Processing of Classifiers and Aspect Markers

for Fluent and Non-fluent Aphasic Cantonese Speakers

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Abstract

The study investigated the processing patterns of classifiers and aspect markers for 18 native Cantonese speakers with fluent and non-fluent types of aphasia using tasks with contextual constraints, i.e. a cloze task and a grammaticality judgment task. Stimuli for eliciting classifiers and aspect markers had undergone processes of matching of psycholinguistic variables (age of acquisition, familiarity and imageability) and validating by different groups of normal Cantonese speakers, resulting in a total of 25 stimuli pairs presenting to the participants with aphasia. It was found that significantly better performances were found: (1) on aspect markers than classifiers (at group level and individual level); (2) for the fluent aphasic group than the non-fluent one (though both groups showed difficulty in morpheme processing); and (3) on the judgment than the cloze task, with (1) being consistent with a number of previous findings for Chinese and (2) being consistent with cross-linguistic studies. Adding to findings for tasks, two significant interaction effects were also found between speaker groups and task and between morpheme class and task. These may imply vital effects of task nature on the performance on different morpheme classes for speakers with different types of aphasia.

Processing of Classifiers and Aspect Markers for Fluent and Non-fluent Aphasic Cantonese Speakers

Aphasia is one of the language disorders which draws great focus in the world. It is generally accepted that aphasia can be classified into fluent and non-fluent types. Goodglass and Menn (1985) stated that Broca's aphasia is an example of non-fluent aphasia, which is characterized by patients' non-fluent and effortful speech; on the other hand, Wernicke's, conduction and anomic aphasias are examples of fluent aphasia, with more fluent speech output but more impaired in other areas, e.g. comprehension, repetition, etc.

Despite this classification, most speakers with aphasia suffer from function word impairment, with omission and substitution being more prominent among non-fluent and fluent aphasic speakers respectively (Von Stockert & Bader, 1976; Caplan, 1986). Yet, this distinction is becoming more and more blurred as revealed by recent studies: Miceli, Silveri, Romani and Caramazza (1989) stated that both omission and substitution patterns existed among non-fluent aphasic speakers. Rochon , Saffran, Berndt and Schwartz (2000) also found that individual variations exist for the impairment patterns among Broca's aphasic speakers, which did not confine to omissions or substitutions. Till now, debates still exist for the manifestation of morphological impairment in fluent and non-fluent aphasic speakers.

The studies discussed so far are consistently examining speakers using Indo-European languages, which are of great inflectional morphology that grammatical elements can be easily manifested. However, to fully understand a certain kind of language breakdown, it is essential to carry out more cross-linguistic studies to identify the related universal processes and mechanisms (Bates, Devescovi & Wulfeck, 2001); studying grammtical impairment in languages with comparatively smaller grammatical marker inventories may also be insightful (Law & Cheng, 2002). Chinese is an example that differs from most of the Indo-European languages in terms of grammatical agreement and inflections such as gender and number. A number of studies have been done to investigate the function word impairment in Chinese.

Packard (1990) investigated the production of closed-class morphemes in narratives by a Mandarin agrammatic subject in a single case study. The result showed that the patient had no substitution errors for the morphemes, but underemployment were shown for classes, e.g. classifiers, pronouns, conjunctions, etc. Moreover, the subject over-employed other classes, e.g. aspect markers, negation markers, etc. Packard (1993) further examined productions from informal interviews and picture description tasks by four Mandarin-speaking aphasic subjects (two non-fluent and two fluent). It showed that non-fluent subjects tended to omit and underuse certain morpheme types, e.g. classifiers, coverbs, conjunctions, etc., while fluent subjects had no production difficulty and were even prone to overuse them. Specific to classifiers, Tzeng, Chen and Hung (1991) analyzed the production from nine Broca's and five Wernicke's Mandarin-speaking aphasic patients with a picture description task. Omission and substitution of classifiers were found in both groups.

Apart from the studies examining the functor use in oral narratives, Lu (1994) also investigated the production of 11 types of grammatical morphemes by eight non-fluent (Broca's) and seven fluent (four Wernicke's and three conduction) Mandarin-speaking aphasic patients using a more structured task. A set of three pictures were presented on each trial, with a contrast concerning a particular morpheme. The subjects were required to describe the pictures with a change of use of the morpheme indicated in the picture stimuli with administrator's modeling. It was found that non-fluent group was impaired on production of all grammatical morphemes, while fluent group produced them relatively normally except certain morpheme classes (e.g. conduction aphasics: classifiers and coverb *ba*; Wernicke's aphasics: classifiers, progressive aspect marker *zai,* plural marker *men*, etc.). At morpheme level, there were relatively easy (e.g. aspect marker *le*) and difficult classes (e.g. classifiers, progressive *zai*). Performances on same-type (e.g. aspect marker *zai* and *le*) and same-surface-form-different-function (e.g. *zai* as aspect marker and locative) morphemes may vary. The research suggested that regardless of the aphasia types, morphological deficit was a common impairment across all aphasia syndromes among native Chinese speakers, which was consistent with the findings for Indo-European languages.

In addition to studies of Mandarin, Yiu and Worrall (1996) analyzed the disrupted production patterns of morphemes from 30 Cantonese-speaking aphasic patients with a story-telling task. It was found that all subjects had difficulties in production and could be classified into three distinct groups: the fluent group relatively did not show any significant disruption, but the two non-fluent groups demonstrated impairment in producing various grammatical morphemes, such as classifiers, coverbs, etc., with different extent. However, the accessibility of aspect markers was relatively preserved in the non-fluent groups.

Law and Cheng (2002) examined the production of different grammatical morphemes from six fluent (one Wernicke's and five anomic) and four non-fluent (one transcortical motor and three Broca's) Cantonese aphasic speakers using a constrained-context cloze task. Participants were required to give appropriate morphemes which were missing in the stimuli (e.g. one should give a classifier *ba2* upon the stimuli '*ngo2 maai2 zo2 loeng2 ___ ze1*' (I bought two umbrellas)). It was found that classifiers, aspect markers and negative markers were easier classes than the others, e.g. pronouns, coverbs, etc. Consistent with Lu (1994), dissociated performance could be noticed among members of the same type and between homophonous morphemes. At speaker group level, the fluent group generally performed better, but the difference between groups was quantitative rather than qualitative. Neither substitutions nor omissions dominated the error patterns of either aphasia group, which were consistent to findings for Mandarin and Indo-European languages.

