Recognition memory of Japanese active and passive sentences: An effect of pragmatics on sentence memory¹

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Some of the recent researches have suggested that verbatim representation of English active and passive sentences will decrease in a very short period. This experiment was planned to examine whether the same results could be found in the case of Japanese active and passive sentences, because the Japanese passive differs from the English passive linguistically. It was found that even after 80 s probe sentences were verified faster if the input sentences were of the same voice. This result was discussed from the viewpoint of the effect of pragmatics on sentence processing.

Key words: memory, recognition, representation, psycholinguistics, pragmatics, sentence comprehension, Japanese.

Several experiments have been done to study the nature of the representation of information stored in short-term memory and long-term memory.

In Sachs' (1967) sentence verification experiment, subjects listened to paragraphs and decided whether a test sentence was the same as the one they had heard 30 s earlier in the paragraph. They could detect semantic changes more easily than non-semantic changes. Semantic changes were detected about 80% of the time, but non-semantic changes (such as changes in voice of the sentence) were detected only about 60% of the time (chance was 50%). Memory for form and memory for content were equally good in an immediate test, but memory for form, though not for content, drastically faded

away with delay. She argued that it was necessary to make a distinction between the short-term memory for a sentence and long-term memory for it.

Jarvella (1971) showed that the ability to verbatimly retrieve a sentence dropped off sharply after just one intervening sentence. This result may suggest that with no delay, there remains a verbatim image of the sentence from which subjects can retrieve information about both form and content. But the verbatim image deteriorates and is replaced by a more permanent, more semantic representation in long-term memory.

Olson and Filby (1972) and Garrod and Trabasso (1973) pursued the plausibility of the distinction between a verbatim representation of sentences and a more semantic representation (e.g., propositional representation) of sentences. In both studies subjects were asked to do a verification task in which reaction times (or verification times) were measured. In the verification task subjects were initially presented sentences to remember and then asked to verify a probe sentence based on

¹ This research was supported by Grant in Aid for Scientific Research, Ministry of Education (Project Number 149008). The first author held a fellowship from the Japan Society for the Promotion of Science while this paper was written.

² We would like to thank Walter Kintsch and Robin Jeffries for valuable comments which improved this paper.

the input sentence. As to immediate memory for sentences, it was found that probe sentences were verified faster if the original input sentences were of the same voice; that is, both probe and input were active sentences or both probe and input were passive sentences. For example, "The car was hit by the truck" was more quickly verified as true if the original input sentence was the same than if it was "The truck hit the car". If the immediate representation of both input and probe is supposed to be form-specific, then it will take longer to verify the sentences which mismatch physically. So the results above indicate that verbatim representations of sentences were stored in short-term memory.

If a form-specific, verbatim representation still remains in long-term memory, the advantage of an exact match between input and probe should be found in verification latencies of a delayed verification task. On the other hand, if a long-term representation of the sentence is semantic or propositional, it should not reflect the voice of the sentence. And the advantage of an exact match of sentences should disappear. Garrod and Trabasso confirmed the decrease of this advantage with a delay of a few seconds. They concluded that either surface or deep structure information was available in long-term store.

Anderson (1974) concluded that immediately after presentation the representation of a sentence is a verbatim image, but at delays there are both verbatim images and propositional representations. Further, he inferred that these propositional representations seemed to have an active-like character.

The purpose of the present study is to test the plausibility of these conclusions by using Japanese active and passive sentences. Alfonso (1974) notes that: "When we speak of the PASSIVE in Japanese the student should not think of the Japanese passive as he thinks of the English PASSIVE, for there are basic differences be-

tween the two. (a) In Japanese not only DYNAMIC VERBS but also certain NON-DYNAMIC VERBS can have a PASSIVE. Verbs like 'rain', 'die', 'sleep', etc., can have a PASSIVE in Japanese, and of course 'go', 'arrive', 'cry', etc. (which are DYNAMIC VERBS), can also have a PASSIVE . . ." (p. 935). Because of this special characteristic of Japanese passive form, it might be possible to get different results on the problem of verbatim versus propositional representation of active and passive sentences in memory.

This study replicated Anderson's experimental procedures with some minor changes. In this study two types of representations are assumed: verbatim representation and common representation. Verbatim representation simply means that active sentences and passive sentences are represented differently in memory. Common representation means that active sentences and passive sentences are represented in the same form. The logic of the experiment is the same as in the preceding studies. If an active sentence and a passive sentence are represented in different forms, match and mismatch between input and probe form will produce a difference in verification latencies. But if an active sentence and a passive sentence are represented in a common form, verification time will not show the interaction between input form and probe form.

