The role of default constructions in the processing of mismatch: The case of possessive free relatives

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Abstract

Townsend and Bever (2001) and Ferreira (2003) argue that simple templates representing the most commonly used orderings of arguments within a clause (e.g., NP-V-NP = Agent-Action-Patient) are used early in sentence comprehension to derive a preliminary interpretation before a full parse is completed. Sentences which match these templates (e.g., active sentences, subject clefts) are understood quickly and accurately, while sentences which deviate from the templates (e.g. passive sentences, object clefts) require additional processing to arrive at the correct interpretation. The present study extends the idea of canonical templates to the domain of noun phrases. I report on two experiments showing that possessive free relative clauses in English, which involve a non-canonical ordering of the head noun, are more difficult to understand than canonically headed noun phrases. I propose two reasons for this finding: (1) possessive free relatives deviate from the canonical template for interpreting noun phrases; and (2) the formal cues for interpreting possessive free relatives are relatively subtle. More generally I suggest that canonical templates help constrain mismatch in language by making certain kinds of mismatches costly for language users. Finally, I argue that evidence for canonical templates fits best within a parallel-architecture, constructionist theory of grammar.

1. Introduction

Languages are full of mismatches or deviations from the canonical mappings between form and meaning.[↑] For example, passive constructions violate the usual correlation between grammatical subject and semantic agent, while object-fronting constructions violate the normal ordering of the direct object in relation to the verb. Although such constructions are common in languages and fulfill useful discourse functions, they come at some cost for language users. Experimental evidence shows that sentences with a non-canonical ordering of arguments are understood more slowly and less

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accurately than sentences with canonical orderings (Ferreira 2003, Townsend and Bever 2001, Love and Swinney 1998).

Why are non-canonical sentence types more difficult to process? Townsend and Bever (2001) and Ferreira (2003) argue compellingly that at least some effects of canonicity can be explained in terms of 'canonical sentence templates.' They argue that simple templates representing the most commonly used orderings of arguments within a clause (e.g., NP-V-NP = Agent-Action-Patient) are used early in sentence comprehension to derive a preliminary interpretation before a full parse is completed. Sentences which match these templates (e.g., active sentences, subject clefts) are understood quickly and accurately. However, sentences which deviate from the templates (e.g. passive sentences, object clefts) require additional processing to arrive at the correct interpretation, leading to slower response times and more comprehension errors.

In this paper, I report on two experiments which further support the hypothesis that canonical sentence templates play a role in sentence comprehension. While previous work in this area has focused exclusively on non-canonical orderings of verbal arguments within clauses, I extend this line of research to mismatches involving a non-canonical positioning of the head noun within the noun phrase. Specifically, I report on two experiments showing that possessive free relative clauses in English, which involve a non-canonical ordering of the head noun, are more difficult to understand than canonically headed noun phrases. I propose two reasons for this finding: (1) possessive free relatives deviate from the canonical templates normally used for interpreting noun phrases; and (2) the formal cues for correctly interpreting possessive free relatives are relatively subtle. More generally I suggest that canonical templates play a role in sentence comprehension and help constrain mismatch in language by making certain kinds of mismatches especially costly for language users. Finally, I argue that evidence for canonical templates fits best within a parallel-architecture, constructionist theory of grammar. In a constructionist theory, canonical templates may be represented directly in the competence grammar (as default constructions), thus simplifying the explanation of their role in sentence processing.

The paper is organized as follows. Section 2 discusses the psycholinguistic motivation for canonical templates and the idea of "good-enough" processing. Section 3 discusses the special properties of English free relative clauses and reports the results of two sentence comprehension experiments. Section 4 discusses some general implications of this study for theories of grammar and theories of sentence comprehension.

2. Why is Canonical Form Simple?

The term 'canonical form' usually refers to the most frequently occurring orderings of arguments within a simple clause in a particular language.[1] Non-canonical structures therefore include function-changing constructions such as the passive construction as well as reordering constructions such as object relatives and object clefts. Menn (2000) observes that canonical sentence form has been shown, in general, to be simpler for processing than non-canonical sentence form. Various explanations have been offered in the literature on sentence comprehension. One is that canonical sentence types have fewer dependencies involving gaps/traces than non-canonical sentence types do (e.g., Grodzinsky 1995). A second explanation is that individual verbs are lexically biased to occur in certain sentence frames (Gahl et al 2003, Menn 2000). For example, highly transitive verbs like *kick* and *break* are biased toward an active interpretation in which the agent comes first, whereas verbs like *elect* and *injure* are biased toward a passive interpretation in which the patient comes first. Thus, processing difficulty arises when the verb is not used in its preferred sentence frame. A third explanation is that 'canonical templates' specifying a particular linear ordering of semantic arguments are used for the initial interpretation of clauses and sentences (Ferreira 2003, Townsend and Bever 2001). Processing difficulty ensues when a sentence violates the relevant template. This explanation is similar to the verb bias explanation, except that canonical templates are specified at a more abstract level independent of any particular lexical items. While all three explanations are well supported at least for certain types of data, the present study focuses only on the third type of explanation.

