Case particle errors in sentence production in Japanese aphasia

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The present study investigated case particle errors in sentence production in Japanese people with aphasia. The patients with fluent aphasia showed many case particle substitutions, whose occurrence rate increased as the number of arguments increased. This indicates that there are deficient controlling mechanisms for case assignment at the positional level processing in fluent aphasia. In non-fluent aphasia, argument omissions were found more than particle only omissions. In Japanese, argument nouns can be omitted in normal conversations if they are inferable from the context. Japanese patients with non-fluent aphasia may use a language-specific strategy, relying on argument omissions rather than only case particle omissions.

Keywords : Aphasia, Sentence production, Japanese, Case particles

1. Introduction

Deficits at the sentential level are one of the common characteristics in aphasia. Traditionally, it has been argued that in European languages, agrammatic aphasia exhibits omission of function words including inflectional morphology in both verb and noun phrases while paragrammatic aphasia shows errors in function words (e.g. Goodglass, 1993). Japanese is an SOV, agglutinative language where verbs occur in the sentence final position, and case marking is represented by particles positioned after nouns. In Japanese non-fluent aphasia, omission of case particles is said to be main characteristics in agrammatism[1]. Also, it is sometimes stated that Japanese people with fluent aphasia exhibit paragrammatism where incorrect case particles are used (Iwata, 1996; Takeuchi, 1995). However, the whole picture is not so simple. In the Japanese literatures (e.g. Sasanuma et al., 1989), it has been argued that telegraphic speech in which only content words are produced is rarely observed in non-fluent aphasia. In fluent aphasia, furthermore, we have the lack of systematic studies dealing with characteristics of deficiency at sentence production in Japan, and little is known about Japanese fluent aphasia in terms of its grammatical deficits.

The aim of this study is to examine how Japanese people with aphasia observed ordinarily in clinical settings exhibits errors in case particles. Especially, I will focus on the two types of case particle errors: particle substitutions and omissions. Recent studies in European languages analyzed various errors in sentence production within refined psycholinguistic models (e.g. Garrett, 1980), which may reveal sentence production deficits in aphasia more explicitly than traditional frameworks do. I will discuss error patterns using a sentence production model.

2. Method

2.1 Participants

Seventeen persons with aphasia (9 fluent and 8 non-fluent) participated in this study. All participants were mono-lingual Japanese speakers. They were all right-handed and suffered from at least one CVA in the left hemisphere. Severity of aphasia varied among the participants; it was determined by the responsible speech-language-hearing therapists. The statistical test revealed that there was no significant difference in severity of aphasia between the two groups: people with fluent and non-fluent (p=.80, two-tailed Fisher's exact test). For the participants' background information, see Appendix 1.

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2.2 Stimuli

The sentence production test in the SALA (Sophia Analysis of Language in Aphasia, Fujibayashi et al., 2004) was administered. The test was developed based on the TRIP (Thematic Roles in Production, Whitworth, 1995). The TRIP assesses both the picture naming of nouns and the picture description of events where the same nouns are used in both the tasks so that we can compare word retrieval in isolation with that of at the sentence level. The test in the SALA was constructed in the same way.

The present study concerns case particle deficits in sentence production, and thus I will only describe the sentence production part. There were 44 target items and one introductory practice item in this part. The target items consisted of the following 4 sentence types: (1) one-argument (n=14), (2) two-argument (n=20), and three-argument (n=10). An A6-size card with black-and-white drawings was presented for each target. Table 1 shows a sample of each of the four sentence types. All the stimuli are given in Appendix 2.

Table 1. Construction types

	Number	Example
1-argument sentence	14	Otokonoko ga waratteiru boy NOM smile "The boy is smiling."
2-argument sentence	20	Ushi ga buta o ketteiru cow NOM pig ACC kick "The cow is kicking the pig."
3-argument sentence	10	Otokonoko ga okaasan ni hasami o miseteiru boy NOM mother DAT scissors ACC show "The boy is showing the mother the scissors."

For the two participants (#5 and #6), the number of items was reduced due to unavoidable circumstances. For #5, the total number was 29 (one argument: 14; two argument: 10; three argument: 5), and for #6, the total number was 22 (one argument: 7; two argument: 10; three argument: 5).