Method

Materials

Ninety-six active sentences were constructed (Active Sentences). Then 96 passive sentences were derived by transforming these active sentences into passive ones (Passive Sentences). Another 96 active sentences were constructed simply by reversing the logical subjects and objects of the original active sentences. New active sentences were called False Active Sentences because their meaning is

opposite to the original. Ninety-six False Passive Sentences were constructed from these False Active Sentences. Passive sentences with funny or ungrammatical expressions were not included in the materials. Examples of the four types of sentences are as follows.

A dog bit a monkey.

(Active)

A monkey was bitten by a dog.

(Passive)

A monkey bit a dog.

(False Active)

A dog was bitten by a monkey.

(False Passive)

Japanese passive sentences used in this experiment were directly parallel to the English passive in grammatical structure. The object of the active sentence appeared as the subject of the corresponding passive sentence in both Japanese and English sentences. Physical differences (e.g., difference in the number of words) between Japanese active and passive forms were not bigger than the differences between English active and passive sentences. No special type of passive form of the kind Alfonso indicated was included in this experiment.

Four types of sentences were combined to get the following eight combinations of input and probe sentences: Active-Active, Active-Passive, Active-False Active, Active-False Passive, Passive-Active, Passive-Passive, Passive-False Active, and Passive-False Passive. Each list for sentence verification had nine input sentences. Eight of the sentences were used to check the verification time of each of the eight combinations of input and probe sentences. Another input sentence was deliberately included in the list as a distractor which would destroy the subject's strategy to remember only a part of an input sentence. Either the noun or verb in a distractor sentence was different from the noun or verb in a probe sentence. Four lists were used for the immediate verification tasks and eight lists were used for the delayed

verification tasks. A set of 12 lists of input sentence consisted of 96 sentences and 12 distractor sentences. A second set of 12 lists was constructed by reversing the voice of the input sentences of the first set. Only one set of probe lists was prepared.

Subjects

Twenty-six male subjects were tested individually. They were students at Tokyo Institute of Technology who volunteered their participation in this experiment. Half of them were given the first set of input lists, and the other half were given the second set of input lists.

Procedure

The input sentences written on 13×18 cm cards were presented to the subject at a 15 s rate. The probe sentences were presented on a screen by a slide projector. Projection of the probes, the measurement of verification time (VT) and print-out of VT were controlled by the Multi-Unit System (Takei Kogyo Co.).

In the immediate verification task the subject studied an input sentence for 15 s. Two seconds later the probe was projected on a screen in front of him. He decided whether the meaning of the probe was the same as the input. Then he indicated whether the probe sentence was true or false by pushing the Yes button or the No button. His verification time was recorded by a digital printer. Then he studied the second input sentence and verified the second probe sentence. He repeated this process until he finished all nine pairs of inputs and probes.

In the delayed verification task the subject studied nine input sentences successively at a 15 s rate. Then one of the nine probes was shown and verified by him. Two seconds later the second probe was presented to be verified. This process was repeated until all nine probes were verified. The presentation order of input sentences was randomized, but the order of probes was fixed for all subjects.

Table 1
Means and standard deviations of verification time as a function of voice of input,
voice of probe, truth value, and delay of condition

	Combination of input and probe sentences		Mean (ms)	SD
The immediate verification task	Active-Active	(A-A)	2 015	499
	Active-Passive	(A-P)	2 402	662
	Passive-Active	(P-A)	2 219	540
	Passive-Passive	(P-P)	2 313	639
	Active-False Active	(A-FA)	2 292	542
	Active-False Passive	(A-FP)	2 549	641
	Passive-False Active	(P-FA)	2 340	552
	Passive-False Passive	(P-FP)	2 527	625
The delayed verification task	Active-Active	(A-A)	2 347	458
	Active-Passive	(A-P)	2 624	599
	Passive-Active	(P-A)	2 688	748
	Passive-Passive	(P-P)	2 538	614
	Active-False Active	(A-FA)	2 397	547
	Active-False Passive	(A-FP)	2 719	636
	Passive-False Active	(P-FA)	2 415	517
	Passive-False Passive	(P-FP)	2 698	653

The average delay between input sentences and their corresponding probe sentences was approximately 80 s.

Subjects practiced on the two experimental conditions by using practice lists before the actual experiments. The 12 lists were divided into four blocks. One list was tested in the immediate condition and two in the delayed in each block of three lists.

Results

Errors in truth judgments were excluded in computing mean verification times. Error rates were 3% in the immediate condition and 6% in the delayed condition. The mean verification times are shown in Table 1 and Fig. 1, classified according to voice of input, voice of probe, truth, and delay of testing. Analyses of variance were performed on these data using subjects as a random variable. Each subject contributes one datum, his mean verification time, to each of 16 conditions

in the analyses of variance. The interaction of each treatment with subjects was used as an error estimate for the treatment.

Significant main effects were found for all four factors. Subjects were faster with active input than passive input, 2 418 ms vs. 2 467 ms, $F(1, 25)=5.07$, $p<.05$; and faster with active probe than passive probe,

Fig. 1. Mean verification times as a function of voice of input, voice of probe, truth value, and delay of condition.

