More lexically-specific knowledge and individual differences in adult native speakers' processing of the English passive

Abstract

This paper presents experimental evidence for the role of lexically specific representations in the processing of English be *and* get *passive constructions. Using a self-paced reading task, processing of full and truncated* be *and* get *passive was compared on sentences containing verbs strongly associated with these constructions, as determined by supercluster analysis (see e.g., Myachykov et al. 2012). This study complements these corpus-based studies by providing evidence from an on-line processing task that tests whether native speakers are sensitive to the observed distributions. The results support a usage-based functional account of processing and interpreting English* be *and* get *passive constructions. Participants' performance was influenced by frequency and lexical specificity. The study also provides evidence of education-related differences in language attainment – the higher educated participants were significantly better at interpreting* be *and* get *full passive constructions than the lower educated participants.*

Keywords: Lexically specific knowledge, English passive, Sentence processing, Usage-based, Education-related individual differences

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1. Introduction

Usage-based approaches to language acquisition posit that children's early representations of the L1 grammar are lexically specific, based on distributional peculiarities, e.g., frequency, of individual words and constructions in the input, and that these lexically specific representations play an important role in language acquisition itself (Tomasello 2003, Goldberg et al. 2004). There is also evidence that adults are very sensitive to the distributional peculiarities of individual words, suggesting that lexically-specific representations survive into adulthood (Garnsey et al., 1997, Holmes et al., 1989, MacDonald, Perlmutter & Seidenberg, 1994, MacDonald & Seidenberg, 2006, Trueswell et al., 1993, Trueswell & Tanenhaus, 1994). On these accounts, more frequently encountered words and constructions, as well as words in constructions (see e.g., Stefanowitsch & Gries 2003, Gries & Stefanowitsch 2004), become more entrenched, resulting in faster retrieval and more reliable interpretation. It has also been argued that the degree of entrenchment of linguistic representations helps to explain observed group and individual differences in processing time and decision accuracy (Street & Dąbrowska, 2014).

This paper presents two experiments with two central aims. The first is to test whether native speakers of English of different educational backgrounds are sensitive to distributional characteristics of particular words in particular constructions. Drawing upon Myachykov et al.'s (2012) Supercluster analysis of *be* and *get* passives, the aim is to determine whether native speakers of English experience a processing burden when reading *get* passive sentences that contain a notional verb which shows a strong preference for *be* passive constructions, and whether the processing burden diminishes when reading *be* and *get* passive sentences which contain notional verbs that do not show a strong preference for either *be* or *get* passive constructions.

The second aim is to test whether there are any individual education-related differences in the processing and interpretation of *be* and *get* full passive constructions, since several studies have shown that higher academic attainment participants are faster and more accurate when interpreting (*be*) passives than lower academic attainment participants (Dąbrowska & Street 2006, Street & Dąbrowska 2010, 2014). Establishing whether there are lexically-specific effects in processing and education-related effects in interpretation would lend empirical support to usage-based approaches as well as experimental support for corpus based studies.

2. The English passive construction

The English passive construction is generally defined as comprising a PATIENT noun phrase (NP), the auxiliary verb *be* or *get (*although, *seem*, *become* can also be used), the past participle form of the main verb, and an optional AGENT NP introduced by the preposition *by* to give sentences such as those in 1. and 2. As such, the English passive has an unusual syntax-semantic mapping; the NP bearing the PATIENT role occurs in the subject position while the AGENT, if stated, is marked by the preposition *by* and appears after the verb.

1. Marjom was kissed by Andy.
2. Marjom got kissed by Andy.

Of course, in truncated passives the agent NP is omitted altogether to give sentences such as those in 3. and 4.

3. Marjom was kissed.
4. Marjom got kissed.

In addition to full and truncated passives, there are also adjectival passives which occur when participle adjectives are used predicatively giving sentences such as the one in 5.

5. Nesta was scared.

Adjectival passives are generally distinguished from other passive constructions; an adjectival passive can be distinguished from a 'true' passive because the past participial adjective can be modified by a degree adverb or adverbial, compare 6. with 7. Truncated passives are sometimes considered variants of the adjective complement construction rather than the passive construction, compare 8. with 9.

