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Atelicity by Plural Noun in VP and Its Effect on Grammatical Aspect in Sentence Processing

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Psycholinguistic studies have reported effects of the grammatical aspect in sentence processing, although the possibility of interaction effects between grammatical and lexical aspects has been underexplored. Rather than uniformly discussing a role of grammatical aspect across verb types, the present research examines an interaction between lexical and grammatical aspects, motivated by Aspect Hypothesis (Andersen & Shirai 1994, 1996, among others) that sees a cross-linguistical observations where children are attested to initially use past/perfective morphology predominantly with telic verbs (i.e., achievement and accomplishment verbs), and imperfective morphology with atelic verbs (i.e., action verbs) across languages including English, Italian, French, Polish, Mandarin, and Cantonese, to name a few. The present work specifically focuses on an atelic lexical aspect, which is especially marked by a bare plural object noun in a verb phrase and reports the preliminary results of its effect in processing of grammatical aspect, i.e., the facilitation where participants chose on-going pictures after reading imperfective sentences more quickly than they chose completed pictures after reading perfective sentences, conforming to Yap et al. (2009).

1. Atelicity and Plurality

Lexical aspect concerns telicity. The sentences (1)(2) shows atelic events, as it has no clear endpoint of a given event (for example, '*folding a t-shirt*' continues (repeats) unspecified times). Repetitive events are as a whole atelic events but they contain multiple repeated endpoints. The sentence (3) shows a telic event, where it has an endpoint (in this example, '*folding a t-shirt*' completes with an execution of folding one specified number of t-shirt).

(1) Atelic Emily walked.
(2) Atelic Emily folded t-shirts.
(3) Telic Emily folded a t-shirt.

2. Grammatical Aspect in Processing Extends to Lexical Aspect

Grammatical aspect concerns perfectivity. Madden & Zwaan (2003) previously explored a role of grammatical aspect in sentence comprehension and found the facilitation effect by perfective grammatical aspect, namely an effect to have comprehenders construct mental representations of completed events when the perfective sentences were used (such as *The man made a fire*) while attesting no such equivalent processing effects with the imperfective sentences (such as *The man was making a fire*). Yap et al. (2009) argued for a possible influence of lexical aspect in such processing behaviors with grammatical aspect, pointing out that Madden & Zwaan only used accomplishment verbs. Yap et al. tested on Cantonese speakers and introduced into their picture-selection experiment

a factor of verb type (i.e., activity vs. accomplishment) to find a facilitation effect between certain types of lexical aspect and grammatical aspect; That is, a facilitation between accomplishment verbs to the perfective grammatical aspect, while activity verbs crucially to the imperfective grammatical aspect. Specifically, with activity verbs, their participants responded more accurate and quickly after reading imperfective sentences than reading perfective sentences in selecting matched pictures to given sentences (note: pictures that depicted an ongoing stage of an event were considered matched for imperfective sentences, and pictures that depicted a completed stage of an event were considered matched for perfective sentences), while with accomplishment verbs, the participants responded more accurately and marginally more quickly after reading perfective sentences than reading imperfective sentences in selecting matched pictures to given sentences.

3. Experiment

The current study explored such facilitation effect attested by Yap et al. by (a) testing on native speakers of English using English sentences, and (b) by testing on atelic (repetitive) events that were marked by a bare plural noun of the verb phrases, thus extending the verb type from activity verbs to atelic (repetitive) verbs, and to another language.

Method

Participants

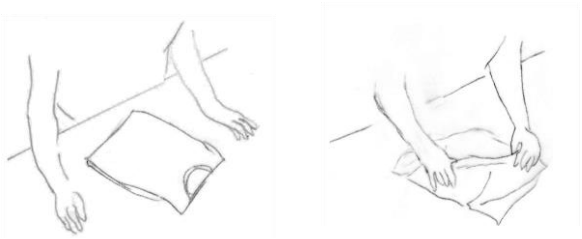
- Fifteen adult native English speakers participated in the experiment.
- Participants were recruited and participated online across various populations, e.g., U.S. (University of Hawai‘i), U.K., Canada.
- Participations were compensated for an online voucher.