Townsend and Bever (2001) propose various 'canonical sentence templates' relevant for the comprehension of clauses and sentences. Canonical templates, which are language-specific, specify linear ordering of constituents and their associated semantic roles. Templates do not include information about hierarchical constituent structure. For example, the so-called Noun-Verb-Noun (NVN) template for English is specified as follows (Townsend and Bever 2001: 247):

(1)	Linear order:	NP	V	NP
	Semantic role:	Agent	Action	Patient
		The dogs	destroyed	the garden.

[1] The terms canonical and non-canonical must be defined differently for languages with relatively free word order. For example, Stamenov and Andonova (1998) show that object-fronting constructions in Bulgarian do not show the kind of filler-gap effects in processing that have been found for English. In free word order languages, canonical form might be defined in terms of certain combinations of case marking, agreement marking, prosodic structure, and semantic roles.

Townsend and Bever (2001) interpret numerous studies showing slower processing for non-canonical clauses and sentences in terms of simple templates such as NVN. Further supporting this idea, Ferreira (2003) used a thematic role decision task to show that passive sentences and object clefts, both of which violate the NVN template, are not only processed more slowly but also *misunderstood* significantly more often than active sentences and subject clefts. This was true even for simple, unambiguous, semantically-plausible sentences with no garden-path structures and no subordinate clauses. For example, for sentences like (2a), participants were 99% correct on agent decisions, whereas for sentences like (2b), participants were only 88% correct (Ferreira 2003: 176). A similar difference was found for patient decisions (97% for actives, 92% for passives).

(2) a. The dog bit the man.
b. The man was bitten by the dog.

Based on the results of three experiments, Ferreira argues that listeners and readers use simple templates for a rough and ready ('good-enough') interpretation of sentences before full syntactic and semantic processing is complete. Importantly, her study showed that incorrect interpretations may linger, leading listeners to misinterpret the intended meaning of the sentence. In the following section I extend this line of research to the realm of noun phrases.

3. Comprehension of English Free Relative Clauses

Ferreira (2003) has shown that canonical templates appear to play a role in the comprehension of simple sentences. In this section, I explore whether similar canonical templates might play a role in noun phrase comprehension. In section 3.1, I propose a set of templates for English noun phrases and show that possessive free relative clauses in English violate the proposed templates. Specifically, possessive free relatives violate the normal ordering of the head noun with respect to its specifiers/modifiers. In sections 3.2 and 3.3, I report on two psycholinguistic experiments, both of which confirm that possessive free relatives are more difficult to comprehend than other types of possessive and non-possessive relative clauses.

3.1 Form-function Mismatch in Possessive Free Relatives

Free relative clauses contrast with normally headed relative clauses in that they do not seem to have any external head. In (3a), the restrictive relative

clause *who said that* modifies the noun *person.* However, in (3b) and (3c), there appears to be no overt head preceding the relative clause.

(3) a. The person who said that is a fool.
b. Whoever said that is a fool.
c. Whichever person said that is a fool.

In general, free relatives have the distribution of the category to which the relative pronoun belongs. For example, *whoever*-clauses as in (3b) and *whichever*-clauses as in (3c) (in which *whichever* functions as a determiner) have the distribution of NPs. Therefore, some authors have analyzed free relative pronouns as heads in a position external to the relative clause (e.g., Bresnan and Grimshaw 1978, Larson 1987). However, because of parallels between free relative clauses and other kinds of *wh*-clauses, the free relative pronoun has more commonly been analyzed as occurring in a position internal to the relative clause, such as Spec CP (Grosu 2002). In clause-internal analyses, distributional facts are generally attributed to the presence of an empty head (Grosu and Landman 1998) or a unary projection (Müller 1999) that allows the clause to function as a NP argument of other heads.[2]

The distinction between these various syntactic analyses is not crucial to the current study, however. Most important for our purposes is the semantic content of the free relative pronoun, which includes the referential index of the NP as part of its meaning. For example, the pronoun *whoever* is understood as 'the person who' or 'anyone who'. Thus, in a subject relative such as (3b-c), the relative pronoun *whoever* or the relative phrase *whichever person* is understood to refer both to the subject of the relative clause (the person who said that) and the subject of the matrix clause (the person who is a fool).

