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The Processing of Aspect

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THE PROCESSING OF ASPECT

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This MA Project, written by J.C. Urbina, and entitled *The Processing of Aspect*, having been approved in respect to style and intellectual content, is referred to you for judgment.

We have read this MA Project and recommend that it be approved.

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ABSTRACT OF THE PROJECT

THE PROCESSING OF ASPECT

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A topic in linguistics that requires more psycholinguistic research is that of aspect. In particular, we are interested in how speakers process aspectual structures in terms of telicity and atelicity. For this project, we examine monolingual English speakers and their processing times linked to aspectual interpretation of telic vs. atelic constructions. Our methodology utilizes Response Serial Visual Presentation (RSVP) (Rayner & Sereno, 1994; Garrod, 2006), which presents readers with sequences on a computer screen, and measures their reading times. The subjects are instructed to complete an additional task, such as a comprehension task. We investigate the distinctions in processing time between telic and atelic predicates and relate this data to recent theoretical proposals concerning the structure of telicity.

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I. INTRODUCTION

The syntax-semantics interface is a growing interest in linguistic research. It encourages a theoretical approach to the overlap of generative grammar and formal semantics. Understanding that syntax and semantics aren't mutually exclusive, Partee (2014) wrote that this interface has given linguists the "obligation to pay attention to both [fields]" (p. 18). There is a structural phenomenon in language whose understanding would be enriched by such an approach; the topic in question here is that of *aspect*—more specifically, *inner aspect*. Theories have been formulated on its compositionality (Thompson, 2006; MacDonald, 2006, 2008a, 2008b), its contribution in understanding phrase structure (deMena Travis, 2010), and its structural processing (Stockall & Husband, 2014).

However, several issues arise in defining this vague expression. 'Aspect' could refer either to a particular facet of something or, most relevantly, to one of two grammatical properties in language: *grammatical aspect* [1] or *lexical aspect* [2]. The issue that linguists contemplate is exactly how to distinguish the two. Binnick (2012) noted that these aspect types are "at least two distinct systems of categories…so intertwined that they have been, and still are, difficult to prise apart" (p. 32). Grammatical aspect includes how a single event may be realized with different sentential structures (e.g., *Bill jumped*

[1] Bhatt & Pancheva (2005) note that the alternate names for grammatical aspect are *viewpoint aspect* and *outer aspect* (p. 1).
[2] Bhatt & Pancheva also note that the alternate names for lexical aspect are *aktionsart*, *situation aspect*, and *inner aspect* (p. 1). The present study is concerned with this type of aspect, which will simply be referred to as *aspect*.

and *Bill had jumped*), relying on overt markers like inflection (*-ed*) and auxiliaries (*had*). On the other hand, lexical aspect determines an event's temporal structure based on the inherent properties of a verb and its arguments. Between grammatical aspect and lexical aspect, this present study is concerned with the latter, which will simply be referred to as *aspect*.

One significant component of aspect is telicity, the semantic property of an event perceived to have duration, an endpoint, or lack thereof. Research has investigated verbs considered either inherently telic or atelic (Stockall & Husband, 2014) to determine how the structure of a verb and its argument warrant a telic or atelic interpretation. Examining the aspectual interpretations of speakers is vital in understanding the "potential limits on the incrementality of parsing" (Husband & Stockall, 2014, p. 160); moreover, the syntax-semantics interface is a helpful approach to assessing "syntactic constraints on the domains for semantic interpretation" (Husband & Stockall, 2014, p. 160).

II. LITERATURE REVIEW

2.1 The Theory of Aspect

Thompson (2006) argues that the aspectual classification of an event is determined by the verb and its arguments. In particular, aspectual properties rely on telicity, which determines the perceived duration and/or endpoint of an event. Telic events have a distinct endpoint whereas atelic events have an ongoing quality. Thompson

provides Vendler's (1967) four classes of events that have contributed to research on the semantics of telicity. Two of these classes favor telic readings, as shown below:

2) a. Accomplishments[3]: events that have a duration and a definite end point
   b. Mary drew the circle.
3) a. Achievements[4]: events that have a definite end point, but are instantaneous.
   b. Mary found the treasure.

(Thompson, 2006, p. 212)

Example (2b) is described as a telic event due to "having a distinct end point" (Thompson, 2006, p. 212). It is understood that the act of drawing was completed at the time of the utterance. On the other hand, Vendler's two remaining classes of event favor atelic readings, as shown below:

4) a. States: events that are ongoing in time
   b. Mary knew French.
5) a. Activities: processes or "happenings" that are ongoing in time
   b. Mary pushed the cart.

(Thompson, 2006, p. 212)

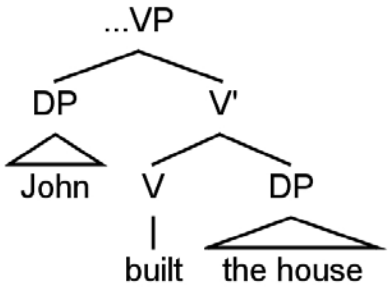
[3] According to Vendler (1957) and Caudal (1999), accomplishment verbs are considered to have non-punctuality and are sometimes referred to as "durative".
[4] Vendler (1957) and Caudal (1999) also consider achievement verbs to have punctuality and are therefore considered "punctual".

An atelic event is interpreted as "[not having] a particular end point specified" (p. 212), which Thompson uses to describe example (5b). Following Jackendoff (1991), Thompson proposes that a telic structure contains the feature of boundedness, specifically on the verb and its arguments (e.g., direct object, prepositional phrase). If a phrase checks the [bounded] feature (located at one or more nodes within the Aspectual Phrase, or AspP), then it contributes to a telic interpretation of an event.

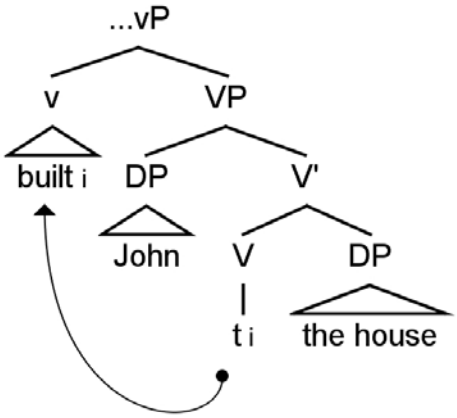
Thompson provides an example of a telic event: *John built the house in a week* (p. 214), which will be constructed with sequential structures to demonstrate the feature checking process. The presence of PP *in a week* comprises Thompson's proposed test for the telicity of an event, which will be discussed in another section. For now, the main clause *John built the house* will be focused on.

6) Underlying structure of main clause, following the VP-internal subject hypothesis (VPISH) (Radford, 1997, p. 154).

a.