Despite the aforementioned studies, study on processing of Chinese grammatical morphemes is still limited. Regarding their methodologies, Packard (1990; 1993) and Yiu and Worall (1996) used narrative tasks only which were of few constraints for one to use the morphemes. The subjects may adopt avoidance strategies to compensate for any breakdown (Law & Cheng, 2002) and thus the results may not truly reveal their processing abilities for the function words. Lu (1994) and Law and Cheng (2002) used tasks with more constrained contexts. However, the task administration in the former study may provide cues for the production of the targets and might thus over-estimate subjects' abilities. The latter one's cloze task only focused on the production but not other domains such as grammaticality judgment on morpheme uses, which should be another important level for one to conclude if the subject's breakdown was due to grammatical processing problems or sole impairment in production (e.g. slips, unfinished utterances) (Schütze, 1996). Moreover, the grammaticality judgment task could be used to elicit reactions to sentence types which occur rarely in conversations (Schütze, 1996), thus speakers' knowledge in unfamiliar conditions could also be studied. With these strengths, speakers' abilities for processing grammatical morphemes could be revealed more accurately if the judgment task was administered together with the cloze task. Relationship between speakers' performance in free and constraint contexts should then be studied to identify any existing discrepancies. Further, these two studies focused on various types of morphemes. Time and effort allocated for studying each morpheme class were limited if compared to studies focusing on certain morpheme types only. Thus, it may be another essential approach to study the processing s of one to two particular types of morphemes with more focused effort. Any dissociation or association found between the morpheme-types may imply linkages in between and thus provide more clues to unveil the underlying processing mechanisms for different morphemes.

Among various morpheme classes, classifiers and aspect markers were chosen as the focus in this study. Literatures have continuously reported dissociated performance for processing of nouns and verbs among Chinese aphasic speakers, with fluent and non-fluent groups being more selectively impaired for nouns and verbs respectively (Bates et al., 1991; Chen & Bates, 1998), which was verified at neurological level that dissociative neural correlates were found for nouns and verbs (Li, Jin & Tan, 2004; Yu et al., 2012). With similar analogy from nouns and verbs, dissociated patterns may also be expected for nominal classifiers and verbal aspect markers between fluent and non-fluent aphasic speakers. Despite the analogy, different processing patterns may also be possible for different individuals.

Therefore, in light of the previous findings, this study aimed to investigate the processing of classifiers and aspect markers of fluent and non-fluent Cantonese aphasic speakers using a cloze task and a grammaticality judgment task which were of constrained contexts. The results of the study could be analyzed in group and individual levels. At the group level, we studied the main effects for the three factors (speaker group, morpheme class and task) and identified any significant interactions in between. At the individual level, we studied the difference in processing of classifiers and aspect markers. To address patients' performance in the free context, language samples would also be obtained in narrative level.

Relationship between performances in narratives and tasks with highly constraint contexts would be identified in order to study the effect of different contexts.

Method

The research was carried out in two stages, namely the development of stimuli and the experimental tasks. First the nouns and verbs in the sentence stimuli for eliciting classifiers and aspect markers were rated by normal participants for their corresponding age of acquisition (AoA), familiarity and imageability as they could affect performance of speakers with aphasia in various tasks, e.g. naming (Bird, Franklin & Howard, 2001; Hirsh & Ellis, 1994; Hirsh & Funnell, 1995). Then the stimuli were further selected according to the normal participants' performance in the cloze and judgment tasks. Finally the finalized stimuli were presented to the participants with aphasia and scores were obtained for analysis.

Development of Stimuli

Participants. Thirty native Cantonese speakers with tertiary education or higher (24 males, six females, M_{age} = 20.8, age range = 19 – 23 years) were recruited for the rating process. Another 32 native Cantonese speakers with tertiary education or higher were recruited to validate the matched stimuli, which 16 of them (11 males, five females, M_{age} = 23.4, age range = 21 – 28 years) were requested to complete the cloze task and the other 16 (seven males, nine females, M_{age} = 23.5, age range = 22 – 26 years) for the judgment task.

Stimuli and procedures.

Rating psycholinguistic variables. Initially a total of 96 sentence stimuli for classifiers and aspect markers were composed for the structured tasks. The nouns and verbs in the stimuli for eliciting the target morphemes were rated by normal participants for their corresponding AoA, familiarity and imageability in a block randomization order, i.e. AoA of nouns, familiarity of nouns, imageability of nouns, AoA of verbs, familiarity of verbs and imageability of verbs. Familiarity was rated with a 5-point scale (1 = *Lowest* and 5 = *Highest*); AoA and imageability were rated with a 7-point scale (1 = *0 – 2 years* or *Lowest* and 7 = *Above 12 years* or *Highest*) (See the rating instructions and scales in Appendix A). After rating, 32 pairs of stimuli for classifiers and aspect markers matched for similar ratings of these psycholinguistic variables were selected for further validation.

Completing the cloze and judgment tasks. In the cloze task, stimuli with the classifiers or aspect markers omitted were given (e.g. '*li1 dou6 jau5 sei3__ wu1 jing1*' (there are four flies) with the classifier '隻 *zek8*' omitted; '*kui5 jing1 sing4 __ dai5 ga1*' (he has promised everyone) with the aspect marker '咗 *zo2*' omitted). They were presented in block randomization order (i.e. stimuli for classifiers and aspect markers were separately presented) and the order of items was also individually randomized within each morpheme class. In the grammaticality judgment task, stimuli were the same sentences in the cloze task with the morphemes filled in. An ungrammatical sentence would be generated according to each stimulus with unsuitable classifiers or aspect markers substituting the correct ones. So the stimuli will be in paired form with one grammatical and the other ungrammatical, e.g. '*li1 dou6 jau5 sei3 zek8 wu1 jing1*' and '* *li1 dou6 jau5 sei3 cheung1 wu1 jing1*'' (as '*cheung1*' was not an appropriate classifier for 'flies') or '*kui5 jing1 sing4 zo2 dai5 ga1*' and '* *kui5 jing1 sing4 gan2 dai5 ga1*' (meaning 'he is promising everyone', which was ungrammatical). All stimuli were presented in individually randomized order. The participants were requested to finish both tasks in written form by filling in the missing words or determining the grammatical sentence in the pair respectively. The data were used for validating the appropriateness of the target answers and verifying if the grammatical contrasts of the paired stimuli in the judgment task were strong enough for differentiation. To select a stimulus, it should be able to elicit a single grammatical target in the cloze task (to avoid too much variation) and be judged as the correct item in the judgment task (to assure a strong grammatical contrast) by over two-thirds of the participants respectively (i.e. from at least 11 out of 16 subjects). The chosen stimuli were then matched again for the aforementioned psycholinguistic variables; those could not be matched would also be eliminated even if they could fulfill the selection criteria. After validating, a subset of 25 stimuli pairs was chosen as the finalized stimuli for participants with aphasia (See Appendix B for the stimuli list).

