

UC Merced

Proceedings of the Annual Meeting of the Cognitive Science Society

Title

Aspectual Coercion and the Online Computation of Sentential Aspect

Permalink

<https://escholarship.org/uc/item/14x15786>

Journal

Proceedings of the Annual Meeting of the Cognitive Science Society, 22(22)

Authors

Todorova, Marina
Straub, Kathy
Badecker, William
et al.

Publication Date

2000

Peer reviewed

Aspectual Coercion and the Online Computation of Sentential Aspect

Marina Todorova (todorova@cogsci.jhu.edu)

Department of Cognitive Science, JHU; 3400 N. Charles Street
Baltimore, MD 21218 USA

Kathy Straub (kath@cogsci.jhu.edu)

Department of Cognitive Science, JHU; 3400 N. Charles Street
Baltimore, MD 21218 USA

William Badecker (badecker@cogsci.jhu.edu)

Department of Cognitive Science, JHU; 3400 N. Charles Street
Baltimore, MD 21218 USA

Robert Frank (rfrank@cogsci.jhu.edu)

Department of Cognitive Science, JHU; 3400 N. Charles Street
Baltimore, MD 21218 USA

Abstract

We investigate the comprehension of sentences where an aspectual incompatibility between a verbal predicate (*send a check*; completive reading) and a verbal modifier (*for years*; durative reading) is resolved through the operation of aspectual coercion. Aspectual coercion modifies the aspectual properties of the predicate in the direction required by the verbal modifier; here the result is an obligatory iterative interpretation for the combined string (*send a check for years*). We find that sentences where the iterative interpretation arises as a result of coercion (*Howard sent a large check to his daughter for years*) show a significant reading delay in the coercion and post-coercion regions as compared to sentences where an iterative interpretation is achieved by other means (*Howard sent large checks to his daughter for years*). Such delay does not occur with substitution of an aspectually neutral modifier (*last year*). We propose that the observed delay is a processing reflex of aspectual coercion deriving either from an initial misanalysis of the aspectual representation of the utterance, or from the need to postulate a null iterative operator in order to arrive at a coherent interpretation of the coerced sentence.

Aspectual Coercion

This study investigates the processing correlates of aspectual coercion. Aspectual coercion has been proposed in the linguistic and computational literature (e.g. Moens & Steedman, 1988) as an operation that resolves a mismatch between the aspectual properties of the verbal predicate, on one hand, and a (temporal) sentential operator, on the other. In English, the operation of coercion does not have an overt morphological reflex. Therefore, it is generally considered to lack a structural counterpart in the syntax. Instead, the effects of coercion are purely semantic: The verbal predicate obligatorily receives a specific aspectual interpretation, which differs from its most natural (or default) aspectual reading. An inquiry into the processing correlates of aspectual coercion promises to provide valuable information

about the mechanisms of semantic processing in general, and details of computing the aspectual interpretation of an utterance, in particular. This study examines the effects of durative adverbial modifiers on the aspectual interpretation of the predicate. It is hypothesized that coercion triggered by such modifiers is associated with a specific processing cost.

Aspect

The grammatical category of *aspect* relates to the internal temporal structure of an event. Aspectual distinctions are anchored around the presence or absence of logical boundaries in the denotation of events. For example, the eventuality denoted by the verb ‘find’ seems to contain a logical endpoint, namely the moment at which one becomes aware of the existence of some novel object. It is implausible that the act of finding extends beyond this endpoint; similarly, we cannot say that an event of finding has been instantiated unless this endpoint has been realized. By contrast, the state denoted by the verb ‘love’ can plausibly extend indefinitely in time. This does not mean that loving cannot reach a terminal point; rather, such a point is not a logically necessary component of the verb’s meaning. For the purposes of this paper, we will call those aspectual readings that contain a necessary and/or realized event boundary *telic*; aspectual readings that are open-ended (i.e. indeterminate with respect to an endpoint) will be called *atelic*.¹

¹Strictly speaking, the labels *telic* and *atelic* are usually applied to the lexical-conceptual structure of events; the properties of sentential utterances are described as *bounded* vs. *unbounded*; *perfective* vs. *imperfective*, etc. We keep only one set of labels for simplicity; however, it is worth pointing out that we consider telic at the sentential level interpretations where the logical endpoint of an event is understood to have been instantiated, i.e. roughly the idea described by the traditional notion of perfectivity.