2.2 Procedures

All the participants went through the practice test first and then the target test. In the practice test, a feedback was given. In each item in the target test, the examiner presented a target sentence orally to the participant while showing him/her a picture card that the target sentence described[2]. After presentation of all the items in the list, the examiner showed the same picture cards again to the participant and asked him/her to describe the event.

2.3 Analyses

2.3.1 Overall scoring processes

I judged whether each response expressed by the participants was correct or incorrect, and counted correct responses for each sentence type. The expressed sentence sometimes contained different content words than those in the original sentence. I followed the scoring criteria indicated in the manual of the SALA. In principle, a synonym of the original word (e.g. "onnnanoko" (girl) → "kodomo" (child)) was allowed. Altering a construction with retainment of propositional meaning such as passivization was also allowed. In the following example, the

output sentence roughly conveys the same notion as the original one, but it is expressed in a passive form, that is different from the original active voice.

[Nezumi ga] [kuma o] oikaketeiru. → [Kuma ga] [nezumi ni] oikakerareteiru
mouse NOM bear ACC chase bear NOM mouse by chase (PASS)
"The mouse is chasing the bear." "The bear is chased by the mouse."

2.3.2 Error analyses

2.3.2.1 Case particle substitution

In this error, the output sentence becomes ungrammatical due to misuses of case particles. In the following, the nominative case particle "ga" is substituted with the accusative "o".

[Inu ga] [booru o] oikaketeiru. → [Inu o] [booru o] nageteiru.
dog NOM ball ACC chase dog ACC ball ACC throw
"The dog is chasing the ball."

I judged whether particles were acceptable, considering the output verb, not the target verb. See the example below.

[Onnnanoko ga] [otoosan ni] [hako o] miseteiru.
girl NOM father DAT box ACC show
"The girl is showing the father the box."

→ [Otokonoko ga] [onnanoko ni] [kao o] miteiru.
boy NOM girl DAT face ACC see

In this example, the verb changes from "miseteiru" (show) to "miteiru" (see). In the present analysis, the particle "ni" in "onnanoko ni" is incorrect, although the case marking pattern fits the original sentence.

2.3.2.2 Case particle omission

I divided omission errors into two types: (1) only particles omitted and (2) whole arguments omitted. In the former, a particle is omitted, but a noun preceding the particle is produced. The latter means that a noun as well as a particle is omitted. In the first example below, a nominative case particle "ga" is omitted, and in the second example, the whole argument "uma o" ("uma" horse and "o" accusative marker) is omitted.

[Kuma ga] [piano o] ketteiru. → [Kuma ϕ] [piano o] ketteiru.
bear NOM piano ACC kick bear piano ACC kick
"The bear is kicking the piano."

[Otokonoko ga]　[uma o]　hiiteiru → [Otokonoko ga]　[φ]　hippatteiru
boy　NOM　horse ACC　pull　boy　NOM　pull
“The boy is pulling the horse.”

3. Results

3.1 Overall scores

Table 2 shows the number and percentage of correct responses in each construction type in the fluent and non-fluent participants with aphasia. There was no significant difference in the number of correct responses between the two groups in each construction type (1-argument: p=.35; 2-argument: p=.22; 3-argument: p=1.00, two-tailed Fisher’s exact test) as well as in total (p=.29).

Table 2. Scores of each construction type

	Fluent	Non-fluent	Total
1-argument	86/126	70/105	156/231
	(68.3%)	(66.7%)	(67.5%)
2-argument	88/170	67/150	155/320
	(51.8%)	(44.7%)	(48.4%)
3-argument	40/85	35/75	75/160
	(47.1%)	(46.7%)	(46.9%)
Total	214/381	172/330	386/711
	(56.1%)	(52.1%)	(54.3%)

3.2 Case particle substitutions

Forty-three substitution errors (5.96%) out of 721 particles were found in fluent aphasia, and 16 substitutions (2.54%) out of 630 particles were found in non-fluent aphasia. The more arguments the sentence required, the more particle substitution errors were found especially in fluent aphasia (Table3, Figure 1) [3].