2 339 ms vs. 2 546 ms, $F(1, 25)=40.75$, $p<.01$. They were faster in the immediate verification condition than the delayed, 2 332 ms vs. 2 553 ms, $F(1, 25)=25.30$, $p<.01$; and faster in making true responses, 2 393 ms vs. 2 492 ms, $F(1, 25)=6.61$, $p<.05$.

There was a highly significant input by probe interaction, $F(1, 25)=12.79$, $p<.01$. This is the form effect found repeatedly in former studies. Subjects are faster when voice of input and probe match. Input $\times$ probe $\times$ truth interaction was also significant, $F(1, 25)=7.01$, $p<.05$.

Input $\times$ probe $\times$ lag interaction was not found to be statistically significant, $F(1, 25)=.23$. Input $\times$ probe $\times$ lag $\times$ truth interaction was not significant either, $F(1, 25)=.58$.

As to making true or false responses, there was a significant probe $\times$ lag $\times$ truth interaction. That is, probe $\times$ lag interaction was significant in the case of true responses, but not significant in false responses.

A significant lag $\times$ truth interaction, $F(1, 25)=7.97$, $p<.01$, indicates that subjects were faster in making true responses in the immediate recognition, 2 237 ms vs. 2 427 ms, but not in the delayed condition, 2 549 ms vs. 2 557 ms.

A significant probe $\times$ truth interaction, $F(1, 25)=6.92$, $p<.05$, means that there was no difference in verification time between true and false responses for active probes, but true responses were faster for passive probes.

Discussion

From the interactions observed in this experiment, the following conclusions could be drawn. First, as to true responses, a clear form effect was found. Subjects could verify sentences faster when voice of input and probe matched. This result supports the verbatim representation hypothesis: Active sentences and passive sentences are represented different-

ly in memory. Second, it was not found in this experiment that verbatim representations in the immediate verification task changed to common representations in the delayed verification task. Active and passive sentences were still represented in a different form after 80 s. Third, the voice of the probe was found more influential than the voice of the input to the verification time of false sentences. At first sight this seems to support the common representation hypothesis. But it was impossible for subjects to know whether a sentence was true or false at the time of input and to use different representation modes for true and false sen-

Fig. 2. A flowchart of the information-processing model.

Table 2
Theoretical equations for verification times

Input-probe	Immediate verification	Delayed verification
A-A	T	T+L
A-P	T+Pr+Mn+Mv	T+L+Pr+Mn+Mv+R
A-FA	T+Mn+R	T+L+Mn
A-FP	T+Pr+Mv+R	T+L+Pr+Mv+R
P-A	T+Pc+Mn+Mv	T+L+Pc+Mn+Mv+R
P-P	T+Pr+Pc	T+L+Pr+Pc
P-FA	T+Pc+Mv+R	T+L+Pc+Mv
P-FP	T+Pr+Pc+Mn+R	T+L+Pr+Pc+Mn+R

Note: $T = t_1 + t_2 + \dots + t_9$.

tences. Therefore, this result must be based upon some special characteristics of verification process of false sentences.

To explain the mean verification times in Table 1, an information processing model of sentence verification process was proposed. As mentioned before, subjects used a verbatim representation both in the immediate verification task and in the delayed verification task. Olson and Filby (1972), and Anderson (1974) already proposed the model of immediate verification of English sentences by verbatim representation. This model assumes that subjects compare the subjects of the input sentence and the probe sentence, and then compare the verbs of the input and the probe. It also assumes that responding "false" takes more time than responding "true".

This model is appropriate to the immediate verification task of Japanese active and passive sentences. A part of the model was modified to account for the process of the delayed verification task. The information processing steps of this model are shown in Fig. 2, and the times associated with each step are given beside or above each box, such as L, Pr, t_1 , etc. In the case of delayed verification, the process of search in long-term memory was attached. And also, the branching conditions from the step of "index value" were changed to fit the data.

Table 3
Parameter estimates

Common verbatim times	T	2 095 ms
Added reading time for passives	Pr	167 ms
Time to retrieve verbatim from LTM	L	222 ms
Added comparison time for passives	Pc	50 ms
First noun mismatch time	Mn	37 ms
Verb mismatch time	Mv	66 ms
Added time for recheck	R	156 ms

The order of comparison (the first nouns [N1], the second nouns [N2], verbs [V]) is slightly different from the English version of the model. This reflects the syntax difference between an SOV language (Japanese) and an SVO language (English), as well as procedural differences. Because a distractor sentence was included in the list in order to destroy subjects' strategy to remember only a part of a sentence, they had to check both N1 and N2.

The correlation coefficient between observed VTs and the VTs predicted by the model was .967. The model explained 93.5% of the variance of the mean VTs.