Experimental Tasks

Participants. Nine pairs of participants with aphasia (a total of 18 participants) were selected from an AphasiaBank research project (Kong, Law & Lee, 2009), with half of them classified with non-fluent type and the other half with fluent type aphasia using a Cantonese version of the Western Aphasia Battery (Yiu, 1992). All of them were Cantonese native speakers and possessed medical reports indicating the stroke histories which lead to subsequent aphasia. Further, their age, education level and gender were matched in order to minimize other factors' effects on their performances in the tasks (see Table 1).

Table 1

Background Information of Participants with Aphasia

Group	Name	Gender	Age	Education level	Aphasia type
Fluent	CML	F	61;03	None	Anomic
	TCH	M	55;10	P.6	Anomic
	CF	M	67;05	F.3	Anomic
	LPN	M	48;08	F.2	Anomic
	WWF	M	63;03	F.3	Anomic
	CWK	M	54;04	Post-secondary	Anomic
	TYK	M	51;05	F.5	Anomic
	KTN	M	54;01	F.3	Anomic
	WWK	M	54;01	F.2	Transcortical sensory
Non-fluent	NYH	F	60;10	None	Broca's
	LYW	M	51;00	P.6	Broca's
	CYY	F	60;04	F.4	Isolation
	MCT	F	50;05	F.3	Transcortical motor
	CKC	M	65;03	F.3	Transcortical motor
	LCY	M	74;10	Degree	Transcortical motor

	CSW	F	50;00	F.5	Transcortical motor
	WML	F	56;02	Post-secondary	Transcortical motor
	CCY	M	57;01	F.4	Transcortical motor

Stimuli and procedures. The 25 validated stimuli pairs for classifier and aspect marker were presented to the participants in form of a cloze task and a grammaticality judgment task. The cloze task would be administered before the judgment task to prevent providing lexical cues for the cloze task if the order was reversed. All stimuli were presented in written form which would also be simultaneously read out to the participants in both tasks (See Appendix C for task instructions). In the cloze task, stimuli for classifiers and aspect markers were presented separately with respective randomized orders. The participants were requested to give the answers orally. In the judgment task, all stimuli pairs were presented in individually randomized order. The participants were requested to determine the grammatical sentence in each pair. Responses were scored if it was either the target answer or an appropriate alternative that had also been given by the normal group (particularly for classifiers in the cloze task); the appropriateness of the answers given by the normal group was judged by three Cantonese native speakers. Scores in four conditions (classifiers in cloze task, classifiers in judgment task, aspect markers in cloze task and aspect markers in judgment task) were then obtained for further analysis. Apart from the two structured tasks, discourse samples from the 18 participants collected through narrative tasks from a modified AphasiaBank protocol (Kong, Law & Lee, 2009) and transcribed with morphological annotations were analyzed. Three tasks (picture description, procedural discourse and story narrative) had been carried out for sample collection. For picture description, the participants would describe four pictures accordingly. For procedural discourse, participants would describe the procedure of making an egg and ham sandwich. For story narrative, participants were required to tell two stories without pictures.

Data analysis. A three-way ANOVA was carried out to compare the performance of participants with fluent and non-fluent aphasia for classifiers and aspect markers in the cloze and grammaticality judgment tasks. The Fisher's exact test was also carried out by setting up contingency tables to identify any dissociation between processing of aspect markers and classifiers for each individual participant. For the narrative data, type-token ratios (TTRs) for classifiers and aspect markers for each participant were calculated to measure the morpheme variety within each class in spontaneous speech. Bivariate correlation test was then carried out to identify any relationship between TTRs in narrative tasks (free contexts) and performances for classifiers and aspect markers in structured tasks (constrained contexts).

Results

Characteristics of Sentence Stimuli for Eliciting Classifiers and Aspect Markers

The 96 sentence stimuli for eliciting classifiers and aspect markers were first composed. The ratings of AoA, familiarity and imageability for the nouns and verbs in the sentence stimuli were then obtained from the normal participants. The nouns and verbs with similar ratings across the three criteria were then matched as pairs, thus 32 stimuli pairs were obtained and the others were eliminated. Then they were further validated by another normal group of participants by completing the cloze and judgment tasks. Seven stimuli for classifiers could not fulfill the selection criteria of eliciting a single grammatical target in the cloze task by over two-thirds of the participants and were thus eliminated. All stimuli for aspect markers fulfilled the selection criteria with five of them not eliciting uniform responses from the participants. These five together with another two stimuli which could not be matched with those of classifiers were thus eliminated. Finally, 25 pairs of stimuli for classifiers and aspect markers were chosen as the final stimuli subset. Table 2 listed the means, standard deviations and ranges of ratings for the nouns and verbs in the chosen sentence stimuli for eliciting the target responses (See Appendix D for detailed ratings).

Table 2

Ratings of the Nouns and Verbs in the Sentence Stimuli for Eliciting Target Morphemes

		Ratings					Ratings		
		AoA	Fam.	Image.			AoA	Fam.	Image.
Nouns	*M*	3.81 (1.00 - 7.00)	2.93 (1.00 - 5.00)	5.36 (1.00 - 7.00)	Verbs	*M*	3.76 (1.00 - 7.00)	3.13 (1.00 - 5.00)	4.73 (1.00 - 7.00)
	SD	1.14	0.92	1.20		*SD*	1.16	0.85	1.40

Note: For the abbreviations, *M* = mean, *SD* = standard deviation, AoA = age of acquisition, Fam. = familiarity, Image. = imageability. Ranges of ratings were given in parentheses.

Main Findings

Table 3 showed the means, standard deviations and ranges of scores of the participants. A three-way ANOVA was then carried out with the scores, with 'speaker group' (fluent vs. non-fluent aphasia) as the between-group and 'task' (cloze vs. judgment tasks) and 'morpheme class' (classifiers vs. aspect markers) as the within-group independent variables.