Table 3. Numbers of substitution errors in case particles

	1 Arg	2 Arg	3 Arg	Total
Fluent	1/126	18/340	24/255	43/721
Non-fluent	1/105	6/300	9/225	16/630

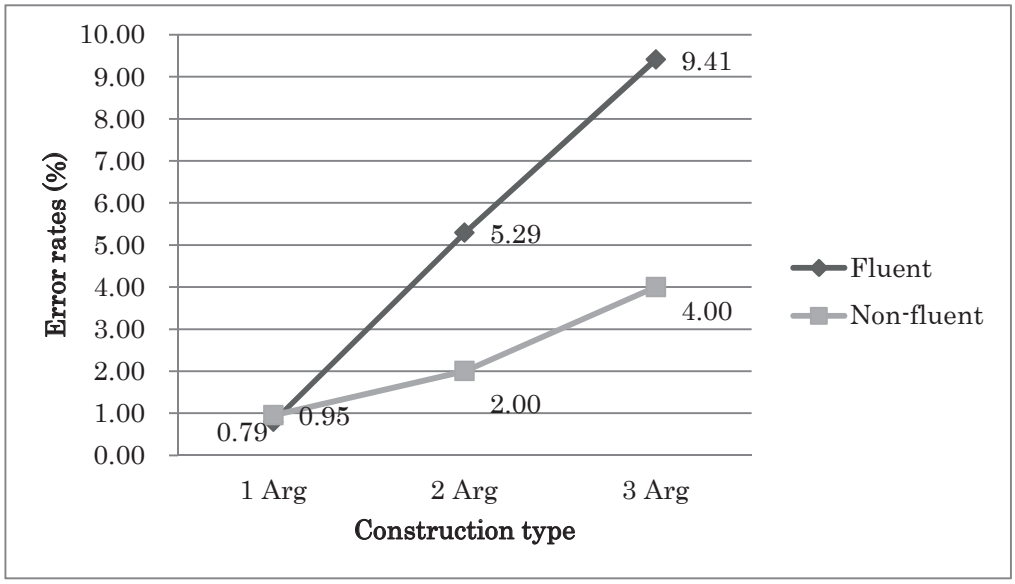

Figure 1. Percentages of case particle substitution errors

3.3 Case particle omissions

There were small number of particle omissions (with nouns produced) in both fluent and non-fluent aphasia (27 errors (3.74%) out of 721 particles in fluent and 15 errors (2.38%) out of 630 particles in non-fluent in total). As shown in Table 4 and Figure2, the rates of particle omissions did not vary among the construction types.