Possessive free relative clauses in English are unique among free relative clauses in that the possessive relative pronoun *whoever's* is interpreted as possessor of the following noun within the relative clause, but also as head of a matrix clause NP. While *whoever's* in (4a) functions within the relative clause similarly to the relative pronoun *whose* in (4b), *whoever's* must also include the referential index of the matrix clause NP. Thus, *whoever's* is interpreted as 'the person whose' or 'anyone whose', and it is the person (not the idea) that is a fool. A few additional examples from naturally occurring internet discourse are included in (5a-c) below.

(4) a. Whoever's idea that was is a fool.
b. The person whose idea that was is a fool.

[2] See also Wright and Kathol (2003) for a constructional view of the headedness mismatch in free relative clauses.

(5) a. "There were rose petals scattered across the floor and some had writing on them. One said, 'I'll love you forever', and another said, 'Be mine till the end of time.' How sweet, *whoever's boyfriend did this is a lucky girl.*" (Quizilla.com, 2-20-2007)

b. "…as far as the kids on stage behind Roger, I agree with Basje on this one too - that's pretty unprofessional...I am pretty sure *whoever's kids those were could afford a nanny or sitter for that night.*" (Queenzone.com, 3-31-2005)

c. "I bet *whoever's car that is is having a worse day than you.*" (Stereokiller.com, 4-16-2007, referring to a picture of a car smashed by a fallen tree)

It is interesting to note that although possessive free relatives are used in casual discourse, and readily interpretable in an appropriate context, they are, at least intuitively, a bit strange and more difficult to understand than ordinary possessive relative clauses as in (4b) above. Here, I capture this intuition in terms of Townsend and Bever's (2001) idea of canonical templates.

Extending the idea of canonical templates to the realm of NP structure, I propose that there exist language-specific canonical templates for NP which pair a certain linear ordering of constituents with a certain semantic role. In English, these templates order the determiner (as in 6) or possessor (as in 7) before the head, where head is defined semantically as bearer of the referential index for NP:[3]

(6) Linear Order: Det N S
Semantic Role: Specifier Head Modifier
[The dogs that got loose] are in trouble.

(7) Linear Order: Possessor N S
Semantic Role: Specifier Head Modifier
[John's dogs that got loose] are in trouble.

Ordinary possessive relative clauses are syntactically and semantically complex, but still conform to same the canonical template for NP, as shown in (8):

[3] The question of whether free relative pronouns like *whoever* really are in a head position external to the relative clause, or whether they are internal to the relative clause, is not important for our purposes. It is clear that they are the only overt cue to the semantic index of the NP.

(8) Linear Order: Det N S
Semantic Role: Specifier Head Modifier
[The guy whose dogs got loose] is in trouble.

Furthermore, non-possessive free relative clauses as in (9) below also conform to the canonical template, despite the (possible) presence of an empty head in the syntax. In terms of identifying the referential index of NP, *whichever dogs* in (9) functions similarly to *the dogs* in (6) above.

(9) Linear Order: Possessor N S
Semantic Role: Specifier Head Modifier
[Whichever dogs got loose] are in trouble.

Superficially, possessive free relatives look similar to possessive phrases as in (7) and *whichever*-phrases as in (9). However, they have an interpretation more similar to that of possessive relative clauses as in (8). In (10), the interpretation of the referential index for the NP depends on the possessive pronoun *whoever's*, thus violating expected interpretation specified by the canonical template:

(10) Linear Order: Possessor N S
Expected Semantic Role: Specifier Head Modifier
Actual Semantic Role: Head Modifier
[Whoever's dogs got loose] is in trouble.

Following Ferreira's (2003) 'good-enough' theory of sentence processing, NPs which violate the canonical template should be more difficult to process than those which do not. For example, the theory predicts that listeners/readers should process sentences such as (10) more slowly than regular possessive relative clauses such as (8) above. In addition, although *whoever's* in (10) refers to the owner of the dogs, listeners/readers should at least occasionally interpret the sentence in (10) to mean that the dogs are in trouble rather than their owner. Such misinterpretations are possible for regular possessive relatives as in (8) as well, but should be less likely since regular possessive relatives conform to the relevant template for NP. In the following sections, I report on two experiments which tested these hypotheses.