Table 3

Scores of Participants with Aphasia on Classifiers and Aspect Markers in Different Tasks

Classifiers				Aspect Markers			
		Tasks				Tasks	
Group		Cloze	Judgment	Group		Cloze	Judgment
Fluent	*M*	14.78	24.44	Fluent	*M*	22.0	22.67
	SD	4.87	1.01		*SD*	3.04	2.92
	Range of scores	7.00 - 21.00	24.00 - 25.00		Range of scores	15.00 - 25.00	16.00 - 25.00
Non-fluent	*M*	5.89	20.89	Non-fluent	*M*	11.56	18.00
	SD	3.14	3.62		*SD*	4.67	4.42
	Range of scores	0.00 – 9.00	16.00 – 25.00		Range of scores	0.00 – 16.00	12.00 – 22.00

Main effects. There were significant main effects of speaker groups, F (1, 16) = 24.25, $p < .001$, $r = .776$, with the fluent group performing better than the non-fluent group, of morpheme class, F (1, 16) = 16.02, $p < .05$, $r = .71$, with the performance on aspect markers better than that on classifiers, and of task, F (1, 16) = 169.79, $p < .001$, $r = .96$, with the performance on judgment task better than that on the cloze task.

Interaction effects. The first significant interaction effect was found between speaker group and task (see *Figure 1*), F (1, 16) = 20.76, $p < .001$. Post-hoc analyses adjusted by the Bonferroni method (with a corrected significance threshold of 0.0125) were then carried out to identify the source of interaction. The results showed that: (1) the performances in the judgment task were significantly better than that in the cloze task for both fluent (F (1, 8) = 41.78, $p < .001$, $r = .92$) and non-fluent participants (F (1, 8) = 135.58, $p < .001$, $r = .97$); (2) the fluent participants performed significantly better than the non-fluent ones in both the cloze (F (1, 17) = 33.32, $p < .001$, $r = .81$) and judgment tasks (F (1, 17) = 9.12, $p < .0125$, $r = .59$). Furthermore, the difference between speaker groups was significantly greater for the cloze than judgment task (F (1, 8) = 8.98, $p < .025$, $r = .72$); the difference between tasks was significantly greater for the non-fluent than fluent group (F (1, 17) = 20.76, $p < .001$, $r = .74$).

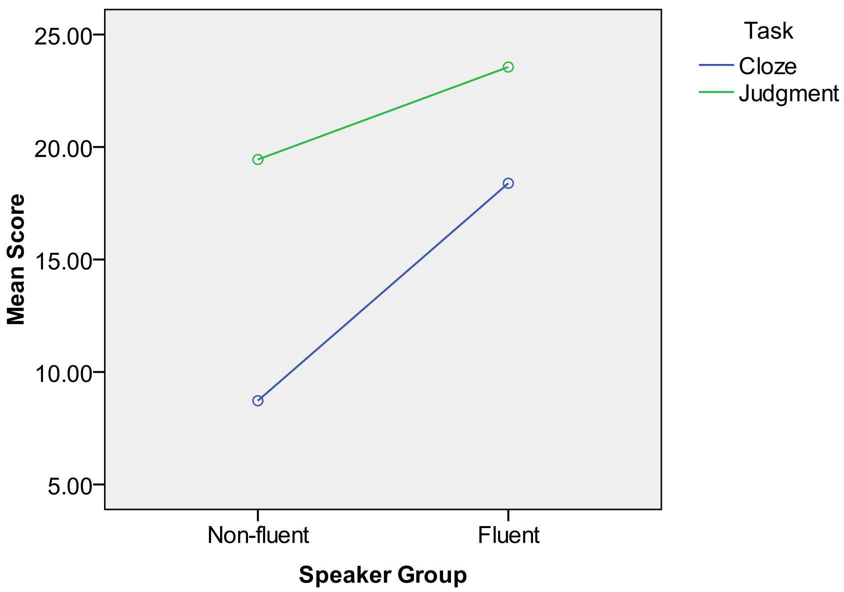

Figure 1. Interaction effect between speaker group and task.

The second significant interaction effect was found between morpheme class and task (see *Figure* 2), F (1, 16) = 51.82, $p < .001$. To identify the source of interaction, post-hoc analyses adjusted by the Bonferroni method (corrected significance threshold: 0.0125) were done. The results showed that: (1) the performances in the judgment task were significantly better than that in the cloze task for both classifiers (F (1, 17) = 116.95, $p < .001$, $r = .93$) and aspect markers (F (1, 17) = 12.54, $p < .0125$, $r = .65$); (2) the performance for classifiers and aspect markers was significantly better in the cloze task (F (1, 17) = -53.75, $p < .001$, $r = .87$) and judgment task (F (1, 17) = 11.41, $p < .0125$, $r = .63$) respectively. Furthermore, the difference between morpheme classes was significantly greater for the cloze than the judgment task (F (1, 8) = 8.98, $p < .025$, $r = .72$); the difference between tasks was significantly greater for classifiers than aspect markers (F (1, 17) = 54.94, $p < .001$, $r = .87$).

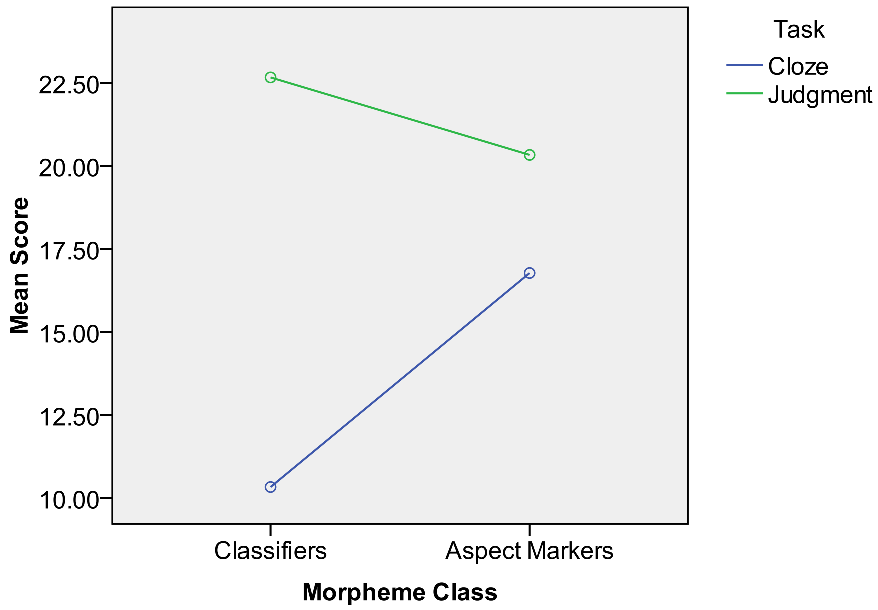

Figure 2. Interaction effect between morpheme class and task.