While telicity is encoded in the conceptual structure of events, it can be modified by the larger context within which an event is embedded. Thus we have a distinction between *lexical* and *grammatical* aspect. Lexical aspect categorizes verbs into aspectual classes based on their meaning (Dowty, 1978; Vendler, 1967). The atelic lexical classes encompass *states* and *processes*:² Verbs such as *love* or *write* describe temporally unbounded eventualities, or, alternatively, eventualities with homogenous reference: A subpart (subinterval) of a state of loving is still a state of loving, and a subpart of an act of writing is still an act of writing. The telic lexical class is that of *events*: Verbs such as *find* denote eventualities that involve some change or transition between different states of affairs. The transition corresponds to the logical boundary of the event. Events have non-homogenous reference: it is hard to conceive of subparts of the event of finding an object, and if we imagine a situation where the object is found after an active search, then any subparts of this (larger) event are instantiations of searching, rather than finding.

The aspectual reading of a fully articulated utterance is not always transparently related to the lexical aspect of its main verb. Rather, the computation of sentential aspect is influenced by the presence of nominal arguments and temporal sentential modifiers. Within the verbal predicate, the presence of an object and its cardinality have important consequences for the resulting aspectual reading: Singular and/or definite (count) objects support telic interpretations, whereas bare plural and/or mass noun objects support atelic interpretations of the verbal predicate. To illustrate, by itself the verb *write* denotes an unbounded process; when combined with a singular object (*write a book*), it denotes a bounded event in the course of which some change/transition is effected (i.e., a new object - a book - comes into existence). This type of predicate is traditionally referred to as an 'accomplishment'. However, if the same verb is combined with a bare plural object (*write books*), it receives an atelic aspectual reading: The predicate now denotes an iterative or habitual process of book-writing. Similarly, punctual eventive verbs, such as *send*, receive an iterative interpretation when combined with a bare plural or mass noun object: The predicate *send letters* denotes a process that can potentially repeat itself over an indefinitely long period. Since there is no special instance of iteration that is regarded as the terminal point of the iterative event, iterative interpretations are open-ended. The importance of the cardinality of the object for the aspectual reading of predicates leads some authors to propose that aspectual properties are computed over the verb-argument complex (Verkuyl, 1993).

To illustrate the effect of temporal operators, the English progressive operator alters the aspectual properties of its input into those of an ongoing process (i.e. an atelic eventuality). Consequently, even though the primitive predicate *send a letter* is associated with a telic reading, its progressive version, *I'm sending a letter*, is an atelic process that does not allow an inference to the completion of the ongoing event. The modification of the aspectual properties of a

verbal predicate by sentential operators is known as aspectual coercion. This paper focuses on the processing cost associated with one particular instance of coercion, which arises in the presence of adverbial material denoting temporal span.

Adverbial Coercion

A long-standing observation in the aspect literature maintains that adverbs denoting extent in time are sensitive to the aspectual category of the predicate that they modify. Adverbs of duration, such as *for X time* or *throughout*, combine with atelic predicates: *John wrote letters for an hour*, whereas adverbs of completion, such as *in X time*, combine only with telic predicates: *John wrote a letter in one hour*.

However, this generalization is not entirely correct. Adverbs of duration can occur in combination with any aspectual type of predicate; the output of such combination, however, is necessarily interpreted as an atelic eventuality. Thus, even though the primitive *write a letter* is a telic accomplishment predicate, its modified counterpart *write a letter for an hour* is interpreted as an atelic process of letter-writing that lasted one hour. The absence of telicity in this expression is made evident by the fact that the sentence *John wrote a letter for an hour* does not entail that at the end of the hour the letter in question has actually been written. Similarly, the primitive punctual predicate *send a letter* can be modified with a durative expression *for several years*. In this case, the overall interpretation shifts to the eventuality denoted by the predicate repeating itself over and over (with some pragmatically plausible frequency) for the extent of several years. Thus, it is clearly the case that adverbs of duration act like coercing operators for some predicates. This behavior is not surprising if we assume that the denotation of durative adverbs picks out a temporal interval within which an event unfolds: Since an interval interpretation is necessarily atelic, all input to the durative adverbial must acquire atelic properties. The specific reinterpretation that occurs as a result of combination of a predicate with a durative modifier is still somewhat dependent on the basic properties of the input event. An accomplishment predicate (*write a letter*) contains a simple process within its denotation; therefore, reinterpretation usually amounts to 'stripping' off its culmination phase and understanding the predicate as an instance of the underlying process that did not reach its endpoint (Moens & Steedman 1988). Punctual events, on the other hand, have neither internal structure nor internal temporal extent. The only way in which they could be forced into an interval interpretation is by introducing a process of repetition of the punctual event. This is what happens in an example such as *John sent a letter to the company for several years*.