3.2 Experiment 1: Verb Decision Task

It is predicted that possessive free relatives should be more frequently misunderstood and more slowly processed than similar phrases that conform

to the ordering defaults for NP. To test this, we used a decision task in which participants were presented with written sentences with the verb missing and asked to fill in the correct verb form ("is" or "are") by pressing a button. Although this particular task has not previously been used in the literature on sentence comprehension, it follows a similar logic to that of the thematic role decision task of Ferreira (2003). Subject-verb agreement is used as an indirect measure of sentence comprehension, since an accurate response requires participants to correctly identify the referent of the subject noun phrase. As with other decision tasks, slower decision time is assumed to indicate more difficulty in processing.

3.2.1 Methods

Materials: Ten sets of stimuli like the set in Table 1 below were constructed by combining each of two levels of two factors (possessive/non-possessive and free/normal). Multiple versions of each sentence type were constructed to counterbalance number specification on the relevant nouns, such that each stimulus set included ten sentences: four for each normal possessive sentence type (with number varied on *guy* and *dog*) and two for each of the other sentence types (with number varied on *dog*).[4]

Sentence Types	*Example Sentence*
normal possessive	The guy whose dogs got loose is in trouble.
free possessive	Whoever's dogs got loose is in trouble.
normal non-possessive	The dogs that got loose are in trouble.
free non-possessive	Whichever dogs got loose are in trouble.

Table 1: Stimulus Materials

Procedure: Following a brief background questionnaire, readers were presented with a series of sentences in which main verb is missing, as in (11):

(11) Whoever's dogs got loose __ in trouble.

[4] Because it was only possible to vary the number of the head noun in the normal possessive sentence type, I included only sentences with the singular version of the head noun (*guy* in Table 1 above) in the statistical analysis. I assumed that the relative pronoun *whoever's* is always grammatically singular, given the ungrammaticality of sentences like: **Whoever's dog did that are in trouble.* Thus, two tokens of each type, varying the number of the relative clause subject (*dog* in Table 1), were included in the analysis.

Upon reading each sentence on the computer screen, participants pressed a button on a response box choosing either 'is' or 'are' to complete the sentence. Participants must identify the head noun in the subject of the matrix clause to make a correct response. A correct response for sentence (11) above, for example, would be 'is', since it is the owner (not the dogs) who is in trouble. Stimuli were presented in five blocks of 40 sentences each (20 test sentences including two tokens from each of the ten stimulus sets, 20 fillers in each block), with random ordering of sentences within each block and random ordering of blocks. Accuracy and response time data were recorded automatically by the E-Prime program used to present the sentences.

Participants: 42 Purdue University students, ranging in age from 18 to 51 (average age 23), participated. Of these, 16 were men and 26 were women. All were native speakers of a North American variety of English. Participants gave informed consent and were compensated with a choice of either $3 or course credit from certain instructors, for a 15-20 minute session.

3.2.2 Results and Discussion

Accuracy: Mean proportion of correct responses for each condition was calculated and analyzed using repeated measures analyses of variance with two factors (possessive/non-possessive and free/normal) of two levels each. Separate analyses were conducted with participants ($F1$) and items ($F2$) as random effects. Accuracy data are shown in Figure 1 below.

As predicted, participants' responses were less accurate for sentences with possessive free relative clauses (78% correct) than for the other three sentence types (94-97% correct). Possessives were significantly less accurate than non-possessives both by participants and by items: $F1(1, 41) = 33.27$, $p < 0.01$; $F2(1, 9) = 43.90$, $p < 0.01$. Similarly, free relatives were significantly less accurate than regular relatives both by participants and by items: $F1(1, 41) = 60.29$, $p < 0.01$; $F2(1,9) = 72.57$, $p < 0.01$. There was also a significant interaction between the factors possessive and free both by participants and by items: $F1(1,41) = 26.40$, $p < 0.01$; $F2(1,9) = 36.13$, $p < 0.01$.

Response time: Mean response times were calculated and analyzed using the same methods as for accuracy (above). The mean response times for accurate responses in each condition are given in Figure 2 below. Inaccurate responses were excluded from the analysis.