Materials

- Twenty-two experimental sentences were constructed by a native speaker of English.
- Each experimental sentence consisted of a transitive verb with a bare plural object noun, creating a repetitive (atelic) interpretation of a described action. See appendix for more examples.
- No adverbs were included in the sentences.
- The experimental sentences were carefully made so that they would not induce a single-time (i.e., thus telic) event interpretation by considering plural entities were taken into a given action *all at once*. For example, *carry books* could be possibly performed on multiple books collectively, so *carry surfboards* were used instead to ensure repetitive interpretation.
- Participants saw each experimental sentence in either the imperfective grammatical aspect (i.e., past progressive) or the perfective grammatical aspect (i.e., simple past).
- In half of sentences the subject noun employed a female name and the other half a male name.
- Confirmation questions were created and randomly appeared within the experimental session, to keep the participants attentive and also for the sake of confirming good participants by checking its accuracy rates when conducting analyses.
- Half the confirmation questions elicited YES and half NO, with the position of the response key for the correct answer counterbalanced.
- Filler sentences were created and included.
- Two pictures that corresponded to each experimental sentence pair (i.e., the imperfective grammatical aspect representing ongoing action, and the perfective aspect representing completed action, were drawn by the investigator and rated and confirmed by native speakers of English. See appendix for more examples.

- Following Yap et al. and Madden & Zwaan, imperfective sentences were coded as 'matched' to a picture of ongoing event, while perfective sentences to a picture of completed state of event, respectively.
- The four lists by a latin square were created, where participants saw either a imperfective or perfective sentence followed by a matched picture either on the left side or the right side in the screen, to secure they appeared equally often across four lists. Each participant saw only one list, i.e., saw only one version of each experimental item.
- The experimental design was 2 (Imperfective vs. Perfective grammatical aspect) by 1 (Plural Atelic lexical aspect)

Sentence–Picture Matching Task



Condition 1: Imperfective + Atelic	Emily was folding t-shirts.
Condition 2: Perfective + Atelic	Emily folded t-shirts.

Figure 1. Sample Experimental Pictures and Sentences

Procedure

- Sentence-Picture Matching Task
- Participants were asked to read a sentence, and judge which of two subsequently presented pictures they thought best matched the sentence. They were asked to respond as quickly as possible. See Figure 2 for illustration of the procedure.
- Participants were instructed to press 'd' with the left finger, if they thought the left picture best describes a sentence, and to press 'k' with the right finger if they thought the right picture best describes a sentence.
- Participants were instructed to keep each finger on the designated keys during the experiment to reduce unnecessary delays.
- Participants were also asked to periodically answer a question regarding the sentence (i.e., confirmation questions mentioned in the Materials section).
- The items were randomly displayed for each participant.
- A practice session was preceded by the experimental session.
- The stimuli were presented and responses were recorded with E-Prime 3.0 (E-Prime Go) software (Psychology Software Tools, Pittsburgh, PA) on a participant's computer (namely a Windows PC).

Online Participation

- To accommodate screen size of a participant's computer, 4:3 aspect ratio version and 16:9 ratio version was created by the experimenter, and participants selected either one that fitted their monitor aspect ratio to avoid distortion and misalignment.
- Participants were instructed to prepare to run the task in a quiet, distraction free environment to ensure reliable experiment results.

READY	Sentence	Pictures
1 sec	1.5 sec	stayed until the key press

Figure 1. Procedure Illustration

4. Results

Data Cleaning

- No participants were removed by the accuracy rates from confirmation questions (Mean = 90.67% including those for fillers).
- Outliners (at 2.5 SDs) of reaction times (RTs, including fillers) of each participant were replaced with the value of 2.5 SD of each participant. Those replaced RTs were 2.3 % of all the experimental RTs that went into the analyses.
- Outliners (at 2.5 SDs) of reaction times (RTs, including fillers) of each item were replaced with the value of 2.5 SD of each item. Those replaced RTs were 1.3 % of all the experimental RTs that went into the analyses.
- No participants were removed as their each average RTs were within 2.5 SDs of the grand average RTs across participants (Mean = 1544 ms).
- No items were removed as their each average RTs were within 2.5 SDs of the grand average RTs across all experimental items (Mean = 1672 ms).
- 3 items out of 22 items in the perfective condition were filled with the average RT of items (i.e., 2195.88 ms) of the perfective condition as no RTs were remained as we examined RTs of the matched responses.