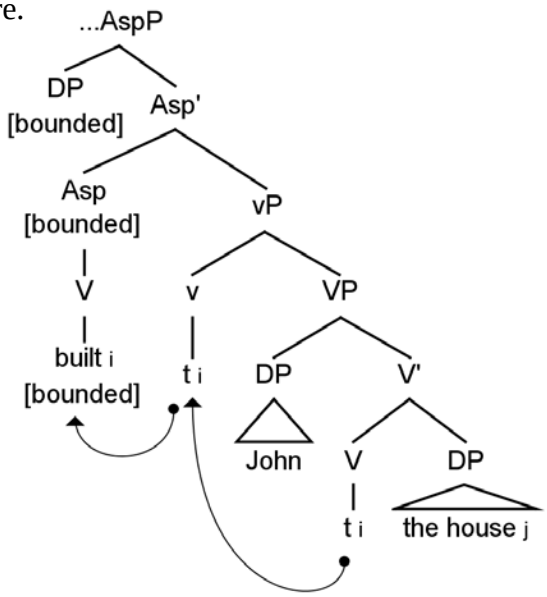


7) Verb raises to Spec *v* of vP[5], or the "outer vp shell" (Radford, 1997, p. 198).

a. 

Thompson argues that the [bounded] feature is located "between the verb and Asp heads" (p. 216), acting as a landing site for either a direct object or a PP to check [bounded] with. According to Thompson, checking this feature constitutes a telic event. Example 8 below demonstrates the order of feature checking:

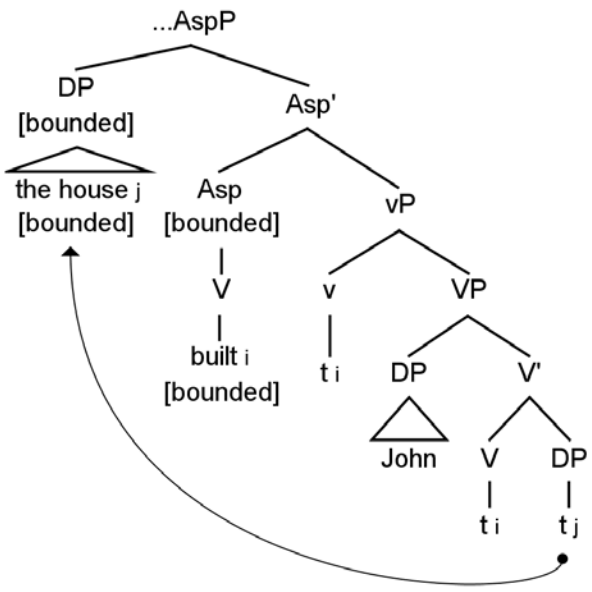
8) Verb raises from Spec of vP to Spec of Asp′ and checks [bounded] feature.

a. 

[5] Also referred to as a "light verb projection" (Davison, 2001, p. 1).

The direct object then checks the [bounded] feature after being raised to a higher projection. According to Thompson, this is located at the Spec of AspP (p. 215), as shown below in 8b:

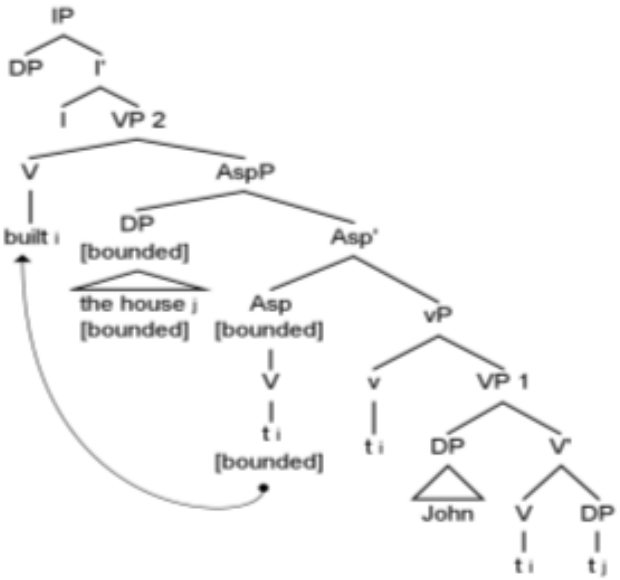
b.



In accordance with telicity, the main verb and the direct object have each checked the [bounded] feature. Next, in order to realize the surface form of the sentence, the remaining constituents must be raised to their respective landing sites. This is illustrated in Example 9, as shown below:

9) Main verb raises to Spec of VP2.

a.



The subject raises from Spec of VP1 to Spec of I′, the next available landing site. Finally, the subject raises to Spec of IP to produce the surface form of the sentence, as shown below in 9b:

b.

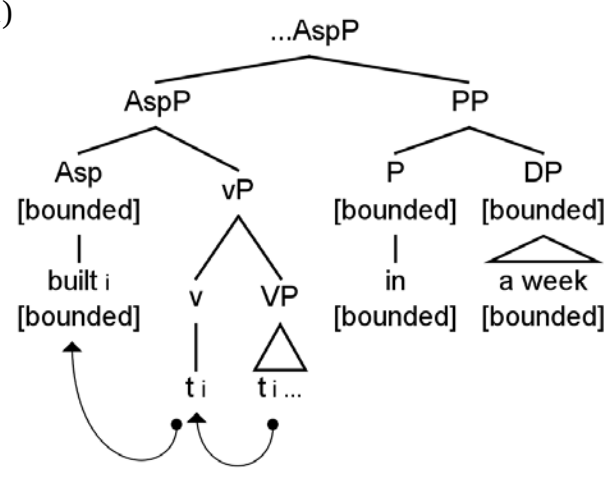
Following Vendler (1967) and Dowty (1979), Thompson uses PP adjunct clauses to determine the telicity of an event. She argues that a PP headed by *in* (e.g., *in a week*) is most compatible with a telic event whereas a PP headed by *for* (e.g., *for a week*) is most compatible with atelic events (p. 213). The accumulated steps found in Example 9b indicate one manner in which telic events check features (i.e., with a bounded direct object). Thompson represents this with a proposed syntactic configuration for a telic event:

10) [bounded] verb, [bounded] Aspect, [bounded] direct object

(Thompson, 2006, p. 215)

Additionally, Thompson argues that a [bounded] PP may check features in a telic event. This is illustrated below, where PP adjunct clause *in a week* is attached to main clause *John built the house*:

11)



Like Example 8a, the main verb checks the [bounded] feature. However, instead of the direct object, it is the PP that follows and checks the same feature. In effect, this produces another telic reading: *John built the house in a week*. Consequently, Thompson proposes a second syntactic configuration for a telic event:

12) [bounded] verb, [bounded] Aspect, [bounded] PP

(Thompson, 2006, p. 215)

As for atelic events, Thompson claims that a bare plural direct object is unbounded even when following a bounded verb (p. 213). This would occur with *houses* in *John built houses*, as illustrated below:

13)

The direct object is unable to check [bounded] feature and, thus, remains "unbounded" or [-bounded]. According to Thompson, this is one structure that lends to an atelic reading. Another type comprises of an unbound PP, which Thompson claims is headed by *for*. This is illustrated below, where PP adjunct clause *for a week* is attached to main clause *John built the house*:

14)

Despite following a [bounded] verb, the PP cannot check for boundedness and, thus, leads to an atelic reading of *John built the house for a week*. The endpoint of this event is neither syntactically nor semantically determined.