To summarize, several factors can potentially contribute to the overall aspectual reading of an utterance: The aspectual class of the main verb, the cardinality of its object, and the input specifications of modifying adverbial material. This situation creates a certain degree of instability within the parsing system, since material encountered later in an utterance can conflict with properties of the semantic representation that have been built up on the basis of material encoded earlier in the utterance. For instance, if the parser is

²There exist various classifications of verbal lexical aspect; the one adopted here is due to Mourelatos (1981).

assumed to incrementally compute a telic representation for the *entire utterance* upon encountering a telic verb (or its combination with a singular object), subsequent modification with a durative adverbial should trigger (potentially observable) aspectual reanalysis immediately after the durative modifier is encoded. Alternatively, one might hypothesize that in the absence of overt aspectual markers, such as a progressive or a perfect operator, aspectual commitment is postponed until all relevant material has been encoded. On that view, sentential aspect is left underspecified for the duration of the sentence. Where no further material relating to aspect becomes available, the aspectual reading for the sentence is determined over the properties of the entities that make up the predicate. However, if additional salient entities, such as a temporal modifier, emerge, these are taken into consideration in the initial computation of sentential aspect. Coercion in this model would amount to nothing more than a selection of the appropriate aspectual value based on all the lexical information provided, though we might expect to observe increased sentence ‘wrap-up’ processing time as the correct aspectual properties of the utterance are calculated, especially when factors informing the computation of aspect are in conflict. Further complications can arise if issues of plausibility/frequency are taken into consideration. It could be, for example, that particular verb + object combinations (given the importance of the cardinality of the object) increase the probability that the overall interpretation of the utterance will be of a certain kind (telic or atelic), and lead to an early adoption of the respective aspectual interpretation. For some verbs, one aspectual usage may be more frequent than the other (for example, the eventuality denoted by the verb ‘break’ may be less likely to be represented as an (iterated) process than the eventuality denoted by the verb ‘kick’, especially when it is understood to affect the same unique object). The kinds of aspectual reinterpretations triggered by coercion may also involve varying degrees of reanalysis: reinterpreting an event as a sequence of iterations is representationally different from reinterpreting an event as incomplete. Clearly, we cannot begin to unravel all of these issues at the same time. The present paper concentrates on one specific question: Is there a processing cost associated with the coercion which occurs when verbs denoting punctual events are forced to assume a repetitive interpretation, and if so, how does this inform our understanding of the mechanisms underlying semantic parsing?

The Psycholinguistics of Aspect

To date, very little research examining the psycholinguistic implications of the coercion process has been reported. In one important exception, Piñango, Zurif and Jackendoff (1999) examined processing costs associated with coercion using a cross-modal lexical decision task. They investigated the effect of interpreting a durative temporal adverbial following a punctual verb (*kick*) vs. a non-punctual verb (*examine*). When the presentation of a lexical decision target coincided with the disambiguation point of the underlined temporal adverbial in coercion contexts like *The man kicked the little bundle of fur for a long time to see if it was alive*, they observed slower responses in comparison to decisions made in the corresponding location for non-coercing contexts

(i.e., *The man examined the little bundle of fur for a long time to see...*). Piñango et al. attribute the longer decision times to the increased processing costs associated with the coercion operation.

Although these results are suggestive, one potential problem undermines their interpretation. The creation of minimal pairs by systematically alternating verbs introduces other interpretive differences to which the observed processing variation might be attributed: Sentences in the “coerced condition” entail an iterative interpretation, unlike most sentences in the “non-coerced condition”. This difficulty suggests that further, more rigorous examination of the on-line implications of the coercion process is indicated.