Table 4. Numbers of case particle omission errors

	1 Arg	2 Arg	3 Arg	Total
Fluent	6/126	12/340	9/255	27/721
Non-fluent	2/105	8/300	5/225	15/630

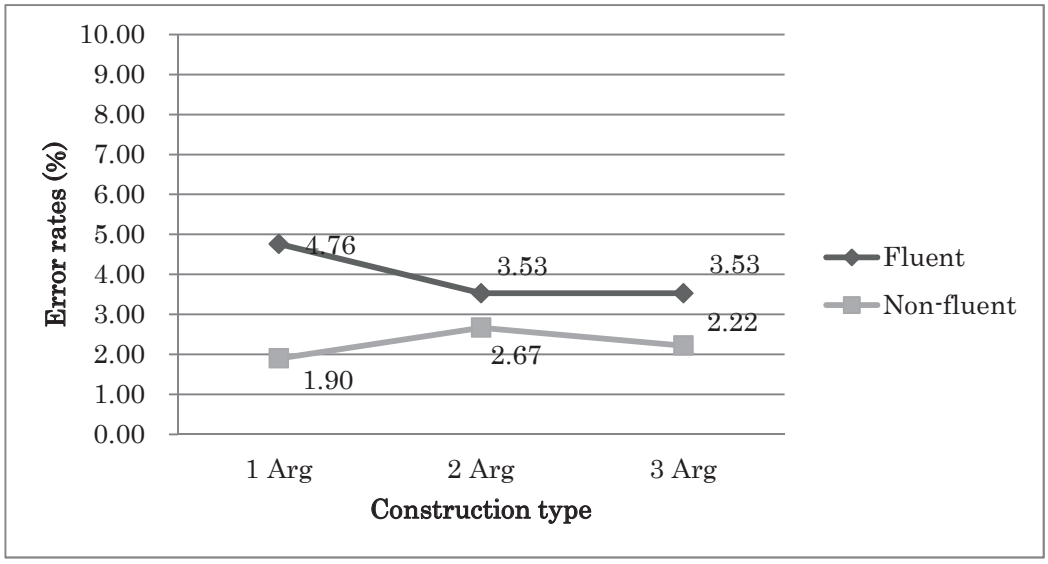

Figure 2. Percentages of particle omission errors (nouns produced)

As shown in Table 5 and Figure 3, more argument omission errors were found in non-fluent aphasia than fluent aphasia; there were 25 omissions out of 721 arguments (3.47%) in fluent aphasia and 67 omissions out of 630

arguments (10.63%).

Table 5. Numbers of argument omission errors (omissions of nouns + particles)

	1 Arg	2 Arg	3 Arg	Total
Fluent	1/126	17/340	7/255	25/721
Non-fluent	7/105	33/300	27/225	67/630

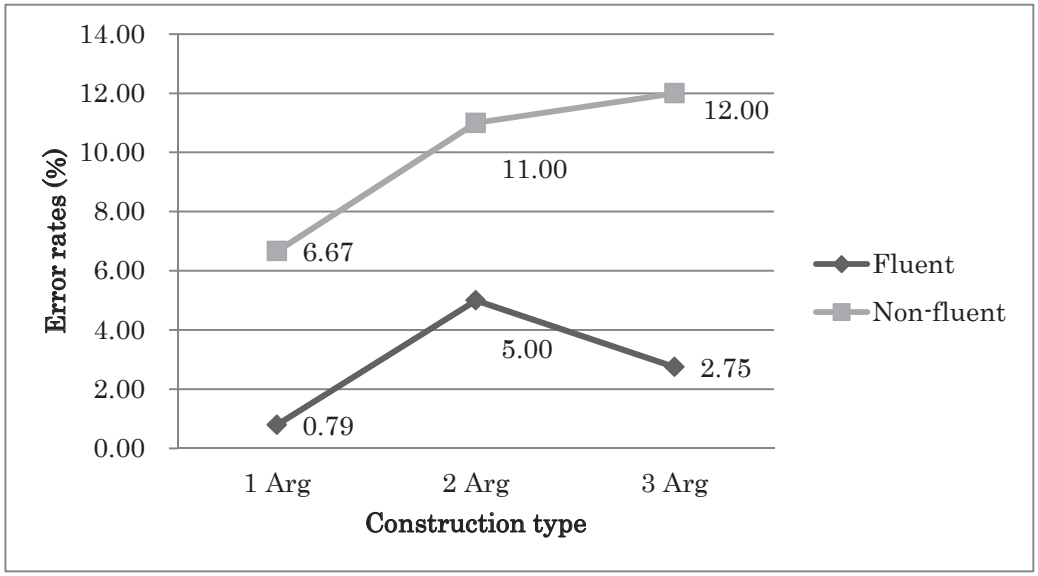

Figure 3. Percentages of argument omission errors (omissions of nouns + particles)

The two types of aphasia exhibited different omission patterns (Figure 4). The statistical analysis confirms that argument omissions were observed much more than particle only omissions in non-fluent aphasia while such a trend was not found in fluent aphasia (p<.01, two-tailed Fisher's exact test).

