67 participants (27 men, 41 women; M = 44.22 years, SD = 12.47) on an online website (Amazon’s Mechanical Turk, hereafter MTurk). They received a nominal fee for their participation.

**Design & Materials**

Twelve problems were presented to the subjects and each had to be answered with one short sentence (see Table X below). The problems needed participants to draw spontaneous inferences from disjunctions and modals. The presented problems used both modal operators “necessary” and “possibly”' and variants of modus ponens in which the subjects’ spontaneous conclusions should be valid or invalid in the modal systems K and T. Each participants received a problem of the following kind:

Premise 1: It is possible that: Alex is in Erie

Premise 2: It is necessary that: if Alex is in Erie then Eddy is in Fremont

What follows?

As a control 4 problems were included in which the categorical premise is irrelevant, and so subjects should respond “nothing follows” even though in logic there are always valid conclusions to be drawn. The problems were presented in a shuffled order. The first 6 the modal operator occurs either on the categorical premise or on the then-clause of the conditional. The second six problems have the modal operator on the conditional premise. The contents of the problems concerned individuals located in cities, and used common first names of people, such as Adam and Susan, and the names of well-known cities, all were two syllables. They were selected at random for a problem from a list we had compiled.

**Procedure**

The experiment was presented online, and we took the usual precautions for such a procedure; for example, the program checked that participants were native speakers of English, and it allowed only one participant from a given computer. The instructions explained that the task was not a test of intelligence or personality, but concerned how people in general draw conditional inferences. The participants were told that they would read sets of two premises, and for each set they had to enter what they infer from the given information. The premises were presented simultaneously. Participants could use as much time as they like.

**Results**

We excluded 17 participants because they did not finish all 12 problems and 5 because they guessed on the control problems. As equivalent formulations were considered: must for the modal necessarily; may, might, could for the modal possibly, and neither, nothing happens, no connection, doesn’t follow for nothing. Eliminated answers included “?”, and “yes”. The overall correctness measured on the nothing follows problems was high (98%). Participants rarely report necessarily as an answer at all (only in 1% of the total answers contained the modal necessarily); and in cases where the premises contained at most the modal necessarily, possibly predicting an answer with necessarily, only 4% of the participants used the modal necessarily, while about 90% of the participants just gave “B” as an answer. This pattern changes in cases with the modal possibly, it is selected in about 29% of the cases; while just “B” is selected in 29% of the cases. In cases where possibly B is predicted, about half of the participants chose this answer, while the other half chose “B” (46% vs. 47%), with 7% of the participants selecting no valid conclusion. If the conclusion was valid in systems K or T had no influence on the use of the modal or on selecting any other answer. So, the main result seems to corroborate that the modal operator necessarily is not interdefinable by the modal possibly. Overall, participants do use the modal necessarily rarely as this modal operator requires an underlying reason. The modal possibly is used more often but only by half of the participants, so it seems like that the internal mental representation uses in many cases just the token for claim. If we exclude the control problems the number of Ss whose performance on the problems fitted the theory’s predictions better than chance was considerably high. As any of the answers a participant gave is in one of the four answer categories B, B, B, and no valid conclusion, the chance for 8 problems to get the MMT prediction is 2. Forty-two out of 45 participants selected at least 3 times the answer predicted by MMT, which is reliable (Binomial, p < 2.2e-16). In contrast the predictions of the modal logics K were selected only by 5 participants above chance (Binomial, p < 0.99). The inter-individual consistency for selecting instead of B could be chosen was high 36 out of the 45 participants responded in all 4 necessary problems “B” (Binomial, p < 1.532e-14)

Table X. The 12 problems, the predictions of the MMT and the logics and the aggregated raw answers for the categories B, B, B, and no valid conclusion.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Premise 1 | Premise 2 | MMT predicted | Logic/ Systems | B | B | B | No valid conclusion |
| A | If A then B | B | Invalid in KT | 3 | 0 | 39 | 3 |
| A | If A then B | B | Valid in KT | 3 | 0 | 40 | 2 |
| C | If A then B | Nothing | Contrary to logic | 0 | 0 | 0 | 45 |
| A | If A then B | B | Invalid in KT | 0 | 18 | 23 | 4 |
| A | If A then B | B | Valid in KT | 0 | 26 | 15 | 4 |
| C | If A then B | Nothing | Contrary to logic | 0 | 0 | 3 | 42 |
| A | (if A then B) | B | Invalid in KT | 2 | 0 | 42 | 1 |
| A | (if A then B) | B | Valid in KT | 0 | 1 | 41 | 3 |
| C | (if A then B) | Nothing | Contrary to logic | 0 | 0 | 0 | 45 |
| A | (if A then B) | B | Invalid in KT | 0 | 20 | 23 | 2 |
| A | (if A then B) | B | Valid in KT | 0 | 19 | 23 | 3 |
| C | (if A then B) | Nothing | Contrary to logic | 0 | 0 | 1 | 44 |