The experiment presented here expands on Piñango et al.’s strategy of contrasting coercion and non-coercion contexts. We examine the processing correlates of the specific type of semantic coercion which arises from the combination of punctual verbs (e.g. *send*) with a durative adverbial (*for X time*), culminating in an iterative reading of the entire utterance. Since it is unclear whether iterative interpretations are computationally more demanding than non-iterative ones, the critical alternation in the materials that we employ hinges on varying the cardinality of the direct object (as opposed to varying the verb) as the factor which controls the initial repetitive vs. non-repetitive aspectual status of the predicate. It should be recalled that bare plural direct objects impose an iterative reading (*send letters*), whereas singular direct objects impose a single-instance reading of the event denoted by the predicate (*send a letter*). In the case of the bare plurals, the repetitive event interpretation is signaled by the plural object prior to the introduction of the durative adverbial and that adverbial simply specifies the temporal span over which the repetitive event occurs. Thus, the interpretation of bare plurals modified by durative adverbials (*sent letters for many years*) is straightforward, since the (atelic/iterative) aspectual reading of the predicate is consistent with the aspectual input specifications of the modifier.

In contrast, the introduction of a durative adverbial modifier following a singular object (*send a letter for many years*) triggers aspectual conflict between the telic predicate and the durative adverbial. This incompatibility is hypothesized to be resolved via the coercion process, through which the predicate is reanalyzed as an iterative event spanning the specified interval. If the reanalysis process suggested as a correlate of aspectual coercion is computationally demanding, we should expect to observe increased processing load at or subsequent to the introduction of aspectual incompatibility (as seen in sentences containing iterative events over singular objects). Evidence of this cost should be observed when we compare parallel regions of the singular vs. bare plural items, just because the coercion operation is hypothesized to occur only over the predicates containing singular objects.

Further, since aspectual coercion is triggered by a specific type of temporal modifier, we would not expect to see evidence of coercion with adverbs that are indifferent to the aspectual properties of the predicates that they have scope over. This expectation is independent of the cardinality of the direct object of the predicate (*sent a letter last year* vs. *sent letters last year*). Although these sentences come to

mean different things (singular vs. multiple instances of letter-sending, corresponding to telic/perfective and atelic/imperfective aspect, respectively), in both cases the aspectual reading is determined solely on the basis of the properties of the verb + object complex, and depends specifically on the cardinality of the direct object. So, temporal adverbs which are indifferent to aspect are not hypothesized to contribute to the aspectual interpretation of the utterance and should combine easily with any type of aspectual input. Therefore, we would not predict any processing load variation to be observed at, or subsequent to, the introduction of such adverbials despite the diverging interpretations ultimately required by such sentences.

Thus, this experiment examines the processing cost associated with coercion toward an iterative interpretation of a telic verb + singular object predicate triggered by the presence of a durative temporal adverbial. Two separate non-coerced, control conditions are employed. First, processing load for the hypothesized coerced sentences is compared with processing load for sentences in which there is a telic verb + bare plural object predicate followed by a durative adverbial. In this control, the bare plural independently signals an iterative event reading so there is no aspectual conflict between the predicate and the temporal adverbial. Secondly, sentences containing durative adverbials are compared to parallel sentences containing non-durative temporal modifiers. This control should allow us to distinguish any potential effects of coercion, as we have described it here, from effects that might instead arise directly out of the singular vs. bare plural object contrast, independent of the coercion operation.

Method

Participants Twenty-four right-handed, native English-speaking undergraduates with no history of language deficits enrolled at the Johns Hopkins University participated in the experiment for course credit or compensation.

Materials Thirty-six transitive aspectual achievement verbs were used to construct the experimental sentences. Each verb was used to create two VP predicates which varied on the cardinality of the direct object (singular indefinite vs. bare plural) so the resulting predicates differed only in iterativity. For each predicate, adverbial modifiers (durative vs. non-durative/aspectually neutral) were selected to allow equally (ultimately) plausible readings in all conditions. Thus, the experiment consists of a 2×2 design crossing **Cardinality** (*singular* vs. *plural*) and **Modifier Type** (*durative* vs. *non-durative*). As can be seen from the stimulus example from Table 1, with the exception of the cardinality of the direct object and the specific temporal adverbial, the lexical content of the sentences was identical across the four conditions.

Table 1: 2×2 experimental design crossing factors of Cardinality and Modifier Type.