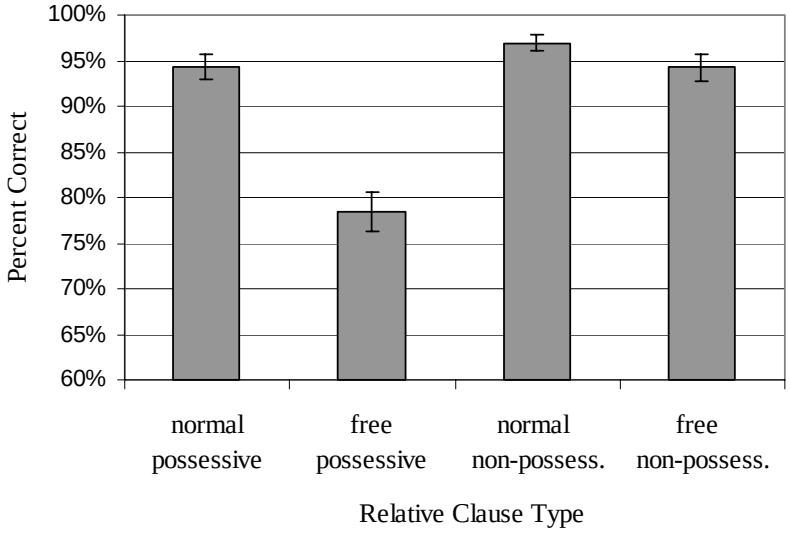

Figure 1: Percent correct for verb decision task. Error bars indicate standard error of the mean.

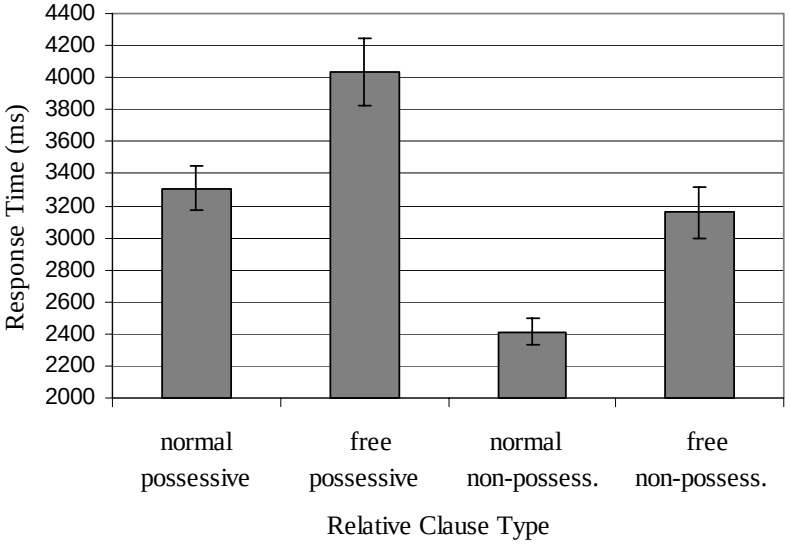

Figure 2: Response time for verb decision task. Error bars indicate standard error of the mean.

As predicted, participants' responses were slowest for sentences with possessive free relative clauses. Possessives were significantly slower than non-possessives both by participants ($F1$) and by items ($F2$): $F1(1, 41) = 105.83$, $p < 0.01$; $F2(1, 9) = 47.33$, $p < 0.01$. Similarly, free relatives were significantly slower than regular relatives both by participants and by items: $F1(1, 41) = 44.95$, $p < 0.01$; $F2(1,9) = 72.57$, $p < 0.01$. However, unlike with the accuracy data, there was no significant interaction between the factors possessive and free: $F1(1,41) = 0.01$, $p = 0.91$; $F2(1,9) = 4.31$, $p = 0.07$.

Participants were least accurate and had the slowest response times for possessive free relatives. Thus, the results for accuracy appear to confirm the initial hypothesis that non-canonical structure contributes to more frequent miscomprehension, since possessive free relatives were the only sentence type with significantly lower accuracy. Results for response time are less conclusive. These results indicate that possessives are processed more slowly than non-possessives, and that free relatives are processed more slowly than normal relatives. However free relatives were slower than normal relatives to about the same degree, regardless of whether they were possessive or not. Since non-possessive free relatives (see Table 1 above) conform to the canonical template for NP, the response time data cannot be explained on the basis of the non-canonical position of the head noun. One possible explanation is that response times were influenced by the special quantificational meaning of free relative pronouns with *-ever*, which is shared by both possessive *whoever's* and non-possessive *whichever* (see Grosu 2002: 148). Another possibility is that the morphological similarity of *whoever's* and *whichever* created confusion (see section 4 below).