MacDonald (2008a) disputes Thompson on four key points: (1) "what the durative phrase and time span adverbial actually tell us aspectually" (p. 2), (2) "the existence of an aspectual projection (AspP) between vP and VP" (p. 2), (3) "a syntactic

domain of aspectual interpretation defined as the projection AspP (between vP and VP) and everything AspP dominates" (p. 2), and (4) Thompson's claim of "the bounded feature checking account of DPs and PPs" (p. 2).

The first point MacDonald addresses is the nature of the time span adverbial (e.g., *in an hour*) versus that of the durative phrase (e.g., *for an hour*). MacDonald acknowledges the standard assumption that the durative phrase is only compatible with an atelic predicate, as he exemplifies with the following constructions:

15) a. John drank a beer #for an hour.
b. John drank beer for an hour.

(MacDonald, 2008a, p. 3)

However, MacDonald claims that this is "a simplification of the facts" (p. 3) and proposes that the durative phrase may also be compatible with telic predicates "under an iterative interpretation" (p. 3), as he illustrates with the examples below:

16) a. John spotted a plane for an hour.
b. John carried a goat into the barn for an hour.

(MacDonald, 2008a, p. 3)

MacDonald's rationale is that the direct object is required to reappear in each iterated event (p. 3). In other words, the iterated subevent of (16a) is that the same plane

is being spotted, and the iterated subevent of (16b) is that the same goat is being carried into the barn. MacDonald refers to the Sequence of Identical Events (SIE) interpretation, which he claims "is elicited by the durative" (p. 4). The proposal is that durative phrases acting outside the SIE interpretation are incompatible with telic predicates. Referring back to (15a) *John drank a beer #for an hour*, MacDonald explains that the incompatibility comes from pragmatic circumstances in that "once a beer is drunk…it cannot be drunk again" (p. 4). MacDonald offers another example of a durative phrase operating outside the SIE interpretation, as shown below:

17) a. John ate a cake #for ten minutes.
b. John built a house #for a month.

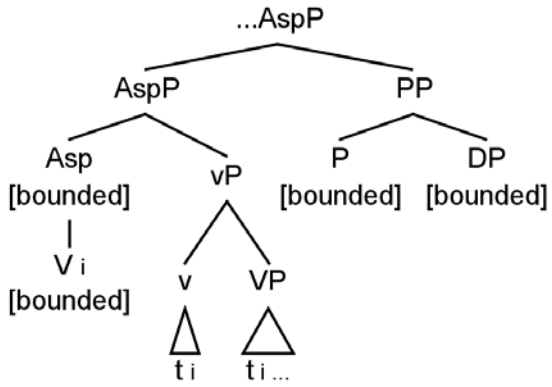
(MacDonald, 2008a, p. 4)

MacDonald attributes this incompatibility to a "pragmatically odd" SIE interpretation (i.e., the same cake cannot have been eaten and the same house cannot have been built in the events' respective iterative subevents) (p. 4). MacDonald concludes that "the durative phrase is syntactically compatible with all aspectual predicate types" (p. 5). Furthermore, he disputes Thompson's claim that the AspP projection is located above the vP to determine the telicity of the predicate.

As the second point of his argument, MacDonald instead proposes that the AspP projection is located "between vP and VP" (p. 1). His rationale is that the durative phrase

(e.g., *for an hour*) must adjoin to a position higher than VP in order to modify the "macro-event described by the predicate" (p. 4).

18) a. Thompson's AspP model



(Thompson, 2006, p. 217)

b. A hypothetical reconstruction of MacDonald's proposed AspP model, based on Thompson's model[6].

MacDonald supports this claim by using the elliptical *do so* construction, as he exemplifies with the following constructions:

[6] [Bounded] features are not included in this reconstruction, as MacDonald addresses them in a separate argument.

19) a. John drank beer for an hour and Frank **did so** for two.

c. Frank played soccer for ten minutes and John **did so** for twelve.

(MacDonald, 2008a, p. 4)

The second conclusion MacDonald draws is that "the interpretation elicited by the durative depends on the telicity of the predicate" (p. 4). In other words, when the durative adjoins to a telic event, it forces an iterative telic interpretation in which "an indefinite number of telic subevents" may occur (pp. 4-5). MacDonald claims that Thompson's model is "problematic" in that it structurally places the time span adverbial (i.e., *in an hour*) higher than the durative phrase (i.e., *for an hour*) (p. 5). This criticism stems from MacDonald's proposal that "the time span adverbial is interpreted within the scope of the durative" and, thus, "the time span must be structurally lower than the durative" (p. 6).

Another facet of Thompson's model that MacDonald disputes concerns the aspectual interpretation and distribution of bare plurals (BPs) and mass nouns (MNs). MacDonald believes that BPs and MNs "cannot establish their respective relations with AspP if they are structurally higher than AspP" (p. 7). Furthermore, he proposes that a BP or MN internal argument makes a durative phrase (e.g., atelic PP *for an hour*) compatible where it isn't possible with (in)definite plurals or count nouns (pp. 6-7). MacDonald illustrates these contrasts with the following examples:

20) a. John ate a pizza #for an hour.

b. John ate pizza/pizzas for an hour.

21) a. John drank a soda #for an hour.

b. John drank soda/sodas for an hour.

(MacDonald, 2008a, pp. 6-7)

However, MacDonald claims that a time span adverbial (e.g., *in ten minutes*) reveals a contrast in aspectual interpretation licensed by BP or MN internal arguments, as he exemplifies below:

22) a. John ate pizzas in ten minutes for an hour straight.
b. John ate pizza #in ten minutes for an hour straight.

23) a. John drank sodas in three minutes for an hour straight.
b. John drank soda #in three minutes for an hour straight.

(MacDonald, 2008a, p. 7)

MacDonald attributes this phenomenon to the Sequence of Similar Events (SSE) interpretation, which he claims is only compatible in the presence of the BP (p. 7). On the other hand, MacDonald claims that the presence of the MN elicits an atelic interpretation (p. 7). Any exceptions concerning the MN, MacDonald says, are most likely attributable to an SIE interpretation (p. 8). MacDonald illustrates this with the following example:

24) John carried a goat into water for an hour.

(MacDonald, 2008a, p. 8)

MacDonald claims that sentence (24) favors an SIE interpretation (i.e., a goat was carried into water, then back out, and back into it again for an hour) over an atelic

interpretation (p. 8). Furthermore, MacDonald proposes that adjoining a time span adverbial (e.g., *in ten minutes*) to a durative phrase could be compatible, as shown below:

25) John carried a goat into water in ten minutes (for an hour straight).