	Durative modifier	Non-durative modifier
Singular object	Even though Howard sent <i>a large check</i> to his daughter <u>for many years</u> , she refused to accept his money A	Even though Howard sent <i>a large check</i> to his daughter <u>last year</u> , she refused to accept his money C
Plural object	Even though Howard sent <i>large checks</i> to his daughter <u>for many years</u> , she refused to accept his money B	Even though Howard sent <i>large checks</i> to his daughter <u>last year</u> , she refused to accept his money D

Condition A reflects the hypothesized coerced context: the aspectual properties of the predicate and the modifier are mismatched and we expect that any processing costs associated with the coercion operation should be observed in this condition. In contrast, no effects of coercion should be observed in the other conditions.

Experimental sentences were constructed on a bi-clausal frame, in which the critical adverbial phrase always occurred in the initial clause. Table 2 shows each sentence subdivided into presentation regions (roughly corresponding to phrases), with the temporal adverbial always occupying Region V. With the exception of the critical alternation, the lexical material within particular regions of a given item was identical. Thus, we expect that any processing costs associated with the coercion operation will be observed at or immediately downstream of region V.³

Table 2: Sentential frame for experimental sentences with type of material by region.

Region :	II	III	IV	V	VI-IX
I					
Although Because Even though	Subject + verb	Direct object	Preposi- tional phrase	Tem- poral ad- verb	2nd clause

Critical items were distributed into 4 lists such that each list included one token of each of the 36 critical items and nine items from each of the 4 treatment conditions. The 4 sets of experimental stimuli were each embedded into a list of 70 filler sentences. Filler items, which were also subdivided into roughly phrasal presentation regions, ranging from 5 to 9 regions in length, varied in syntactic structure as well as syntactic and semantic complexity. Since the experimental paradigm employed in this study allowed for the collection of sensibility judgment data, 30 of the filler items were designed not to make sense. Nonsense filler items were

³There is some evidence that processing of semantic information follows a slower time-course than syntactic processing (Boland 1997). This suggests that a coercion effect is likely to occur later than the actual presentation of coercing material, namely in region VI.

incongruous based on some grammatical violation (e.g., subject/verb agreement), conceptual/pragmatic constraints (e.g., implausible event), or both. Thus, the experiment consisted of 4 separate list conditions containing 106 items each. Individual lists were pseudorandomized for presentation order such that one or more filler items intervened between every pair of target items. Presentation lists orders were randomized independently to avoid item-ordering effects.

Overview of Task & Procedure This experiment employed a self-paced, makes-sense judgment task in which participants evaluated sentences presented region-by-region in the center of a computer screen. Participants were instructed to quickly read each region and indicate whether that text region “made sense” with respect to the previously presented material from that trial. Two types of data were recorded for each participant for each text region: reading/judgment times and regional rejection rates. The rate of text presentation was controlled by individual participants in that new text material replaced the previous material as soon as a participant indicated a judgment (via a button press). At the end of each trial, participants were asked to provide make-sense judgments for the entire sentence. Thus, the data collected in this task allows us to examine processing load effects via reading/judgment latencies for specific regions. In addition, by recording sensibility judgments we can examine by-region rejection rates to test our intuitions regarding the aspectual infelicity in the coerced condition. Furthermore, we can confirm that ultimately participants do arrive at a meaningful interpretation in all sentence conditions. Finally, the make-sense judgment task has the added advantage of discouraging fast readers from buffering text material or postponing their interpretations until sentence-final regions are reached. Although no judgment feedback was given on critical trials, participants were encouraged to actively engage in regional make-sense judgments by receiving negative feedback when their make-sense judgments conflicted with those of the experimenters on filler trials.

Results

In sentence-final judgments, participants rejected 19% of the sentences in Condition A (the coerced condition), but only 7% in Condition B (the non-coerced, bare plural condition): $\chi^2 = 14.73$, $df = 1$, $p < .001$. Rejection rates in Conditions C & D were 8% and 9%, respectively. Sentences which were judged to be nonsensical *overall* were excluded from further analysis. However, items for which participants indicated that one or more regions were nonsensical, but judged the sentence to be acceptable overall were included in the analysis.