Performances of Participants with Aphasia at Individual Level

The performance of each participant with apahsia was analyzed by the Fisher's exact test in order to identify any significant difference in performances for classifiers and aspect markers at individual level; any performance pattern for the two morpheme classes that was different from the findings at group level could be found.

In the cloze task, eight participants with aphasia performed significantly better in producing aspect markers than classifiers, $p < .05$, while the other ten did not perform significantly differently for the two classes. In the judgment task, one performed significantly better for aspect markers than for classifiers, $p < .05$, while the other 17 did not perform significantly differently for the two classes. In other words, there were participants performed significantly better for aspect markers than for classifiers in both the cloze and judgment tasks, but we could not observe the reverse pattern for anyone in neither task.

Correlation between Performance in Narrative Production and in Tasks with Contextual Constraints (Cloze and Judgment Tasks)

All classifiers and aspect markers appeared in the narrative samples (i.e. not confined to those targets in the experimental tasks) were annotated. Corresponding TTRs of classifiers and aspect markers were calculated respectively to identify the relationship between participants' performances in narrative production and constrained-context tasks (See Appendix E for detailed summary of TTRs and performances in structured tasks).

It was found that the TTR of classifiers in narrative production and the performance of classifiers in the cloze task were significantly negatively correlated, $r = -.47$, $p < .05$, meaning that as participants produced more types of classifiers in narrative production, their performance for classifiers in the cloze task declined. Also, significant negative correlation could be observed between TTR of aspect markers in narrative production and the performance of aspect markers in the cloze ($r = -.61$, $p < .05$) and judgment task ($r = -.52$, $p < .05$). These also meant that as participants produced more types of aspect markers in narrative production, their performance for aspect markers in both structured tasks declined.

In sum, the major findings included significantly better performances for the fluent than the non-fluent group, on the aspect markers than the classifiers and in the judgment than the cloze task. Two significant interactions were found between speaker group and task and morpheme class and task. At individual level, eight and one participants performed significantly better on aspect markers than classifiers in the cloze and judgment task respectively. Negative correlations were found between TTRs of classifiers and aspect markers in narrative production and performance in tasks with contextual constraints.

Discussion

The present study revealed a significantly better performance on aspect markers than classifiers across tasks and speaker groups. This could be further supported at individual level that eight and one participants with aphasia performed significantly better on aspect markers than classifiers in the cloze and judgment task respectively, while the reverse pattern could not be observed in both tasks. These conformed to Packard (1990) and Yiu and Worrall (1996) that the accessibility of aspect markers for speakers with aphasia seemed relatively preserved, in which a better performance of aspect markers than other morpheme classes such as classifiers was expected. These also supplemented the findings in Law and Cheng (2002) that when both classifiers and aspect markers were found as the relatively easier morphemes for speakers with aphasia to produce, the processing ability for aspect markers seemed to be better preserved as indicated in the present study. These also conformed to Lu (1994) that classifiers and the perfective *le* were one of the most difficult and relatively easier morphemes for speakers with aphasia respectively, but it did not support the finding that the progressive *zai* was one of the most difficult morphemes. Despite this, aspect markers seemed easy across studies, but this may not appear so for classifiers.

The worse performance for classifiers may be attributed to its relatively greater size of paradigm in general, which is a vital factor to determine if that particular morpheme class can be accessed and used correctly (Menn & Obler, 1990). Lu (1994) further explained that the morphemes were organized by their syntactic functions and different paradigms were thus formed, like classifiers, aspect markers, etc. Members in the same paradigm would have close relations with each other; misuse of other members in the same paradigm may be easily observed for agrammatic speakers as they were impaired in differentiating their uses. For classifiers which have over 60 members in the system (Matthews & Yip, 1994), speakers with aphasia may found it difficult to remember all the agreements between different nouns and classifiers which could lead to relatively less satisfactory performance of classifiers.

Concerning the performance discrepancy between the present study and Lu (1994) for the progressive aspect marker, the factor of syntactic complexity may account for it. For Mandarin Chinese, the perfective *le* and progressive *zai* are placed in different positions in relation to the verb, with the former placed after the verb and the latter before the verb. This difference in order may bring different syntactic processing loads to speakers with aphasia and result in different performance patterns on them. Further, in Mandarin there are many other ways to express the progressive aspect instead of solely using *zai* (Lu, 1994); speakers' exposure for *zai* may be less and thus lead to relatively worse performance. However, in Cantonese the perfective *zo2* and progressive *gan2* usually appear at the same position. The participants may have fewer syntactic considerations when processing and thus their performances were similar. For classifiers, although they appear in the same position (before the target noun) and thus pose little syntactic processing load, the present finding of a relatively better performance for aspect markers than classifiers may imply that the factor of size of paradigm may have a greater impact on morpheme processing for aphasic speakers.

At the speaker group level, the present study revealed that the fluent group performed significantly better than the non-fluent group across tasks and morpheme classes. Despite the performance difference between groups, both groups suffered some degree of disruption in the processing of classifiers and aspect markers. It conformed to previous findings that morphological deficit manifested across all aphasia syndromes regardless of aphasia types (Saffran, Berndt & Schwartz, 1989). Moreover, the performance patterns of classifiers and aspect markers were similar in both groups, i.e. aspect markers better than classifiers. No significant interactions could be observed between speaker groups and morpheme classes, meaning that no distinct performance patterns could be observed for the two groups. This did not match with the previous prediction that with the analogy of dissociable performance of nouns and verbs for fluent and non-fluent aphasic speakers, such dissociative patterns might also be expected for classifiers and aspect markers between fluent and non-fluent groups. In contrast, the present findings can further verify the suggestions that a continuity of grammatical morpheme impairment exists across various aphasia types (Saffran et al., 1989) and performance of fluent and non-fluent groups mainly differed quantitatively but not qualitatively (Law & Cheng, 2002), with a focus of two morpheme types in the present study.