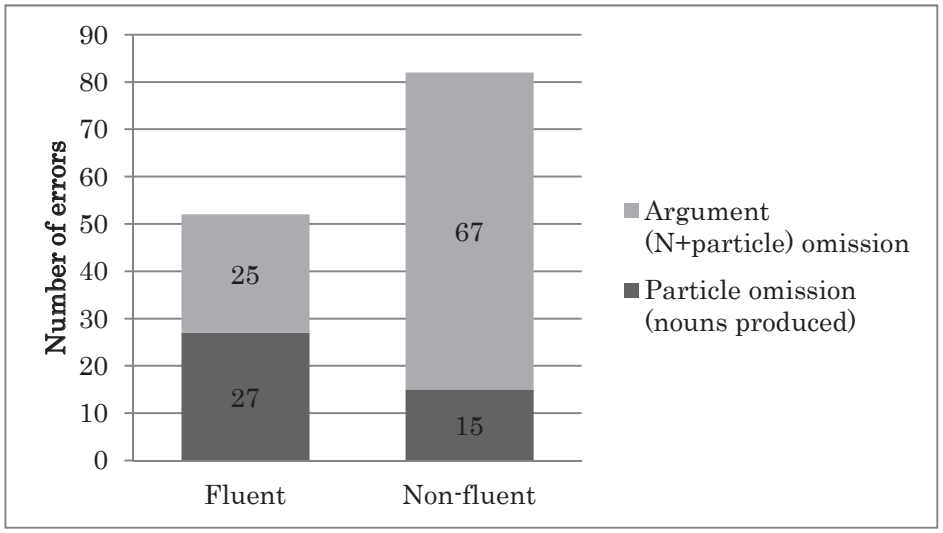

Figure 4. Argument omissions and only particle omissions

4. Discussion

Figure 5 shows Garrett's model (Garrett, 1980) of sentence production. This model was originally developed

from various data of speech errors such as spoonerism, and covers non-linguistic conceptual processes to actual articulatory processes. There are two components pertinent to grammatical processing: the functional and positional levels. The functional level selects the major lexical items, specifies the predicate-argument structure, and assigns semantic roles onto the argument nouns. In the positional level, the syntactic frame accompanied by the grammatical morphemes is created. In aphasia in European languages, it is argued that argument omission indicates malfunction in forming the predicate-argument structure or assigning semantic roles to the nouns in the functional level representation while functional word errors such as substitutions or omissions of inflectional morphology may occur due to problems in activating the syntactic frame at the positional level (e.g. Webster et al., 2007; Whitworth, 1995).

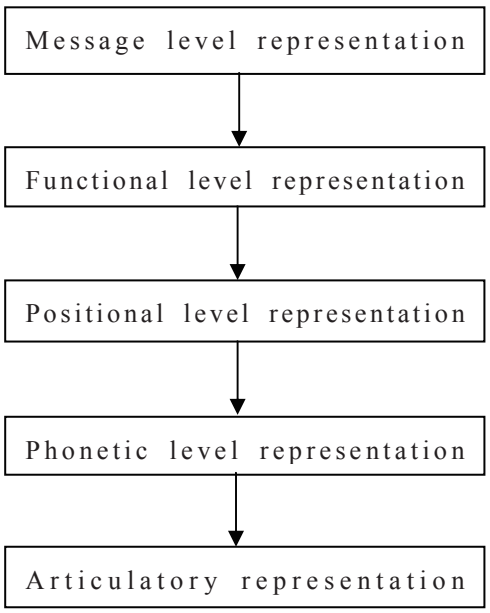

Figure 5. Garrett's model of sentence production

In this study, the participants with fluent aphasia and those with non-fluent aphasia did not show a clear difference in the overall scores. However, the error patterns exhibited in the two groups were quite different, being consistent with the traditional view; patients with fluent aphasia tend to substitute grammatical morphemes with other morphemes while patients with non-fluent aphasia are prone to omit them.

The particle substitutions in the participants with fluent aphasia may reveal that they have disorders at the positional level, which make them difficult process case particle specifications in the syntactic frames. Also, their case marking was influenced by the number of arguments; the more arguments were contained in a sentence, the more case marking errors were found. This might mean that complicated computation at the positional level can result in incorrect selection of case particles. Butterworth & Howard (1987) and Harley (1990) suggested that paragrammatism does not occur due to syntactic deficits per se; paragrammatic patients retained syntactic rules, but had deficient mechanisms that control their application, resulting in paragrammatic speech. Considering their arguments within Garrett's model, the result shown in the patients with fluent aphasia may suggest that sentences with multiple arguments require more processing loads in controlling the creation of the syntactic frames than sentences with single arguments, and thus fluent aphasia with control deficits may exhibit more case marking errors in two or three argument sentences than in 1-argument sentences.

