Assessing the Conditional Inference During Text Processing

Hiroko Nakamura (o060506r@mbox.nagoya-u.ac.jp)
Jun Kawaguchi (kawaguchij@cc.nagoya-u.ac.jp)
Department of Psychology, Nagoya University
Nagoya, 464-8601, Japan

Conditional inference is deductive reasoning which draw a conclusion from conditional statement "If P then Q" and categorical premise. There are four forms of conditional inference. Both modus ponens (MP; P is true therefore Q is true) and modus tollens (MT; Q is false therefore P is false) are logically valid inference forms. In contrast, either affirmation of the consequent (AC; Q is true therefore P is true) or denying the antecedent (DA; P is false therefore Q is false) leads logically invalid conclusion. Previous studies showed that people often made an invalid inference when they answered the conditional reasoning task (Wason, 1966).

According to the mental logic theory (Braine & O'Brien, 1991), people drew invalid conclusion because they interpreted conditional statement as biconditional (if P then Q and if Q then P). While, mental model theory (Johnson-Laird & Byrne, 1991) claimed that people often failed to represent the mental model of counter example case, consequently they made an invalid inference.

Rader & Sloutsky (2002) showed that people automatically made MP and AC inferences during the text processing by using on-line priming task. In this study, we used on-line priming task to test the automatic conditional inference process and to examine the model theory and the logic theory. In this experiment, participants were asked to read texts which contained conditional statements and categorical premises of MP, AC, DA or MT inference, then they answered lexical decision task. The probe word of the lexical decision task was the focal concept of the conditional inference. Therefore, if participants made a conditional inference during the reading, the RT of judgment task should be faster than when they didn't make inference, because the probe word was corresponded with the conclusion of the inference. The logic theory predicted that more AC and DA inference would be made when conditional statements were easy to interpret as biconditional statements. While the model theory predicted that the biconditional interpretation wasn't affected the inference during the reading.

Method

Participants. Sixty undergraduate students at the Nagoya University took part in the experiment.

Materials. We made 32 critical stories and 52 filler stories. Each story was four sentences long. Critical stories contained conditional statements in the second sentence. Half of the critical stories had conditional statements that were easy to interpret as biconditional statements, and reminding 16 stories had conditional statements that were difficult to interpret as biconditional. There were eight versions in each critical story: MP-inference, MP-no inference, AC-inference, AC-no inference, DA inference, DA-no inference, MT-inference, and MT-no inference. Each inference version mentioned categorical premise of the conditional inference in its fourth sentence. While no inference versions were identical to their inference versions except that the fourth sentence mentioned categorical premise without assertion. Probe words of critical stories were conclusion of the conditional inference. An example of the critical story and probe word are displayed in table 1.

Table 1: Sample Story

Order	Condition		Sample
1			Thomas woke up and he didn't know what time is it now.
2	MP, DA		He thought that if it was dark outside then it was night.
	AC, MT		He thought that if it was night, then it was dark outside.
3			Thomas arose to open a window.
4	Affirmation	Inference	He discovered that it was dark outside.
		No inference	He wondered whether it was dark outside.
	Negation	Inference	He discovered that it was not dark outside.
		No inference	He wondered whether it was not dark outside.
Probe			NIGHT

Procedure. Macintosh Power Book 400 computer with PsyScope. 1.2.5 program was used for stimulus presentation and data collection

Participants were told to read a series of stories and answer the lexical decision task by pressing the key. Inference was not mentioned. Each story was presented sentence by sentence on the screen. When participants read the sentence, they were prompted to press the space key, followed by the next sentence. After each story, probe word was appeared on the screen for the lexical decision task.

Results and Discussion

Table 2: Mean Reaction Time (msec)

Inference form	Direction	Premise version: Inference	No-inference
MP	Conditional	874	892
	Biconditional	888	905
AC	Conditional	858	875
	Biconditional	856	916
MT	Conditional	888	900
	Biconditional	863	908
DA	Conditional	888	899
	Biconditional	890	906

Table 2 shows mean RTs of the lexical decision task. Mean reaction times were analyzed in 2(validity: valid, invalid)X2(negation: affirmative, negative)X2(direction: conditional, biconditional)X2 (premise version: inference, no inference) ANOVA. Negation was a between subject factor and reminding three factors were varied within subjects. A main effect of premise version was significant (F (1, 58)=7.86, p<.01). RTs of inference condition were faster than that of no inference condition. Thus participants automatically made conditional inference during the reading. Contrary to the logic theory's prediction, the main effect of direction wasn't observed. These results are accordance with model theory's prediction.