At the task level, the present study found a significantly better performance for the judgment than the cloze task. With the items in both tasks matched with the three influential psycholinguistic variables, this performance discrepancy may mainly be attributed to the task factor. This finding can help us distinguish the nature of morphological impairment of the aphasic participants – they were seemingly more prone to production problems rather than grammatical processing impairment; the actual functor processing abilities among aphasic speakers in previous studies might have been underestimated as their production abilities (either in free or constraint contexts) were often the only focus. This discrepancy may be explained by the reduced cognitive load in the judgment task than other tasks (e.g. free narrative) which may involve other performance variables like memory factors, i.e. speakers should be able to memorize before producing the morphemes in narratives (Schütze, 1996).

For both morpheme classes and speaker groups, the nature of the task could pose significant effects on the performances as demonstrated by the significant interactions of between speaker group and task and between morpheme class and task. For the former interaction, although the fluent group performed significantly better in both tasks, the difference between tasks was significantly greater for the non-fluent group – they improved more significantly when the task was shifted from the cloze to the judgment task. This may further verify an underlying phenomenon that significant amount of residual knowledge on morpheme processing may exist in the non-fluent group which was not ‘lost’ yet. For the latter interaction, the task effect was even more obvious as significantly better performance on aspect markers and classifiers was observed in the cloze and judgment task respectively. The factor of size of paradigm may also explain the change in performance pattern: when the task was shifted from the cloze to the judgment task, a less demanding process was required from free recall of one suitable morpheme from more than 60 members in the same paradigm to grammaticality judgment between only two alternatives, resulting in the significantly greater improvement of performance between tasks for classifiers.

For the relationship between production of morphemes in narratives and tasks with constraint contexts for speakers with aphasia, there was an unexpected pattern of negative correlations between TTRs in narrative productions and performance in the experimental tasks for both morpheme classes. In normal circumstances, as TTR approaches the value of 1, it indicates that more different morpheme types are produced. However, the situation in this study differed for the participants with aphasia – the mean TTRs of both morpheme classes for non-fluent group were greater than that of the fluent group (CL: 0.55 (non-fluent) > 0.15 (fluent); ASP: 0.36 > 0.25), despite the more different types of morphemes produced by the fluent group (mean type of CL: 6.67 (fluent) > 1.78 (non-fluent); of ASP: 2.56 > 1.44). This may be attributed to the much greater number of tokens produced by the fluent group for both classifiers ($M_{token} =$ 44.44 (fluent) > 4 (non-fluent)) and aspect markers ($M_{token} =$ 11.78 (fluent) > 5.89 (non-fluent)). The proportion for the increase in the nominators (morpheme type) was not great enough as compared to that in the denominators (token amount) for both morpheme classes, leading to relatively smaller TTRs for both classes in the fluent group. When referring back to the performance in the experimental tasks, the fluent group performed significantly better than the non-fluent group. Combing these findings, it may thus explain the presence of negative correlations between performances in free and constrained contexts.

Clinical Implications

Regarding the continuity of morpheme impairment found across various aphasia types, clinicians should focus on the individual erroneous morpheme processing patterns but not just crudely classifying them as 'fluent' or 'non-fluent' speakers. Also, regarding the discrepant grammatical abilities in different tasks, clinicians should assess patients in various aspects (e.g. comprehension, production and judgment abilities) as to have a more comprehensive assessment on one's linguistic ability. In particular, clinicians may utilize the judgment task at both assessment and treatment levels – at assessment level, the performance may indicate the grammatical impairment extent; poor performances in both production and judgment tasks may suggest not only expressive but also grammatical processing problems. At the treatment level, grammaticality judgment training can be implemented prior to that of production as to ensure that the patients can self-discriminate the correct usages of different morphemes, which is an indispensable ability for appropriate morpheme production.

Limitations and Further Studies

Limitations were noted in this study that although the factor of difference in size of paradigm between classifiers and aspect markers may explain the performance difference, the performance on aspect markers could be overestimated due to a further reduction of its paradigmatic size in the study, i.e. only two choices (*zo2* and *gan2*) were available for the participants to process in order to provide maximized grammatical contrasts. Despite this modification, the difference between their paradigmatic complexities was still too large. It may mask the effect of other possible factors which could also lead to the processing discrepancies. Therefore in future studies same number of targets for both morpheme classes can be set (e.g. five for each class) as to minimize the paradigmatic complexity effect at task level. It may also be more convincing to attribute any processing discrepancies between morpheme classes to other factors (e.g. semantic difference).

Conclusion

This study investigated the processing of classifiers and aspect markers of fluent and non-fluent Cantonese aphasic speakers using a cloze task and an additional grammaticality judgment task that was not included in previous studies. The findings were consistent with previous Chinese findings that aspect markers were an easier morpheme class for processing than classifiers across speaker groups and tasks, which may be explained by their sizes of paradigm. The findings of better performance for the fluent than the non-fluent group with an absence of distinct impairment pattern were also consistent with cross-linguistic studies. At the newly-explored task level, the performance in judgment was better than that in the cloze task, which may be explained by the reduced cognitive load for the former task. The interactions could indicate significant effects of task nature on the performances on both morpheme classes and different aphasic speaker groups. These may reveal the importance of the task factor on the processing of different morpheme classes for speakers with different types of aphasia, which can be further studied in the future.

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Appendix A

Rating Instructions and Scales of the Psycholinguistic Variables

Age of Acquisition for Nouns (Verbs)

在這測試中，我們需要您來評定您是在多大年齡首次習得某個名(動)詞。所謂首次習得是指第一次學會該詞和它的意思，不管是以口頭形式或是書面形式學會。請隨意選擇標尺上的任何年齡段，不必考慮是否已使用某個年齡段多次。

例子:

媽媽(俾): 如果您認為此詞是在 1 歲學會的--> 0-2 歲

字典(選擇): 如果您認為此詞是在 7 歲學會的-->7-8 歲

保險箱(體驗): 如果您認為此詞是在 14 歲學會的--> >12 歲

請認真仔細填寫每個項目，在過程中注意不要翻看前面的選擇。如遇上不懂的項目，可選擇「不適用」。謝謝您的合作！

1	2	3	4	5	6	7
0-2 歲	3-4 歲	5-6 歲	7-8 歲	9-10 歲	11-12 歲	>12 歲

Familiarity for Nouns (Verbs)