In the patients with non-fluent aphasia, telegraphic sentences were rare. This finding is consistent with some

previous studies in Japanese (e.g. Sasanuma et al., 1989). However, the results of the present study do not indicate that non-fluent aphasia retains normal sentence processing without case marking deficits. Instead, the patients tended to omit the whole arguments, rather than omit the case particles only. In European languages, it is argued that many patients with non-fluent aphasia show evidence indicating their deficiencies at the functional level as well as the positional level (e.g. Carammaza & Miceli, 1991; Saffran et al., 1980). Although many patients with non-fluent aphasia may have deficient predicate-argument structures in Japanese language as well, I propose another possible interpretation. In Japanese, argument nouns can be omitted in normal conversations if they are inferable from the context. This language-specific phenomenon may induce argument omissions in non-fluent aphasia. Non-fluent aphasia has defining characteristics of its reduced speech output (Takeuchi, 1995). When patients have difficulties in case marking, they may strategically rely on more familiar type of omissions (i.e. argument omissions) even if they could produce nouns. Assuming this language-specific strategy, we can explain why telegraphic speech is rarely found in Japanese aphasia.

5. Conclusions

This study examined case particle errors in Japanese people with aphasia. The patients with fluent aphasia showed many case particle substitutions, whose occurrence rate increased as the number of arguments increased. This may reflect deficient controlling mechanisms for case assignment at the positional level processing. In non-fluent aphasia, argument omissions were found more than particle only omissions. Japanese patients with non-fluent aphasia may use a language-specific strategy, relying on argument omissions rather than only case particle omissions.

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Notes

[1] In Japanese, case particles can be absent in sentences produced by normal speakers. This phenomenon is sometimes apparent in casual speech (Tsujimura, 1996). Patients with agrammatism exhibit particle omissions in formal situations such as picture descriptions in language testing as well as in conversations. Thus, we may say that particle omissions in agrammatic speech are different from those found in normal speech.

[2] This test uses a delayed repetition task in order to elicit the responses. One of the advantages adopting this strategy is that the subjects are expected to use specific words and constructions so that they can avoid elliptic and deictic responses if they have normal linguistic abilities (Whitworth, 1996).

[3] The number in the denominators indicates the number of all possible particles, including omitted particles as well as actually produced particles.

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Appendix A. Participants

	Sex[1]	Age	Etiology	Fluency[3]	Severity	MPO[4]
1	M	48	hemorrhage	F	mild	38
2	F	52	SAH[2], infarction	F	moderate	26
3	M	56	hemorrhage	F	moderate	55
4	M	73	infarction	F	severe	115
5	M	64	infarction	NF	moderate	58
6	M	63	hemorrhage	NF	moderate	20
7	M	50	hemorrhage	NF	mild	84
8	M	54	hemorrhage	NF	severe	132
9	F	65	infarction	NF	mild	252
10	M	57	infarction	NF	mild	152
11	M	49	infarction	F	mild	114
12	M	65	infarction	NF	mild	61
13	M	65	hemorrhage	NF	moderate	144
14	M	65	infarction	F	moderate	46
15	M	61	infarction	F	mild	61
16	F	53	SAH	F	moderate	55
17	M	30	infarction	F	moderate	103

[1]: M: male, F: female, [2]: SAH: subarachnoid hemorrhage, [3]: F: fluent, NF: non-fluent

[4]: MPO: months post onset

Appendix B. List of stimuli

1-argument sentences

1	Otokonoko ga waratteiru. boy NOM smile	“The boy is smiling.”
2	Akachan ga utatteiru baby NOM sing	“The baby is singing.”
3	Uma ga aruitteiru. horse NOM walk	“The horse is walking.”
4	Neko ga hashitteiru. cat NOM run	“The cat is running.”
5	Buta ga waratteiru. pig NOM smile	“The pig is smiling.”
6	Tori ga utatteiru. bird NOM sing	“The bird is singing.”
7	Okaasan ga hashitteiru. mother NOM run	“The mother is running.”
8	Onnanoko ga naiteiru. girl NOM cry	“The girl is crying.”
9	Inu ga neteiru. dog NOM sleep	“The dog is sleeping.”
10	Nezumi ga korondeiru. mouse NOM fall down	“The mouse is falling down.”
11	Kuma ga aruiteiru. bear NOM walk	“The bear is walking.”
12	Obaasan ga naiteiru. grandmother NOM cry	“The grandmother is crying.”
13	Usagi ga neteiru. rabbit NOM sleep	“The rabbit is sleeping.”
14	Otoosan ga korondeiru. father NOM fall down	“The father is falling down.”