(MacDonald, 2008a, pp. 8-9)

MacDonald's rationale for this phenomenon is that there is an "AspP between vP and VP with which BPs and MNs establish distinct relations" (p. 9). MacDonald constructs the following model to support his claim:

26)

MacDonald's third argument against Thompson's model has to do with the "domain of aspectual interpretation" (p. 13). In other words, the domain consists of elements that affect aspectual interpretation based on higher or lower structural position with respect to AspP (p. 13). Reflecting back to his BP and MN claims, MacDonald

proposes that BPs are raised to Spec of AspP while MNs agree with Asp-projection (p. 10). According to him, because BP and MN "external arguments" are structurally higher than AspP, they cannot affect the predicate's aspectual interpretation (p. 10). MacDonald adds that Thompson's model doesn't account for how internal arguments affect the telicity of a predicate whereas external arguments do not (p. 11). In other words, he claims that Thompson's system does not prevent "the external argument from moving to AspP to check the [bounded] feature and contribute to aspectual interpretation" (p. 12). Furthermore, MacDonald states that Thompson's model fails to account for why "internal arguments can affect the telicity of the predicate while external arguments cannot" (p. 13).

MacDonald's fourth and final argument disputes two of Thompson's claims. The first concerns "the bounded feature checking account" (p. 18), which Thompson proposes DPs and PPs abide by because their bounded feature elicit telic interpretations (Thompson, 2006, p. 215). Consequently, if either a DP or PP doesn't check the bounded feature, it results in ungrammaticality. MacDonald, however, contends that telic predicates (e.g., *John crossed the street*) maintain grammaticality even with a DP (e.g., *for an hour*) and a bounded PP (e.g., *to the other side*). The resulting grammatical sentence is *John crossed the street for an hour to the other side*. MacDonald proposes that the predicate is still telic "as indicated by the interpretation of the durative phrase" (p. 19). He concludes that having both a bounded DP and a bounded PP doesn't necessarily result in ungrammaticality (p. 19).

The second claim of Thompson's that MacDonald disputes pertains to "[t]he higher adjunction site of the time span adverbial compared to the durative phrase" (p. 18).

MacDonald presents Thompson's claim that the time span adverbial cannot incorporate preposition stranding (e.g., **How many hours did you read that book in?*) because it adjoins to AspP, outside the vP (p. 21). On the other hand, the durative (e.g., *How many hours did you push that cart for?*) handles it better because it adjoins within the VP (p. 21). MacDonald also presents Thompson's *only* test, which he says Thompson claims can only adjoin to VP. Therefore, *only* is compatible with the durative, but not with the time span adverbial. However, MacDonald proposes that Thompson's analysis "undermines her proposal that bounded PPs check their feature at AspP, above vP. First, bounded PPs would be predicted not to incorporate, and therefore, not be able to preposition strand" (p. 22). MacDonald then concludes that "either these tests do not work, in which case the claim that the time span adverbial is adjoined to AspP, which is above vP, is not correct, or these tests do work, in which case, bounded PPs cannot adjoin to AspP, which is above vP" (pp. 22-23).

2.2 The Processing of Aspect

In examining aspect, Stockall and Husband (2014) conducted two experiments to determine the processing times of verbal aspectual features and how these features contribute to (a)telic constructions. Experiment 1 investigated online aspectual processing by manipulating verbal telicity (i.e., inherently telic vs. unspecified verbs). Experiment 2 then investigated the behavior of inherently atelic verbs with respect to the processing correlate of inherently telic vs. unspecified verbs gathered from the previous experiment. The overall study was designed to determine "the aspectual representation of verbs" (p.

277) and to investigate how this representation is used with respect to the aspectual interpretation of a sentence during online processing.

Stockall and Husband base their theoretical approach around what they call the "comprehension system", described as that which recovers the lexical content and lexical features of words (p. 279). In turn, the lexical content of words is used to project structure and "commit" to an aspectual interpretation (p. 279). Stockall and Husband chose to focus on transitive verbs given the results of previous research, which found that stative transitive verbs (e.g., *know*) were processed faster than eventive transitive verbs (e.g., *build*) in self-paced reading (Gennari and Poeppel, 2003). With this finding, Stockall and Husband concluded that "aspectually relevant features of verbs themselves, if present, can affect processing responses" (p. 280). Therefore, they theorized that the comprehension system uses aspectually relevant features when projecting structure and committing to an aspectual interpretation.

Stockall and Husband predicted that an aspectually unspecified verb would cause the comprehension system to apply the verb's internal argument to the (a)telic construction of the predicate (p. 280). However, inherently telic or atelic verbs would cause the comprehension system to apply the verb directly to respective telic or atelic constructions without regard to the verb's internal argument (p. 280). Given these two possible scenarios (i.e., unspecified verbs vs. inherently telic or atelic verbs), Stockall and Husband designed two distinct experiments to account for the differences in calibration of the comprehension system. Using this approach, Stockall and Husband also expected to shed light on the "processing profiles" for predicates (p. 280). In other words, how a

predicate is processed should vary depending on the verb type (i.e., inherently telic, inherently atelic, or unspecified).

The results of Experiment 1 found that inherently telic verbs (e.g., *lost*) were associated with a different processing profile from unspecified verbs (e.g., *read*, *solve*, *drink*) (p. 288). According to acceptability scores, participants had judged sentences containing unspecified verbs to be less acceptable than sentences containing inherently telic verbs. Stockall and Husband gathered that "atelic and telic predicates are associated with distinct responses" (p. 284). The results of Experiment 2 found that the processing profile of inherently atelic verbs (e.g., *roamed*) resembled the processing profile of unspecified verbs more than that of inherently telic verbs. Based on acceptability scores, participants had judged sentences containing inherently atelic verbs as less acceptable than sentences containing unspecified verbs.

Stockall and Husband noted that although Experiment 1 showed evidence of a class of inherently telic verbs, Experiment 2 provided no lexical distinction between unspecified verbs (p. 288). Thus, they concluded that the aspectual representation of verbs is divided into two classes: inherently telic and aspectually unspecified (p. 289). Furthermore, predicates that failed to support telic constructions (i.e., "inherently" atelic) likely occurred due to an interpretation "supported by wider world knowledge" as opposed to a "structurally licensed interpretation" (p. 289).

Summarizing past research on aspectual interpretation, Husband and Stockall (2014) offer insight on processing costs with respect to telicity. For instance, Husband and Stockall note that additional processing costs are usually expected with additional complexity regarding the structure of (a)telic events (p. 159). Some of the experiments

cited show that “atelic interpretations are significantly more costly to process than telic, consistent with semantic models of telicity” (pp. 159-160). However, the experiments with “merely suggestive” results show greater processing costs for telic predicates (p. 160).

Husband and Stockall reiterate the study by Gennari and Poeppel (2003), where eventive verbs (e.g., *build*) were found to have prompted longer processing times than did stative verbs (e.g., *know*) (p. 166). These results, as Husband and Stockall point out, provide support for two claims: processing time is affected by “representational semantic complexity”, and the activation of the event’s structural properties facilitates the processing of verb meanings (p. 167).