3.3 Experiment 2: True-False Decision Task

Because subject-verb agreement in English is subject to factors other than the grammatical number of the head, the results in Experiment 1 might not be a direct reflection of participants' understanding of the subject noun phrases. For example, an anonymous reviewer pointed out that it is possible that participants might have chosen the plural verb in cases where the referent of *whoever* was understood to potentially refer to more than one person (e.g., *whoever's dogs* is understood as *the people whose dogs*). Experiment 2 tested the same hypotheses as Experiment 1 using a different task in which subject-verb agreement was held constant.

3.3.1 Methods

Materials: Test stimuli were constructed in the same way as in Experiment 1, with the same sentence types tested (see Table 1 above). However, number on the nouns was not varied in this experiment. Instead, all nouns occurring

in the subject NP were made singular to ensure that information about subject-verb agreement did not influence participants' responses. There were ten stimulus sets, each including one token of each of the four sentence types.

Procedure: Following a brief background questionnaire, a series of sentences was presented on the computer screen, each followed by either a true statement or a false statement. For example:

(12) Sentence: Whoever's dog got loose is in trouble.

[Pause with blank screen]

Statement: Some dog is in trouble. (True or False?)

Participants must press a button on the response box choosing 'true' or 'false' to indicate the truth of the statement in relation to the original sentence. To respond accurately, participants must identify the head noun in the subject of the matrix clause. For example (12) above, the correct answer would be 'false' since it is the owner, not the dog, who is in trouble. There were four balanced blocks of 30 sentences each (10 test sentences including one sentence from each of the ten stimulus sets, 20 fillers in each block). Sentences were ordered randomly within each block, and blocks were also ordered randomly. Accuracy and response time data were recorded automatically by the E-Prime program used to present the sentences.

Participants: 25 Purdue University students, ranging in age from 18 to 23 (average age 20), participated. Of these, 5 were men and 20 were women. Except for one subject (whose data were excluded from the final analysis), all were native speakers of a North American variety of English. Participants gave informed consent and were compensated with a choice of either $6 or course credit from certain instructors, for a 35-40 minute session. Three subjects were excluded from the analysis: one due to a computer error, one who failed to pay attention to the task, and one who turned out to be a native speaker of Spanish.

3.3.2 Results and Discussion

Accuracy: As in Experiment 1, mean proportion of correct responses for each condition was calculated and analyzed using repeated measures analyses of variance with two factors (possessive/non-possessive and free/normal) of two levels each. Separate analyses were conducted with participants ($F1$) and items ($F2$) as random effects. Accuracy data are shown in Figure 3 below.

Results for accuracy were very similar to Experiment 1. As predicted, participants' responses were less accurate for sentences with possessive free relative clauses (69% correct) than for the other three sentence types (95-98% correct). Possessives were significantly less accurate than non-possessives

both by participants (*F*1) and by items (*F*2): *F*1(1, 21) = 56.19, p < 0.01; *F*2(1, 9) = 26.03, p < 0.01. Similarly, free relatives were significantly less accurate than regular relatives both by participants and by items: *F*1(1, 21) = 24.97, p < 0.01; *F*2(1,9) = 13.34, p < 0.01. There was also a significant interaction between the factors possessive and free both by participants and by items: *F*1(1,21) = 59.88, p < 0.01; *F*2(1,9) = 20.55, p < 0.01.

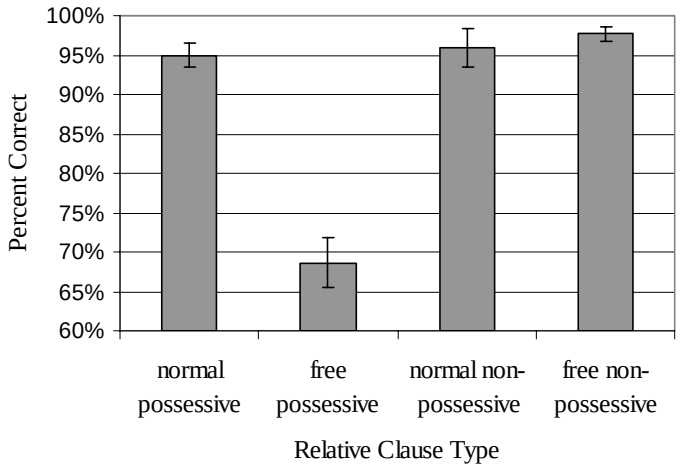

Figure 3: Percent correct for true-false decision task. Error bars indicate standard error of the mean.