Reading time data Analyses on the reading/judgment latencies were computed separately using subjects and items as random factors. Analyses of latencies for text regions preceding the temporal adverbial (I-IV) and in regions VII and VIII were not different across treatment conditions ($F_s < 1$). Subsequent analyses focus on differences observed in Regions V (the adverbial modifier) and VI (immediately following the coercion region). In the full analysis evaluating Modifier Type and Cardinality, no main effect of Modifier

Type emerged (all $p_s > .25$), although a main effect trend toward Cardinality emerged (Region V: $F_1(1, 23) = 3.71$; $p < 0.06$; $F_2(1, 35) = 1.8$; $p < 0.19$.; Region VI: $F_1(1, 23) = 4.97$; $p < 0.05$; $F_2(1, 35) = 2.88$; $p < 0.09$). The interaction between these two variables was nearly significant at Region V ($F_1(1, 23) = 5.40$; $p < 0.02$; $F_2(1, 35) = 2.60$; $p < 0.11$) and significant at Region VI ($F_1(1, 23) = 17.6$; $p < 0.005$; $F_2(1, 35) = 5.97$; $p < 0.05$). This is not surprising since, here, the operation of coercion occurs only within certain factor combinations.

The crucial comparisons contrasted the effects of Cardinality within the Modifier Type alternation. As can be seen in Figure 1, response latencies for Regions V & VI in Condition A, the Singular+Durative, coerced iterative items, were significantly longer than those in Condition B, the Plural+Durative non-coerced, iterative items (Region V: $F_1(1, 23) = 7.34$; $p < 0.05$; $F_2(1, 35) = 4.66$; $p < 0.05$; Region VI: $F_1(1, 23) = 24.51$; $p < 0.0001$; $F_2(1, 35) = 9.27$; $p < 0.005$). In contrast, as is shown in Figure 2, no effects of Cardinality emerge in the critical text regions of sentences modified by Non-Durative adverbials (All $F_s < 1$).

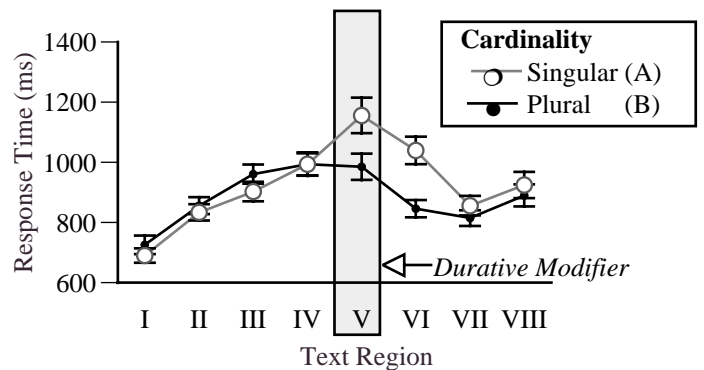


Figure 1: Response latency by text region for **Duratives** by Cardinality of Object

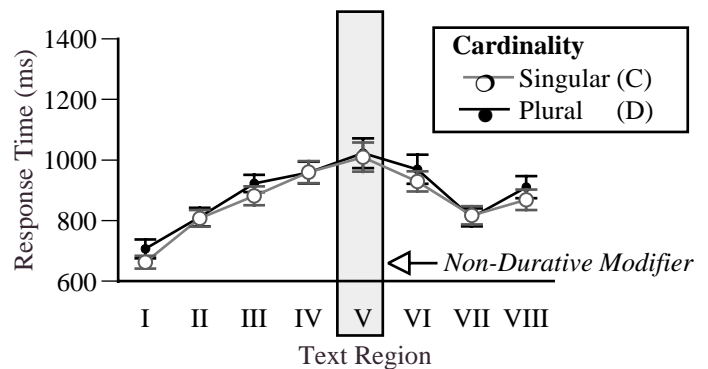


Figure 2: Response latency by text region for **Non-Duratives** by Cardinality of Object

Make-sense judgment data As can be seen in Figure 3, even in sentences which were ultimately judged to be acceptable, subjects indicated that the temporal adverbial Region V was difficult to integrate more frequently in the coerced singular durative condition than in the other treatment conditions. Chi-squared analysis reflects that this difference also holds for the Cardinality contrast within the Durative condition ($\chi^2 = 9.40$ (df=1); $p < .005$), but not between the non-durative conditions ($\chi^2 = .07$)

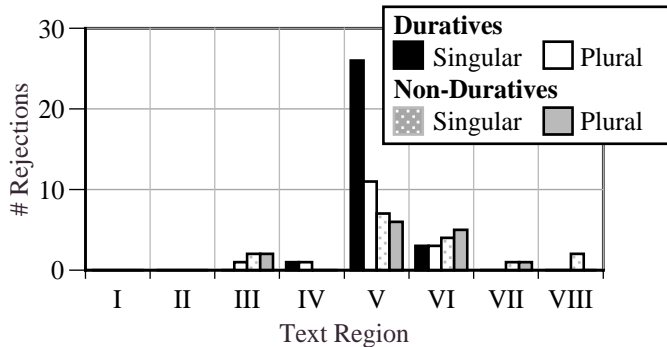


Figure 3: Regional make-sense judgments.