Table 2 shows the prediction equations for eight conditions. Table 3 shows the parameter estimates obtained by the least squares estimation method.

The most important conclusion drawn

from these analyses is that the verbatim representation model works very well both in the immediate recognition and the delayed recognition of Japanese sentences. A delay of 80 s is not long enough for necessitating a common representation hypothesis for active and passive sentences.

Why does a verbatim representation of Japanese passive survive longer than the representation of English passive? As mentioned before the Japanese passive sentences used in this experiment were directly parallel to the English passive in structure. If physical differences between Japanese active and passive sentences were bigger than the difference between English active and passive sentence, it should be natural that verbatim representation of Japanese passive sentence could survive longer than the one of English passive sentences. This explanation can not be applied in this experiment because physical differences were minimized.

Howard and Niyekawa-Howard (1976) wrote as follows. "It has commonly been argued that the Japanese passive differs markedly from the English passive not only in its syntactic behavior but in its semantic character as well. For example, Kuroda (1965) states that 'the Japanese passive sentence is, in principle, not neutral as it is in English, but carries an implication of disadvantage for the subject' (p. 160). Other linguists working within widely divergent theoretical frameworks have distinguished between two classes of passive sentences, those that have a strong emotional implication for the subject and those that do not" (p. 209). Howard and Niyekawa-Howard say that the former type of passive is called "adversative passive", "adversity passive" or "affective passive", and that the latter type is called "pure passive" or "simple passive". As an example of the adversative passive, they contrast the following active and passive sentences (p. 210).

- a. *Oya wa kodomo o Nihon ni nokoshita.*
parent child Japan leave

'The parent left his child in Japan.'

- b. *Kodomo wa oya ni Nihon ni nokosareta.*
leave-passive

'The child was left in Japan by his parent.'

"In this case, the passive sentence clearly implies that the child was rejected or otherwise suffered an adverse effect. This implication is absent for the active sentence." (p. 210)

In addition to the existence of the adversative passive, there is a special type of passive which does not have the corresponding active form. The examples are the following passives.

Jack wa ame ni hurareta.
rain fall-passive

'Jack was rained on.'

Jack wa tsuma ni sinareta.
wife die-passive

'Jack was died by his wife.'

Based on these linguistic analyses of Japanese passive sentences, it is reasonable to assume that the Japanese tend to process and retain a passive sentence as a passive, and that transforming every passive into active form distorts meaning and sometimes makes no sense. When a speaker uses a passive sentence, a hearer should notice it in order to cooperate with the speaker's intention. The hearer must understand that the speaker is implicating that he uses a passive form instead of an active form. If the Japanese have a stronger strategy to process a passive sentence differentially from an active sentence than English speaking people, this same strategy was certainly used in this experiment. In this experiment no special passives of the type mentioned above were included in the material, so subjects could have used the same manner of information processing as English speaking subjects did. But Japanese subjects seemed to have used their everyday strategy in this experiment. Consequently, it should be natural that a verbatim representation of Japanese passive survived longer than the one of English passive.

This argument is related to pragmatics. Since the work of Morris (1938) it has been common to recognize three areas within the field of semiotics: syntax, semantics, and pragmatics. He defined pragmatics as the study of the relations between signs and their human users. A more restricted definition can be seen in Gazdar (1979). He made the following statement. "Pragmatics has as its topic those aspects of the meaning of utterance which cannot be accounted for by straightforward reference to the truth conditions of the sentences uttered. Put crudely: PRAGMATICS = MEANING - TRUTH CONDITIONS" (p. 2). Recently psychologists have begun to pay attention to a pragmatic function of surface forms. Keenan, MacWhinney, and Mayhew (1977) found that statements which were high in interactional content (e.g., speaker's intentions, beliefs, and attitude toward the listener) yielded excellent memory for surface form, as well as meaning. Kintsch and Bates (1977) found that surface memory was particularly strong for jokes and extraneous statements that deviate from the text act of a lecture. And they proposed that memory for surface form should be a function of the role of a statement in the whole text unit. Bates, Masling, and Kintsch (1978) reported that surface memory tended to be higher for explicit reference than for anaphoric utterances.

The present finding that the surface form of the Japanese passive survived longer introduces a speculative hypothesis that it might be another instance of pragmatic effects in memory. It demonstrates that in certain cases people remember not only what is said, but also how it is said, even in a laboratory setting.

This leads to a new hypothesis that how long a verbatim representation survives should depend on the conditions of an experiment and on the strategy of information processing subjects use in an experiment. And also it is necessary to study a change of representation over longer time

periods as Anderson and Paulson (1977) suggested. Finally, the present research suggests a rather new research area in psychology, that is, the effects of pragmatics in human information-processing.

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- (Received June 25, 1980 ; accepted March 28, 1981)