Response time: Mean responses times were calculated and analyzed using the same methods as for accuracy (above). The mean response times for accurate responses in each condition are given in Figure 4 below. Inaccurate responses were excluded from the analysis.

As predicted, participants' responses were slowest for sentences with possessive free relative clauses. Possessives were slower on average than non-possessives (2198ms vs. 1813ms). This difference was significant both by participants and by items: *F*1(1, 21) = 13.37, p < 0.01; *F*2(1, 9) = 20.86, p < 0.01. Although free relatives were also slower than regular relatives (2043ms vs. 1968ms), this difference was not significant: *F*1(1, 21) = 1.16, p = 0.29; *F*2(1,9) = 0.73, p = 0.41. There was also no significant interaction between the factors possessive and free: *F*1(1,21) = 0.32, p = 0.58; *F*2(1,9) = 0.83, p = 0.39.

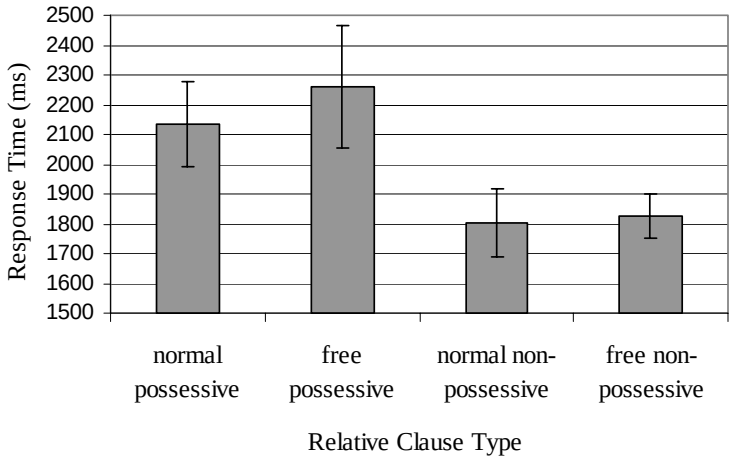

Figure 4: Response time for true-false decision task. Error bars indicate standard error of the mean.

As in Experiment 1, participants in Experiment 2 were least accurate and had the slowest response times for possessive free relatives. The results for accuracy again appear to confirm the hypothesis that non-canonical structure contributes to more frequent miscomprehension. Possessive free relatives showed by far the lowest accuracy (69% as compared with 95-98% for the other three sentence types). As in Experiment 1, results for response time are inconclusive. While the results show that possessives are processed more slowly than non-possesives, the difference between free relatives and normal relatives was not significant. Thus, accuracy results but not response time results support the hypothesis that possessive free relatives should be more difficult to comprehend than the other sentence types.

4. Conclusions and Implications

Two experiments on possessive free relative clauses suggest that simple canonical templates for NP may play a role in comprehension of both canonical and non-canonical NPs. Violation of the default appears to affect basic understanding of NP meaning, as shown in the accuracy results for both experiments. Following Ferreira (2003, 2002), this kind of evidence suggests a 'good-enough' model of sentence processing in which listeners' or readers' interpretations are initially based on information from simple canonical templates. When the language input violates the relevant template, there are at least two possibilities: (1) the violation is recognized and the correct interpretation is computed, overriding the initial interpretation; or (2) the

syntactic information in the sentence is not fully processed and the incorrect interpretation lingers. Such a model can explain our accuracy results for possessive free relative clauses: for accurate responses, the violation is recognized and repaired, while for inaccurate responses, the initial interpretation lingers. This helps explain the significant differences we found between regular possessive relative clauses and possessive free relatives. There is still, of course, the possibility that some responses were inaccurate for independent reasons. However, such as possibility is necessary anyway to explain why some of the control sentences also yielded inaccurate responses.

The idea of canonical templates and 'good-enough' processing has general implications for the nature of language as well. The use of canonical templates in processing may help constrain the occurrence of non-canonical construction types in languages by making certain linear order mismatches especially costly for language users. In a relatively fixed word order language, deviations from the canonical ordering of the verb's arguments typically require special formal marking in the grammar and/or lexicon (Hawkins 2004: 147-167). For example, the grammar of English does not permit the kind of mismatch that would result in an interpretation of example (13a) below in which the cat is the agent of the action. Such an interpretation is at least conceivable, given the existence of alternations as in (13b-c), where a lexical difference between the verbs *like* and *please* indicates a reversed ordering of argument roles.