Another study which investigated event structure was conducted by McKoon and Macfarland (2002). They investigated how events are processed with respect to externally- or internally-caused structures. McKoon and Mcfarland found that, regardless of the number of arguments in a sentence, the more complex externally caused events (e.g., *break* in *John broke the glass*.) had longer processing time than the less complex internally caused events (e.g., *bloom* in **John bloomed the flower*.). Husband and Stockall believe that the study “provides further evidence that event structure plays an active role in verbal processing” (p. 167).

Investigating aspectual coercion using adverbial modification, Piñango et al. (1999) had presented participants with sentences containing punctual verbs (e.g., *jump, sneeze*) and adverbial modifiers (e.g., *until*) that indicate an extended time span. The test sentences in the study were structured as having the verb precede the adverbial modifier (e.g., *The insect hopped effortlessly until it reached…*). With a similar design, Brennan

and Pylkknen (2008) switched the order to placing the adverbial modifier before the verb (e.g., *Throughout the day the student sneezed in the back of the…*). These results showed that punctual verbs like *sneezed* were read more slowly in sentences given aspectual coercion. Husband and Stockall believe this validates the idea that processing cost is associated with aspectual coercion (p. 168). They also theorize that based on the research, "[p]rocessing costs increase when the telicity of the VP mismatches the aspectual requirements of an adverbial modifier" (p. 171). In other words, the telicity of the verb must match that of the adverbial modifier (i.e., telic verbs attach to telic adverbial modifiers while atelic verbs attach to atelic adverbial modifiers) to have lower processing costs.

Husband and Stockall discuss the projection of AspP, which they say lies "between the verb and the functional projection for tense, TP" (p. 180). This claim suggests that tense and aspect are treated as separate elements. Considering the influence that tense may have on projection hierarchy, Husband and Stockall propose the following:

"If the presence of tense on verbs requires the projection of AspP as well as TP, we may expect to see processing costs associated with its projection when processing terminative verbs which assign their event properties to AspP, compared to unspecified verbs which have no event properties to assign to AspP and may not project AspP at all" (p. 180).

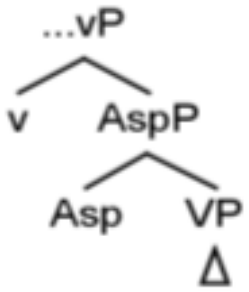
To reiterate, the differing theories concerning the projection of AspP are illustrated below:

27) Thompson (2006) proposes that AspP is located above the vP.

a.

MacDonald (2008a) proposes that AspP is located between vP and VP.

b.



Husband and Stockall propose that AspP is located between the verb and TP.

c.

The unanimous consensus among the three models is that AspP is placed at a higher projection than VP. The question, however, becomes a matter of where vP is located with respect to AspP. Understanding the roles of vP and AspP will shed light on telic constructions regarding agency and causative interpretations within a sentence. Radford (1997) states that arguments such as agency may originate within the vP shell (p. 198), which becomes a projection headed by a light verb. He defines a light verb as "[a]n affixal verb (often with a causative sense like that of *make*) to which a noun, adjective or verb adjoins" (p. 264). Butt (2004) claims that, with respect to telicity, light verbs "generally do signal some kind of boundedness or telicity or causation" (p. 16). This is likely due to the fact that a verb and its argument(s) do determine telicity, or the aspectual classification of events, as authors like Vendler (1967) and Thompson (2006) claim. Hence, it is worth investigating something like the vP projection, which may yield information on the processing of aspect. Concerning AspP, it is defined as a projection that "encodes whether a designated point in the event has been achieved, and is more predictable in its distribution and semantic contribution" (deMena Travis, 2010, p. 253). Designating the temporal endpoint of an event is the core idea behind telicity. However, the question becomes a matter of where vP and AspP are respectively located within the syntactic structure. Opposing theories are given regarding the hierarchy of these projections (i.e., AspP is above vP; AspP is below vP). In other words, one goal of this study is to determine the model that fits best according to our data. We will consider the three models presented in 27(a-c) as well as potential others if the results suggest so.

As for processing itself, we turn to the results of Gennari and Poeppel (2003), which found that "stative verbs [were] recognized faster than eventive[7] verbs, consistent with an effect of semantic complexity" (p. 33). Husband and Stockall (2014) repeat this claim in their research summaries (p. 167). Gennari and Poeppel attribute their findings to the idea of semantic complexity, or how semantic properties are processed based on activating the event properties of a verb (p. 29). Eventive verbs are more likely to be processed slower due to having an abundance of complex meanings, entailed properties, and semantic structure (p. 29). Stative verbs, on the other hand, only require the activation of a "single non-dynamic situation", meaning they have fewer sub-events to process than do eventive verbs (p. 29). Therefore, of the four verb classes proposed by Vendler (1967) (i.e., accomplishments, achievements, statives, and activities), we predict that stative verbs will facilitate the shortest processing time. On the other hand, based on the findings of Brennan and Pylkknen (2008), we predict that achievement verbs[8] will facilitate longer processing with aspectual coercion. In other words, we expect a mismatched pair of a verb and an adverbial modifier (e.g., telic verb with atelic adverbial modifier) to result in higher processing costs. This sort of construction resembles the SIE (Sequence of Identical Events) interpretation as proposed by MacDonald (2008a), in that a telic predicate may be compatible with a durative phrase. Thus, we expect sentences with the iterative interpretation to elicit longer processing time. This would be in

[7] Gennari and Poeppel indicate that eventive verbs fall under accomplishments, achievements, and activities (pp. 28-29). This claim is supported by Hyams (2011), who states that eventive predicates include "accomplishments, achievements, and activities" (p. 241). Therefore, we will also classify eventive verbs as including three of the four verb classes (i.e., accomplishments, achievements, and activities).
[8] Husband and Stockall (2014) refer to this as "punctual verbs" (p. 168).

accordance with the relationship between semantic complexity and the processing of event properties.

III. METHOD

3.1 Participants

A total of twelve English monolinguals (five males, seven females) were selected for the present study. The participants were all native speakers of American English. Only those whose first language was English were considered and selected for this study. The participants' completed educational levels ranged from high school to graduate school. The mean age of the participants was 27.25.

3.2 Experimental Methodology

The present study used the methodology of Response Serial Visual Presentation (RSVP), presented via SuperLab. In the RSVP methodology, participants were presented with one sentence at a time on a computer screen.

3.3 Procedure

Each participant was seated in front of a computer and logged into the RSVP software via SuperLab. The participant was then instructed to produce individual sentences on the screen by pressing the spacebar. After one sentence was silently read, the participant pressed the spacebar to read the following sentence. This procedure repeated until the session concluded. The participants' processing time (or reading time)

of every sentence was measured in milliseconds, spanning between the initial spacebar click at the beginning of the reading to the final spacebar click at the end of the reading.