As can be seen in Table 1, the accuracy rates for matched imperfectives were significantly higher than those for matched perfectives for atelic verbs, both in the subject analysis [$t(14) = 6.185$, $p < .001$ (paired, two-sided)] and in the item analysis [$t(21) = 5.217$, $p < .001$ (paired, two-sided)]. That is, the results showed the facilitation where participants chose on-going pictures after reading imperfective sentences more correctly than they chose completed pictures after reading perfective sentences. As can be seen in Table 2, the mean response times for matched imperfectives were faster than those for matched perfectives for activity sentences, both in the subject analysis [$t(14) = 3.354$, $p = .005$ (paired, two-sided) and in the item analysis [$t(21) = 2.760$, $p = .012$ (paired two-sided)]. That is, the results showed the facilitation where participants chose on-going picture after reading imperfective sentences more quickly than they chose completed pictures after reading perfective sentences.

5. Conclusion

The present study targeted on English and confirmed that atelic verb phrase, where atelicity was marked with a plurality of object noun in a verb phrase, showed the effect attested by Yap et al. who tested Cantonese on activity verbs to conclude that comprehenders were sensitive to lexical aspect type (specifically, activity vs. accomplishment) when processing grammatical aspect. The contribution of the present study is that the effect was confirmed with atelic (repetitive) verb phrases in English.

	Atelic Lexical Aspect (Verb + dir.obj. Pl)		
	Grammatical Aspect	Mean	SD
Subject Analysis	Perfective	34.2	14.4
	Imperfective	78.9	16.8
Item Analysis	Perfective	34.1	25.5
	Imperfective	79.7	22.2

Table1. Mean Accuracy Rates (in Percentages) for Matched Perfectives and Mismatched Imperfectives in as Sentence-Picture Matching Task

	Atelic Lexical Aspect (Verb + dir.obj. Pl)		
	Grammatical Aspect	Mean	SD
Subject Analysis	Perfective	2096	1081
	Imperfective	1590	673
Item Analysis	Perfective	2196	927
	Imperfective	1590	440

Table2. Mean Response Times (in Milliseconds) for Matched Perfectives and Matched Imperfectives in a Sentence–Picture Matching Task

References

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Notes

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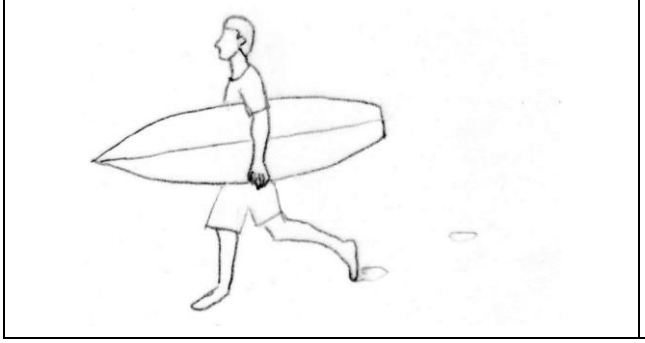
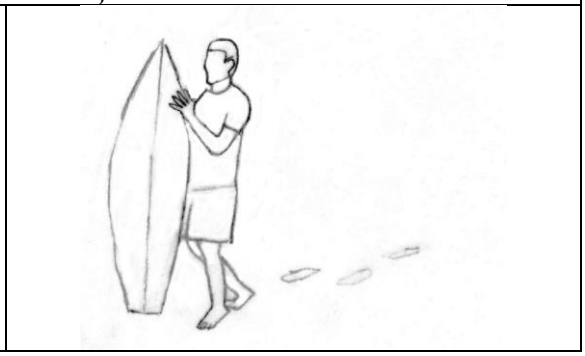
2. This research was supported by Grant Number 21K13002 from JSPS KAKENHI Grant-in-Aid for Early-Career Scientists.

Appendix

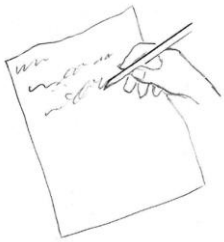
Sample Experimental Stimuli

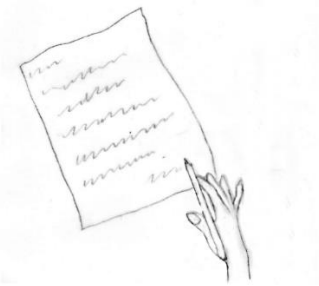
Andrew {was carrying / carried} surfboards.	
	

Lucy {was knitting / knitted} scarves.

Charlie {was climbing / climbed} mountains.

Hayleigh {was writing / wrote} letters.





Joan {was slicing / sliced} pumpkins.