(13) a. The dog chased the cat.
b. The dog likes the cat.
c. The cat pleases the dog.
d. The cat was chased by the dog.

However, lack of any kind of formal marking would result in a high degree of ambiguity, thus making sentences involving non-canonical ordering of arguments more difficult to comprehend even in an appropriate discourse context. Thus, in cases where the template is violated, languages tend to mark the difference by using different verbs (as in 13b-c), or by using explicit grammatical markings. In (13d), for example a passive sentence with explicit formal marking (auxiliary verb *be*, preposition *by*) is used to express a reversal of argument role ordering.

In the light of this general preference for explicit marking of non-canonical structures, it is possible that possessive free relatives are confusing because the possessive pronoun *whoever's* is the *only* linguistic cue to the intended interpretation and may be confusable with other morphologically similar pronouns. This is in contrast to passive sentences, which contain multiple formal cues. The lexical meaning of *whoever's* 'the person whose' includes the meaning associated with the head noun in a regular relative

clause.[5] Most of the time, this cue was sufficient for interpreting possessive free relatives accurately (78% in Experiment 1, 69% in Experiment 2), but it was not in a significant minority of cases. It is therefore possible that possessive free relatives are especially hard because of the morphological similarity between the relative pronouns *whoever's* and *whichever*. Since *whichever* conforms to the NP template, confusability with *whoever's* does not significantly affect accuracy of interpretation. However, this potential confusability could explain why non-possessive free relatives with *whichever* showed longer response times than regular non-possessive relatives in Experiment 1 (see Figure 2 in section 3.2.2 above).

Evidence for canonical templates also suggests that certain models of competence grammar may be preferable to others. Townsend and Bever (2001) adopt a Principles and Parameters style theory of syntax. Because this type of theory does not permit form-meaning pairings ('constructions') directly in the grammar, Townsend and Bever must put canonical templates into a special level of 'pseudo-syntax' distinct from the grammar. However, the idea of canonical templates fits easily into a parallel-architecture, constructionist view of grammar (e.g., Jackendoff 2007, Goldberg 2006, Goldberg and Bencini 2005, Yuasa 2005, Sag 1997). Using such a theory, canonical templates can be understood as 'default constructions' that specify basic mappings between linear order (not hierarchical structure) of constituents and semantic roles. Specific constructions such as passive contain the relevant information to override the defaults, but in online comprehension, this information is not always accessed in time to ensure a correct interpretation. Thus, using a constructionist theory allows us to simplify the representation of linguistic knowledge that is relevant for sentence processing.

Finally, I suggest that the approach taken here is compatible with at least some aspects of usage-based models of grammar and processing (e.g., MacDonald, Pearlmutter, and Seidenberg 1994).[6] Usage-based models emphasize the importance of frequency effects and lexical biases. In this light, default constructions can be understood as constructional biases of clauses or phrases, akin to lexical biases of verbs. Constructional biases are based on frequency of certain linear order-semantic role mappings, distinct

[5] In a Google search of internet discourse, I found a few examples in which *whoever's* did not seem to indicate the head noun. For example: "I took a shower while whoever's kids these were did homework" (DISboards.com, 12-05-2005). The difficulty of this construction may be prompting a re-analysis of *whoever's* as meaning 'some unknown person's' rather than the 'the person whose'. This issue needs to be investigated and controlled for in future research on this topic.

[6] What is not predicted by usage-based models, however, is Ferreira's finding that incorrect interpretations of non-canonical structures may linger after disambiguating information is presented. This goes against the idea that all relevant information is used as soon as it becomes available.

from the frequencies of particular lexical items or particular constructions such as the passive construction. Infrequent constructions that conform to the relevant linear order default are predicted to be easier to understand than equally infrequent constructions that violate the default, all else being equal. Ferreira (2003: 179-184) provides some evidence for this. Her study found that comprehension of subject clefts (e.g., *It was the dog who bit the man*), which conform to the canonical templates but are infrequently used, is more similar to that of active canonical sentences than to that of object clefts or passives. While the current study cannot speak directly to this issue, since frequency information was not collected, these predictions suggest interesting directions for future research.

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