Half of the sentences were accompanied with respective comprehension Yes/No questions, which immediately appeared after certain sentences. The comprehension question only pertained to the immediately preceding sentence and not to any other sentences in the session. For example, the participant would read the sentence, *Jerry drank the milk.* This would be followed by the question, *Did Jerry drink the juice?* The participant must then have pressed either 'y' for 'yes' or 'n' for 'no'. The session could not continue unless the participant selected the correct response. This was to ensure memory and focus on the given tasks.

Sentences and their corresponding comprehension questions were randomly generated for every test. However, this study was designed so that a sentence and its comprehension question were fixed as one unit and would always appear together as a two-part sequence. The participants were initially given a pre-trial training of six sentences before beginning the experimental trial.

3.4 Stimuli

The participants were presented with a total of seventy-two sentences, consisting of thirty-six target sentences and thirty-six fillers. The target sentences only utilized transitive verbs in the past tense. The sentence structures were divided into eight types:

1. Accomplishments (Telic 1, or T1)
2. Achievements (Telic 2, or T2)
3. Statives (Atelic 1, or A1)

4. Activities (Atelic 2, or A2)
5. Ambiguous Verb[9] + *in*-PP
6. Ambiguous Verb + *for*-PP
7. MacDonald + *for*-PP + *in*-PP
8. MacDonald + *in*-PP + *for*-PP.

Sentence types T1, T2, A1, and A2 were composed of monotransitive structures so that only a direct object acted as the verb's argument (e.g., *John built the house, Kyle knew German*). The two "ambiguous" sentence types utilized ambiguous verbs, which may elicit either a telic or an atelic interpretation. For example, given a particular PP, the verb *read* fits into a telic predicate (e.g., *John read the book in an hour*) and into an atelic predicate (e.g., *John read the book for an hour*). Thus, one of our sentence types used an ambiguous verb with the time span adverbial[10] (*in*-PP) and the other sentence type used the same verb with the durative phrase[11] (*for*-PP). Finally, the remaining two sentence types were constructions based around MacDonald's proposed SIE interpretations. One sentence type consisted of a monotransitive clause (e.g., *Neil trained the cat*) followed by a *for*-PP (e.g., *for a month*) followed by an *in*-PP (e.g., *in a year*), combining into a sentence with two prepositional arguments (e.g., *Neil trained the cat for a month in a year*). The other sentence type inverted the prepositional arguments so that the structure comprised the same monotransitive clause (e.g., *Neil trained the cat*) followed by an *in*-PP (e.g., *in a month*) followed by a *for*-PP (e.g., *for a year*). These structures also

[9] Stockall and Husband (2014) refer to this as an "unspecified verb", which may elicit either a telic or an atelic interpretation based on context and sentential structure. We will abbreviate "ambiguous" as *amb*.
[10] Indicated as T(PP), or Telic(PP).
[11] Indicated as A(PP), or Atelic(PP).

combined into a sentence with two prepositional arguments (e.g., *Neil trained the cat in a month for a year*). This syntactic configuration was based on MacDonald's proposed SIE representation of iterative events.

In the present study, two groups of participants received two separate tests. Group A only received sentence types T1, T2, Amb+*in*-PP, and MacDonald+*for*-PP+*in*-PP. Group B only received sentence types A1, A2, Amb+*for*-PP, and MacDonald+*in*-PP+*for*-PP. Each sentence type was given nine sentences. This ensured that every participant, regardless of the group, received thirty-six test sentences.

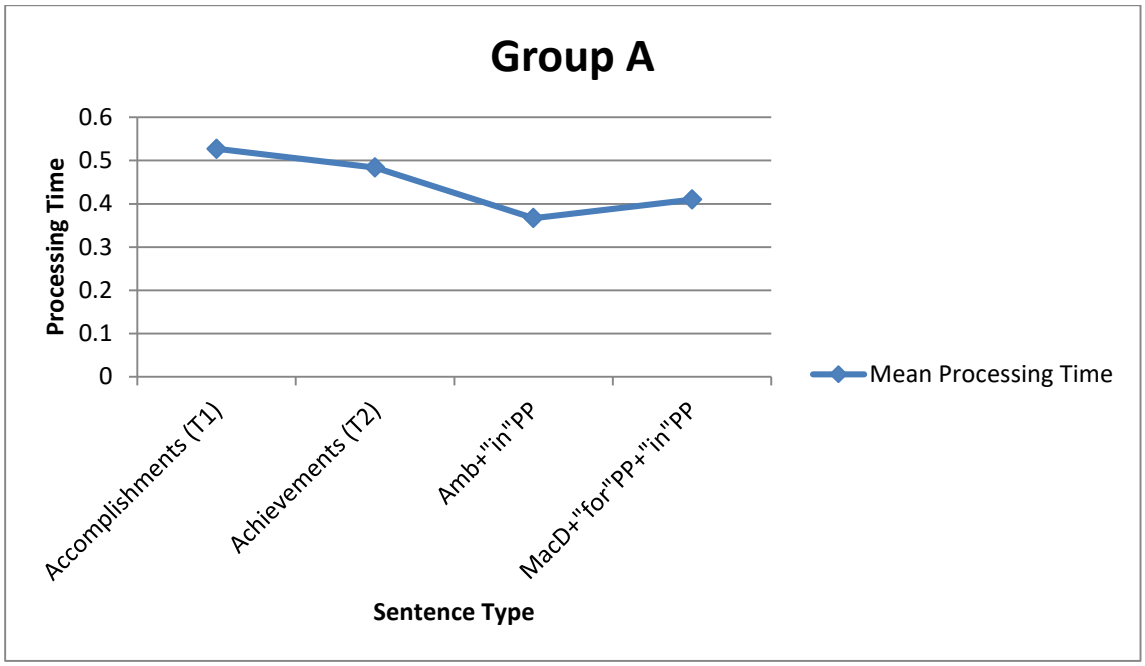
IV. RESULTS

The analyses of Groups A and B were conducted separately. Calculations were made by dividing the processing time by the number of words in the sentence. A one-way ANOVA with repeated measures was conducted to compare the effect of sentence type (4 levels) on processing time for Group A. This group had received the sentences types: T1, T2, Ambiguous+*in*-PP, and MacDonald+*for*-PP+*in*-PP. Results revealed a main effect of sentence type, $F(3,15) = 3.32$, $p = .049$. There was a near-significant difference between T2 sentences and Ambiguous+*in*-PP sentences ($p = .066$). The mean processing time per word of T2 sentences (.484 seconds) tended to be higher than that of the sentences with the Ambiguous+*in*-PP sentences (.367 seconds). All of the mean processing times from Group A are presented in Table 1.

Table 1 Mean Processing Times per word in seconds (Group A).