請為一系列名(動)詞的熟悉程度進行評定。您可以用日常接觸(作出)或聯想到該名詞所表達的事物或物件(遇見該動作或事件的次數)的次數作推算，如每天都會接觸到(做/遇見)的可選擇「頻密」，有時接觸到(會做/遇見)的可選擇「間中」，如此類推。請隨意選擇標尺上的任何數字，不必考慮是否已使用某個數字多次。

例子:

原子筆(睡覺): 每天也接觸到(會做/遇見)-->頻密

燈泡(游水): 有時接觸到(會做/遇見)-->間中

火箭(攀石): 很少接觸到(會做.遇見)-->很少

請認真仔細填寫每個項目，在過程中注意不要翻看前面的選擇。若您不認識某特定詞語，可選擇「從不」。謝謝您的合作！

1	2	3	4	5
從不	極少	間中	頻密	經常

Imageability for Nouns (Verbs)

請為下列名(動)詞的可表象性高低進行評定。可表象性是指當您見到一個詞語時，能夠引發相應、有意義的視覺形象的難易和快慢程度。當你看到一個名(動)詞時，如果能夠很容易、很快產生與之對應的具體清晰的視覺形象，那麼就表明該名(動)詞的可表象性很高，應給予較高的評分；如果覺得該材料很難使你產生對應的視覺形象，那麼表明該名(動)詞的可表象性很低，應給予較低的評分，如此類推。請隨意選擇標尺上的任何數字，不必考慮是否已使用某個數字多次。

例子:

原子筆(唱歌): 可表象性極高-->7

路線(選擇): 可表象性中等-->4

思想(相信): 可表象性極低-->1

請認真仔細填寫每個項目，在過程中注意不要翻看前面的選擇。如遇上不懂的項目，可選擇「不適用」。謝謝您的合作！

1	2	3	4	5	6	7
極低	頗低	低	中等	高	頗高	極高

Appendix B

Finalized Stimuli List for Participants with Aphasia

		Cloze Task	Grammaticality Judgment Task	
Morpheme class			Grammatical	Ungrammatical
Classifiers	1.	呢度有三____鉛筆	呢度有三枝鉛筆	呢度有三枝鉛筆
	2.	呢度有四____螞蟻	呢度有四隻螞蟻	呢度有四隻螞蟻
	3.	呢度有一____白紙	呢度有一張白紙	呢度有一張白紙
	4.	嗰度有五____手錶	嗰度有五隻手錶	嗰度有五張手錶
	5.	嗰度有四____烏蠅	嗰度有四隻烏蠅	嗰度有四隻烏蠅
	6.	呢度有一____扇	呢度有一把扇	呢度有一片扇
	7.	呢度有七____生命	呢度有七條生命	呢度有七條生命
	8.	嗰度有五____試卷	嗰度有五張試卷	嗰度有五隻試卷
	9.	嗰度有一____樂曲	嗰度有一段樂曲	嗰度有一筆樂曲
	10.	呢度有一____菜刀	呢度有一把菜刀	呢度有一片菜刀
	11.	呢度有五____蠟燭	呢度有五枝蠟燭	呢度有五把蠟燭
	12.	嗰度有四____文章	嗰度有四段文章	嗰度有四筆文章
	13.	呢度有三____海報	呢度有三張海報	呢度有三張海報
	14.	呢度有三____拐杖	呢度有三枝拐杖	呢度有三枝拐杖
	15.	嗰度有一____手槍	嗰度有一把手槍	嗰度有一片手槍
	16.	嗰度有四____表格	嗰度有四張表格	嗰度有四隻表格
	17.	嗰度有五____裂痕	嗰度有五條裂痕	嗰度有五條裂痕
	18.	呢度有一____報告	呢度有一項報告	呢度有一項報告
	19.	呢度有三____法例	呢度有三條法例	呢度有三枝法例
	20.	嗰度有四____熱線	嗰度有四條熱線	嗰度有四條熱線

	21. 嗰度有兩____長笛	嗰度有兩枝長笛	嗰度有兩枝長笛
	22. 呢度有兩____工程	呢度有兩項工程	呢度有兩條工程
	23. 呢度有三____資金	呢度有三筆資金	呢度有三筆資金
	24. 呢度有五____經費	呢度有五項經費	呢度有五條經費
	25. 嗰度有五____遺產	嗰度有五筆遺產	嗰度有五段遺產
Aspect markers	1. 佢哋喺操場玩____	佢哋喺操場玩緊	佢哋喺操場玩咗
	2. 雀仔喺天空飛____	雀仔喺天空飛緊	雀仔喺天空飛咗
	3. 佢醒____一陣間	佢醒咗一陣間	佢醒緊一陣間
	4. 我等____佢返屋企	我等緊佢返屋企	我等咗佢返屋企
	5. 我遲____起身返學	我遲咗起身返學	我遲緊起身返學
	6. 佢應承____大家	佢應承咗大家	佢應承緊大家
	7. 佢哋搞錯____時間	佢哋搞錯咗時間	佢哋搞錯緊時間
	8. 佢批准____我嘅請求	佢批准咗我嘅請求	佢批准緊我嘅請求
	9. 佢原諒____我嘅錯	佢原諒咗我嘅錯	佢原諒緊我嘅錯
	10. 我拒絕____佢嘅要求	我拒絕咗佢嘅要求	我拒絕緊佢嘅要求
	11. 綁匪殺____人質	綁匪殺咗人質	綁匪殺緊人質
	12. 我擔心____佢嘅將來	我擔心緊佢嘅將來	我擔心咗佢嘅將來
	13. 我喺度努力訓練____	我喺度努力訓練緊	我喺度努力訓練咗
	14. 佢哋兩人和好____	佢哋兩人和好咗	佢哋兩人和好緊
	15. 我打破____紀錄	我打破咗紀錄	我打破緊紀錄
	16. 佢注視____我嘅行動	佢注視緊我嘅行動	佢注視咗我嘅行動
	17. 唐樓今日倒塌____	唐樓今日倒塌咗	唐樓今日倒塌緊
	18. 我猶疑____去唔去約會	我猶疑緊去唔去約會	我猶疑咗去唔去約會
	19. 佢否決____你嘅建議	佢否決咗你嘅建議	佢否決緊你嘅建議
	20. 我拋棄____我伴侶	我拋棄咗我伴侶	我拋棄緊我伴侶

21. 花車喺度巡遊____	花車喺度巡遊緊	花車喺度巡遊咗
22. 佢為將來拼搏____	佢為將來拼搏緊	佢為將來拼搏咗
23. 我回味____以前嘅事	我回味緊以前嘅事	我回味咗以前嘅事
24. 電話訊號中斷____	電話訊號中斷咗	電話訊號中斷緊
25. 飛機喺上空盤旋____	飛機喺上空盤旋緊	飛機喺上空盤旋咗

Note: Items with the same number were matched as they had similar ratings across the three psycholinguistic variables. There were two sets of orders for the stimuli in both the cloze and judgment tasks, i.e. Cloze Task – Set A, Cloze Task – Set B, Judgment Task – Set A and Judgment Task – Set B. These subsets were presented to participants in a block randomization order, e.g. Participant A: Cloze Task – Set A and Judgment Task – Set A, Participant B: Cloze Task – Set A and Judgment Task – Set B, Participant C: Cloze Task – Set B and Judgment Task – Set A and Participant D: Cloze Task – Set B and Judgment Task – Set B, and so on.