General Discussion

This study investigated the comprehension of sentences where an aspectually incompatible predicate - modifier combination is interpreted with the aid of the semantic operation of aspectual coercion. Aspectual coercion operates by altering the aspectual specifications of the predicate in a direction matching the input specifications of the adverbial modifier. In the specific case studied here, the semantic consequence of coercion is an obligatory iterative (atelic) interpretation of predicates involving punctual eventive (telic) verbs when these predicates are modified with adverbs of duration. Iterativity arises in this particular situation as the only temporally unbounded analysis applicable to eventive verbs lacking a durational component in their conceptual structure. The goal of our study was to establish whether the coercion operation has any disruptive consequences for sentence comprehension.

We find that participants are significantly delayed when reading a durative adverbial modifier that follows an aspectually incompatible predicate (punctual verb + singular object), as compared to reading the same adverbial following an aspectually compatible modifier (punctual verb + bare plural object). No such difficulties arise when the same predicates are modified by aspectually neutral adverbials, which do not trigger coercion. We hypothesize that the observed latency is indicative of an increase in processing cost associated with the need to undergo coercion in order to form a coherent representation of the utterance. On the other hand, within the predicate, objects of specified vs. unspecified cardinality were read with a comparable degree of ease: this suggests that decisions about utterance aspectuality are made after both the verb and its arguments have been encountered.

While we take our results to indicate that coercion is, indeed, a costly operation, they are compatible with several hypotheses as to *why* this should be the case. On one hand,

it is possible that the difficulty in the comprehension of coerced sentences reflects a price associated with some reanalysis of the current representation of the utterance. That is, it could be that the combination of a telic verb and singular object leads to an early decision of a telic aspectual value for the utterance under construction; and subsequent modification of that value is undesirable (costly). If this is the case, we would expect to observe the same degree of processing difficulty to occur in sentences where iteration is introduced by means of an overt lexical item, e.g. *Howard sent a large check to his daughter every year*.

Alternatively, the difficulty in interpreting coerced iterative sentences may stem from the fact that the existing representation has to be updated through the mediation of an iterative operator that is not morpho-syntactically expressed. To make this point clearer: a durative adverbial must attach to input which has some atelic properties. When this input is a process (*write*) or contains a process-like subcomponent (*write a book*), combination with a durative modifier is unproblematic. However, if the input does not have a continuous interpretation (*send a check*), an attempt to combine it directly with a durative adverbial will lead to an incoherent conceptual representation. The strategy of introducing an iterative operator - which has the effect of creating a novel, atelic event as input to the modifier - can then be regarded as a form of repair. It is possible that the observed processing delay reflects an attempt at the combination of predicate and modifier without the mediation of an iterative operator with the concomitant failure to form a sensible interpretation of the whole. If this is the case, we would expect the coercion effect to disappear in cases where an overt iterative element makes the interpretation domain of the modifier explicit, e.g. again in *Howard sent a large check to his daughter every year*. We plan to address these issues in further research.

Acknowledgments

We would like to thank Géraldine Legendre and Paul Hagstrom for helpful comments on an earlier draft of this paper.

References

- Boland, J. (1997). The relationship between syntactic and semantic processing in sentence comprehension. Ms.
- Dowty, D. (1978). *Word meaning and Montague grammar*. Dordrecht: Reidel.
- Moens, M., & Steedman, M. (1988). Temporal ontology and temporal reference. *Computational Linguistics*, 14, 15-28.
- Mourelatos, A. (1981). Events, processes, and states. *Linguistics and Philosophy*, 2, 415-434.
- Piñango, M, Zurif, E., & Jackendoff, R. (1999). Real-time processing implications of enriched composition at the syntax-semantics interface. *Journal of Psycholinguistic Research*, 28, 395-414.
- Vendler, Z. (1967). *Linguistics in Philosophy*. Ithaca, NY: Cornell University Press.
- Verkuyl, H. (1993). *A Theory of Aspectuality*. Cambridge, UK: Cambridge University Press.