Sentence Type	Time (seconds)

T1	.527
T2	.484
Amb+*in*-PP	.367
MacD+*for*-PP+*in*-PP	.410



A one-way ANOVA with repeated measures was also conducted to compare the effect of sentence type (4 levels) on processing time for Group B. This group had received the sentences types: A1, A2, Ambiguous+*for*-PP, and MacDonald+*in*-PP+*for*-PP. Results revealed a main effect of sentence type, $F(3,15) = 8.22$, $p = .002$. There was a significant difference between A2 sentences and Ambiguous+*for*-PP sentences ($p = .047$). The mean processing time per word of A2 sentences (.499 seconds) was significantly higher than that of the sentences with the Ambiguous+*for*-PP sentences (.378 seconds). There was a near-significant difference between A1 sentences and MacDonald+*in*-PP+*for*-PP sentences ($p = .070$). The mean processing time per word of A1 sentences

(,466 seconds) tended to be higher than that of Ambiguous+*for*-PP sentences (.309 seconds). All of the mean processing times from Group B are presented in Table 2.

Table 2 Mean Processing Times per word in seconds (Group B).

Sentence Type	Time (seconds)
A1	.466
A2	.499
Amb+*for*-PP	.378
MacD+*in*-PP+*for*-PP	.309

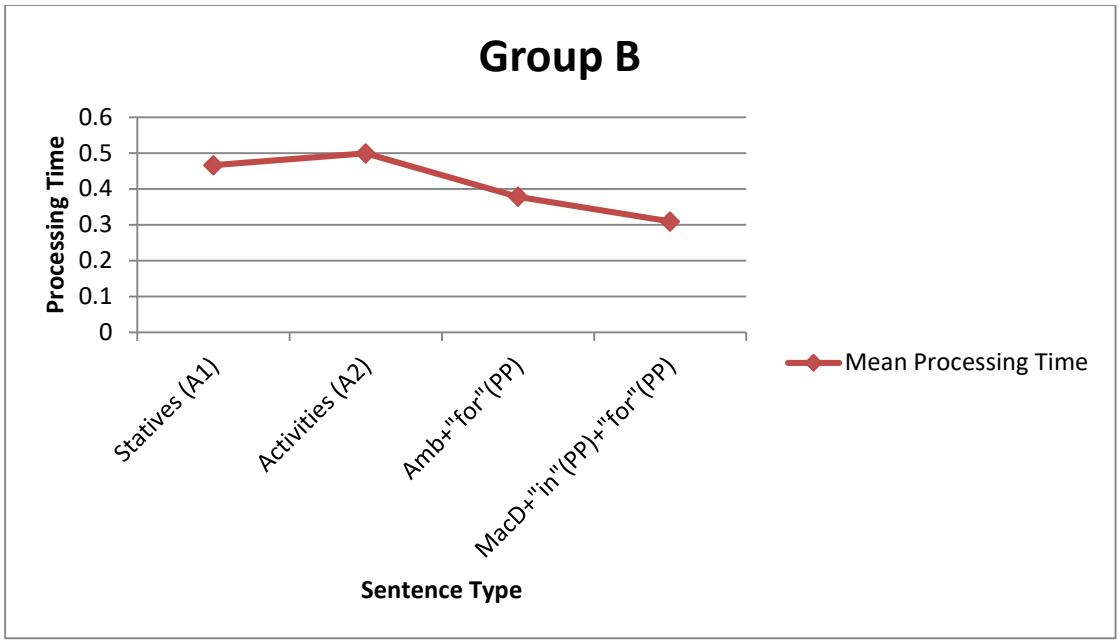
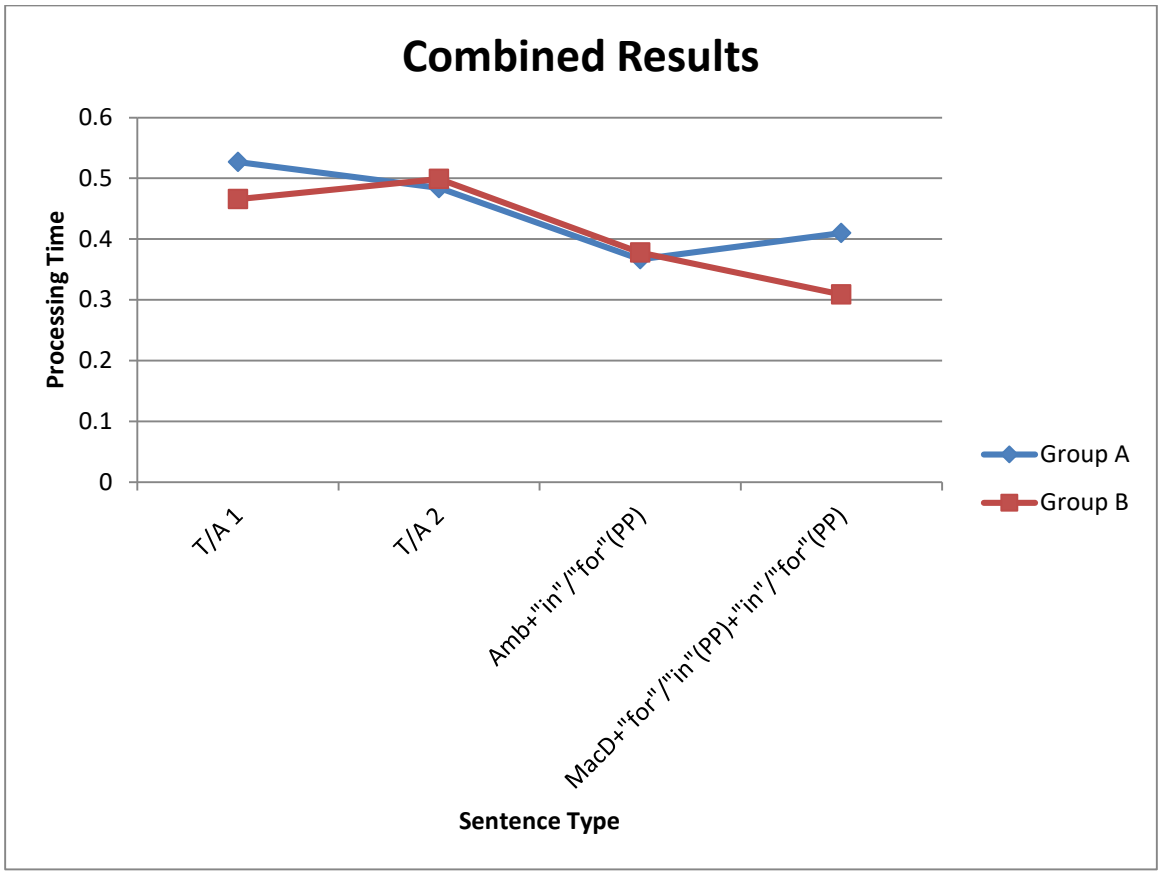


Table 3, presented below, was made in order to compare the processing times per word between Groups A and B. Based on visual inspection, the two group performances were about the same. The gap between the two MacDonald sentences indicated that Group A had processed their MacDonald sentences (i.e., MacD+*for*-PP+*in*-PP) much

faster than Group B had processed their own MacDonald sentences (i.e., MacD+*in*-PP+*for*-PP).