2-argument sentences

1	Neko ga koppu o nameteiru. cat NOM glass ACC lick	“The cat is licking the glass.”
2	Inu ga booru o oikaketeiru. dog NOM ball ACC chase	“The dog is chasing the ball.”
3	Akachan ga densha o tataiteiru. baby NOM train ACC hit	“The baby is hitting the train.”
4	Onnanoko ga terebi o motteiru. girl NOM TV ACC hold	“The girl is holding the TV.”
5	Kuma ga piano o ketteiru. bear NOM piano ACC kick	“The bear is kicking the piano.”
6	Okaasan ga gitaa o nageteiru. mother NOM guitar ACC throw	“The mother is throwing the guitar.”
7	Otoosan ga baketsu o fundeiru. father NOM bucket ACC step on	“The father is stepping on the bucket.”
8	Buta ga kutsu o hiiteiru. pig NOM shoe ACC pull	“The pig is pulling the shoe.”
9	Uma ga kuruma o oshiteiru. horse NOM car ACC push	“The horse is pushing the car.”
10	Otokonoko ga osara o aratteiru. boy NOM dish ACC wash	“The boy is washing a dish.”
11	Otokonoko ga uma o hiiteiru. boy NOM horse ACC pull	“The boy is pulling the horse.”
12	Ushi ga kuma o aratteiru. cow NOM bear ACC wash	“The cow is washing the bear.”
13	Nezumi ga kuma o oikaketeiru. mouse NOM bear ACC chase	“The mouse is chasing the bear.”
14	Inu ga nezumi o nameteiru. dog NOM mouse ACC lick	“The dog is licking the mouse.”
15	Ushi ga buta o ketteiru. cow NOM pig ACC kick	“The cow is kicking the pig.”
16	Inu ga usagi o aratteiru. dog NOM rabbit ACC wash	“The dog is washing the rabbit.”
17	Otoosan ga ushi o oshiteiru. father NOM cow ACC push	“The father is pushing the cow.”
18	Otokonoko ga inu o motteiru. boy NOM dog ACC hold	“The boy is holding the dog.”
19	Buta ga neko o nageteiru. pig NOM cat ACC throw	“The big is throwing the cat.”
20	Okaasan ga kuma o daiteiru. mother NOM bear ACC embrace	“The mother is embracing the bear.”

3-argument sentences

1	Onnanoko ga neko ni hana o miseteiru. girl NOM cat DAT flower ACC show	“The girl is showing the flower to the cat.”
2	Otoosan ga inu ni keeki o ageteiu. father NOM dog DAT cake ACC give	“The father is giving the cake to the dog.”
3	Okaasan ga akachan ni pan o ageteiru. mother NOM baby DAT bread ACC give	“The mother is giving the bread to the baby.”
4	Otokonoko ga okaasan ni hasami o miseteiru. boy NOM mother DAT scissors ACC show	“The boy is showing the scissors to the mother.”
5	Onnanoko ga otoosan ni hako o miseteiru. girl NOM father DAT box ACC show	“The girl is showing the box to the father.”
6	Okaasan ga buta ni tegami o miseteiru. mother NOM pig DAT letter ACC show	“The mother is showing the letter to the pig.”
7	Otokonoko ga neko ni ringo o ageteiru. boy NOM cat DAT apple ACC give	“The boy is giving the apple to the cat.”
8	Obaasan ga kuma ni hon o ageteiru. grandmother NOM bear DAT book ACC give	“The grandmother is giving the book to the bear.”
9	Onnanoko ga obaasan ni yakan o miseteiru. girl NOM grandmother DAT kettle ACC show	“The girl is showing the kettle to the grandmother.”
10	Otoosan ga onnanoko ni meron o ageteiru. father NOM girl DAT melon ACC give	“The father is giving the melon to the girl.”