Appendix C

Verbal Instructions for the Cloze and Grammaticality Judgment Tasks

Cloze Task

您好！感謝您參與是次填充測試。每次您會看見和聽見一條題目，而該題目有一個字會被省略。當您聽到題目之後，您就可以講出您認為最適合的答案。

在開始前，我們可以先做幾個練習。

例 1：「呢度有兩___書」

例 2：「嗰度有三___糖」

接下來的題目只有兩個可能，您可以以「咗」字或「緊」字回答。我們可以先做幾個練習。

例 1：「佢失蹤___一年」

例 2：「警察喺街度巡邏____」

在作答時，您不必考慮是否已多次使用某一個字。請認真仔細作答每個項目。

Grammaticality Judgment Task

您好！感謝您參與是次文法判斷測試。於測試中，每次您會看見和聽見兩句句子，您需要從不同的句子組合中判斷哪一句子比較自然，再告訴我您的選擇。在開始前，我們可以先做幾個練習。

例 1：「呢度有兩本書；呢度有兩隻書」

例 2：「呢度有三本糖；呢度有三粒糖」

例 3：「佢失蹤緊一年；佢失蹤咗一年」

例 4：「警察喺街度巡邏緊；警察喺街度巡邏咗」

Appendix D

Matched Nouns and Verbs in the Sentence Stimuli for the Experimental Task

Nouns in sentence stimuli for classifiers	Ratings			Verbs in sentence stimuli for aspect markers	Ratings		
	AoA	Fam.	Image.		AoA	Fam.	Image.
鉛筆	1.97	3.50	6.77	玩	1.47	4.33	5.53
螞蟻	2.40	2.83	6.50	飛	2.03	2.47	6.20
白紙	2.67	3.80	6.43	醒	2.60	4.20	5.40
手錶	2.80	3.60	6.67	等	2.53	4.03	5.50
烏蠅	2.97	2.90	6.33	遲	2.70	3.60	4.93
扇	2.63	2.83	6.47	應承	3.00	3.73	3.97
生命	3.13	3.67	3.33	搞錯	3.53	3.77	3.47
試卷	3.13	3.60	6.27	批准	3.47	3.30	4.00
樂曲	3.33	3.37	4.33	原諒	3.23	3.30	3.70
菜刀	3.37	3.10	6.60	拒絕	3.33	3.27	4.40
蠟燭	3.10	2.43	6.60	殺	3.20	1.93	5.87
文章	3.90	4.03	5.20	擔心	3.57	3.83	4.30
海報	3.93	3.70	6.03	訓練	3.87	3.57	5.30
拐杖	3.63	2.23	6.43	和好	3.77	2.93	4.40
手槍	3.53	2.20	6.10	打破	3.90	2.83	4.73
表格	4.13	3.37	5.73	注視	4.47	2.87	5.00
裂痕	4.13	2.57	5.90	倒塌	4.47	2.13	5.97
報告	4.63	3.67	5.03	猶疑	4.87	3.47	4.03
法例	4.53	3.07	3.97	否決	4.57	2.80	4.07
熱線	4.72	2.37	3.38	拋棄	4.53	2.60	4.50

長笛	4.57	2.07	6.60	巡遊	4.57	2.00	5.83
工程	5.07	2.83	4.50	拼搏	5.40	3.57	4.27
資金	5.30	2.67	4.17	回味	5.17	3.23	3.57
經費	5.47	2.67	3.53	中斷	4.37	2.77	3.73
遺產	5.17	1.90	3.77	盤旋	5.30	1.80	5.60

Note: For the abbreviations, AoA = age of acquisition; Fam. = familiarity; Image. = imageability. Items in the same row were found with similar ratings across the three criteria and thus the relative stimuli were matched as a pair.

Appendix E

Performance of Aphasic Speakers in Narratives and Constrained-Context Tasks

Participants with Aphasia	*Ratios of Correct Answers in Constrained-Context Tasks				Type-Token Ratios in Narrative Production	
	Cloze Task		Grammaticality Judgment Task		Classifiers	Aspect Markers
	Classifiers	Aspect Markers	Classifiers	Aspect Markers		
NYH	0.00	0.00	0.64	0.48	1.00	1.00
LYW	0.12	0.44	0.64	0.68	0.00	0.33
CYY	0.36	0.56	0.80	0.60	0.00	0.00
MCT	0.12	0.44	0.76	0.48	1.00	0.60
CKC	0.36	0.44	0.80	0.80	1.00	0.75
LCY	0.28	0.56	0.88	0.76	0.22	0.08
CSW	0.28	0.52	1.00	1.00	1.00	0.14
WML	0.28	0.56	1.00	0.80	0.50	0.15
CCY	0.32	0.64	1.00	0.88	0.25	0.14
CML	0.44	0.60	1.00	0.64	0.10	0.33
TCH	0.56	0.92	1.00	0.96	0.11	0.16
CF	0.28	0.88	1.00	0.84	0.14	0.25
LPN	0.52	0.84	1.00	0.96	0.20	0.29
WWF	0.84	1.00	1.00	1.00	0.20	0.16
CWK	0.84	0.84	0.96	1.00	0.15	0.33
TYK	0.80	1.00	0.96	1.00	0.23	0.17
KTN	0.52	0.88	0.88	0.88	0.13	0.23

WWK	0.52	0.96	1.00	0.88	0.13	0.33

*Note: The ratios of correct answers in constrained-context tasks were calculated by dividing the number of correct answers by the total number of stimuli (25) in each task.