Table 3 Processing Times combined from Groups A and B.



V. DISCUSSION

There was a significant difference between activity sentences (A2) and ambiguous sentences with the durative phrase (*for*-PP). Participants had processed the latter quicker than they had the former. This suggests that there was more cognitive cost in processing

the activities despite them having fewer words per sentence than did the ambiguous sentences. It was an unexpected result that a sentence with a prepositional argument was processed faster than a sentence without. There is no indication that semantic complexity had a role in differentiating these two sentence types. However, it would be worthwhile to investigate the behavior of the durative phrase in light of other sentence types. Furthermore, the durative phrase should also be experimented with different verb types to possibly elicit different results.

Stative sentences (A1) tended to be processed slower than MacDonald's SIE construction (i.e., MacD+*in*-PP+*for*-PP) was. This was also unexpected given that the latter sentence type contained two prepositional arguments. This result suggests that, like activity sentences, there was more cognitive cost in processing the stative sentences. Moreover, this information shows no support of Gennari and Poeppel's finding that statives were processed quicker than the other verb types were. Future research should analyze the nature of atelic verbs and their predicates to determine the cause of their costlier processing.

Achievement sentences (T2) tended to be processed slower than were ambiguous sentences with the time span adverbial (*in*-PP). Like in the case of the A2 sentences, more cognitive cost may have been elicited in the achievement sentences than in the sentences with prepositional arguments. Our initial prediction was correct in that achievements would be processed longer (Brennan and Pylkknen, 2008). However, the results don't indicate that this was due to aspectual coercion as it had been in the literature. In fact, our finding is unexpected in the sense that achievement sentences without aspectual coercion were slower to process. Further analysis can better indicate

the nature of achievement verbs and their predicates with regard to the cause of costlier processing.

Of the four verb types, there was no clear indication as to which were processed the fastest or the slowest. Based on visual inspection of Table 3, the data suggest that statives were processed the quickest. However, in light of the other graph points, this isn't a significant finding. The same applies to accomplishments (T1), which seemed to have been processed the slowest of the four verb types. A larger participant sample in future studies could possibly yield more significant results.

Finally, the data didn't shed light on the location of AspP in the syntactic configuration of (a)telic sentences. The results didn't indicate which of the three models (i.e., Thompson's, MacDonald's, Husband and Stocall's) was the most plausible. Further analysis of (a)telic predicates may shed light on the theoretical realm surrounding aspect in English. It is possible that different verb types exhibit unique movements and feature checking that may account for distinctive processing times and comprehension.

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APPENDIX

The following is the complete list of the experimental stimuli used in the present study. Some sentences are accompanied with a Yes/No comprehension question that participants had to have answered.

Group One – Telic Sentences

Accomplishments (T1) (Group A)

(1) John built the house.
Did John build the house?
(2) Carl delivered the pizza.
Did Carl deliver the pizza?
(3) Alice baked the pie.
Did Keith bake the pie?
(4) Bill recited the alphabet.
(5) Virginia wrote the textbook.
(6) Wilson drew the triangle.
Did Wilson draw the triangle?
(7) Julia filled the bottle.
(8) Dave destroyed the evidence.
(9) Sam ruined the computer.

Achievements (T2) (Group A)

(1) Laura crossed the finish line.
(2) Oliver threw the ball.
Did Emily throw the ball?
(3) Patricia lost the watch.
(4) Sarah mailed the letter.
Did Sarah mail the letter?
(5) Tyler finished the puzzle.
(6) George solved the crime.
Did George solve the crime?
(7) Mark won the tournament.
(8) Tara found the key.
Did Tara find the key?
(9) Paula reached the summit.

Group Two – Atelic Sentences

Statives (A1) (Group B)

(1) Kyle knew German.
(2) Adam remembered the password.
Did Molly remember the password?
(3) William hated the mosquitoes.
(4) Mia understood algebra.
(5) Rudy had the ball.
Did Eliza have the ball?

(6) Liz loved the winter.
(7) Francine imagined the ghost.
(8) Doreen enjoyed the bicycle.
Did Doreen enjoy the bicycle?
(9) Bruce feared the spider.

Activities (A2) (Group B)

(1) Steven pushed the cart.
(2) Todd touched the glass.
(3) Stephanie flew the plane.
(4) Michael played the game.
(5) Richard drove the truck.
Did Richard drive the truck?
(6) Nancy stirred the coffee.
Did Jeffrey stir the coffee?
(7) Harry practiced the piano.
Did Harry practice the piano?
(8) Christina consulted the lawyer.
(9) Tim studied the artifact.
Did Britney study the artifact?

Group Three – Ambiguous Sentences

With *in*-(PP) (Group A)

(1) Freddy read the book in an hour.
(2) Melissa painted the wall in a half-hour.
Did Jason paint the wall?
(3) Diana cooked the steak in thirty minutes.
(4) Phillip drank the wine in twenty minutes.
(5) Karla folded the paper in two seconds.
(6) Martha did the homework in an hour.
(7) Paul sewed the pants in two hours.
(8) Bob drew the picture in an hour.
(9) Mary skinned the potatoes in an hour.

With *for*-(PP) (Group B)

(1) Freddy read the book for an hour.
(2) Melissa painted the wall for a half-hour.
Did Jason paint the wall?
(3) Diana cooked the steak for thirty minutes.
(4) Phillip drank the wine for twenty minutes.
(5) Karla folded the paper for two seconds.
(6) Martha did the homework for an hour.
(7) Paul sewed the pants for two hours.
(8) Bob drew the picture for an hour.

(9) Mary skinned the potatoes for an hour.

Group Four – MacDonald Sentences

MacD+*for*-PP+*in*-PP (Group A)

(1) Neil trained the cat for a month in a year.
Did Neil train the cat?
(2) Rachel fixed the car for a week in a month.
Did Tucker fix the car?
(3) Jenny ironed the shirt for an hour in a day.
(4) Edward caught the pencil for a second in a minute.
Did Tammy catch the pencil?
(5) Betty stopped the car for a minute in an hour.
(6) Evelyn recognized the teacher for a day in a month.
(7) Susan doubted the writer for a day in a summer.
(8) Kelly admired the painting for a year in a decade.
(9) Gina performed the play for a week in 3 months.

MacD+*in*-PP+*for*-PP (Group B)

(1) Neil trained the cat in a month for a year.
Did Neil train the cat?
(2) Rachel fixed the car in a week for a month.
Did Tucker fix the car?
(3) Jenny ironed the shirt in an hour for a day.
(4) Edward caught the pencil in a second for a minute.
Did Tammy catch the pencil?
(5) Betty stopped the car in a minute for an hour.
(6) Evelyn recognized the teacher in a day for a month.
(7) Susan doubted the writer in a day for a summer.
(8) Kelly admired the painting in a year for a decade.
(9) Gina performed the play in a week for 3 months.