6. Nesta was extremely scared.
7. ?Marjom was extremely kissed by Andy.
8. The window was broken.
9. The window was open/opened.

In addition, the English passive, particularly the full passive, is rare, especially in spoken language. According to Roland et al. (2007), ''a verb phrase in a written corpus such as Brown or Wall Street Journal is four or five times more likely to be passive than one in a spoken corpus such as Switchboard'' (2007:17). Street & Dąbrowska's (2010) searches of the BNC indicate that mean frequency of the full passive is about 63 per million words in written texts, compared to about 9 per million in speech – a sevenfold difference in frequency. Gordon & Chafertz (1990) found only 4 tokens of the passive in over 86,000 child directed utterances.

In the child language acquisition literature, it is widely recognized that processing and interpreting passive sentences correctly is problematic for children and this is especially true if the passive sentence is reversible as in 10. and 11.

10. The girl was chased by the boy.
11. The boy was chased by the girl.

Interestingly, the most common error made by children is to assume that the first NP in passive sentences is the AGENT and the second NP the PATIENT. Thus children appear to adhere to the canonical semantic role assignment of the active transitive declarative construction (i.e., AGENT VERB PATIENT). There is also evidence from adult native speakers of English, particularly those with lower academic attainment, exhibiting similar problems processing and interpreting full passive constructions (see, e.g., Abbot-Smith et al., 2017, Ferreira 2003, Dąbrowska & Street 2006, Street & Dąbrowska 2010).

In fact, the English passive has been of considerable interest to theorists and researchers in the language sciences. For generativist grammarians, the passive, or more specifically the passive transformation, has been central to most versions of generative theory (e.g., Chomsky 1957, 1967, 1971) whilst in the more recent transformational accounts (e.g., Minimalist Program, Chomsky 1995) the passive transformation is subsumed along with other NP/DP movement under move α (alpha). As such the passive has been used as a parade example of movement: a syntactic ability which forms part of the innately specified Universal Grammar (UG) and which is 'triggered' by minimal exposure to the language environment. Although there is some disagreement between proponents of this account about how or rather when the passive is acquired in childhood (see, e.g., Pinker 1984, Atkinson 1996, Radford 1990, Clahsen 1996), they nevertheless predict that once the child has access to the relevant aspect of UG, acquisition of the passive should be a fast process rather than an emergent developmental one, and that mastery of the passive should be complete by early childhood in typically developing children. In fact, L1 convergence, the idea that all typically developing native speakers master their L1 grammar in early childhood and therefore have the same mental representation of their L1 grammar, provides one of the strongest arguments, along with Poverty of the Stimulus, for the posited UG (Chomsky 1975, Nowak et al. 2001, Hermon 2002, Lidz & Williams 2009).

For usage-based theorists (see, e.g., Tomasello 2003) in early language development children do not possess the fully abstract categories and schemas of adult grammar. Instead children construct these abstractions only gradually and in piecemeal fashion with some categories and constructions appearing much before others and often as a consequence of the frequency of occurrence in the input. That is, children's early representations of the grammar are lexically specific and these lexically specific representations are known to play an important role in language acquisition. For example, young children's' syntactic representations have been shown to be tied to particular lexical items, typically verbs, and numerous studies have provided evidence that children use verb-specific schemas (Brooks & Tomasello 1999, Tomasello, 2003, Abbot-Smith & Tomasello, 2006, Behrens 2009).

For example, Brooks & Tomasello (1999) tested whether children under 3 years can produce a full passive sentence using a novel verb they have only heard modeled in the active. Evidence that they can do this would support the idea that young children's earliest production of the passive is underpinned by a verb-general representation of the construction. Evidence that they cannot do this suggests that children learn the passive on a verb-by-verb basis. Brooks & Tomasello taught groups of children novel verbs (e.g., *meek*, *tam*) in either active or passive structures and then elicited them in both constructions. After short but intensive training sessions 85% of younger children (age 2;11) and 95% of the older children (age 3;5) produced a passive with a novel verb if the verb had been modeled in the passive (with different NPs expressing the AGENT and PATIENT roles). However, if they had only heard the verb in active sentences, none of the children produced a full passive, and only 12 per cent were able to produce a truncated passive.

These results suggest that English-speaking children under 3 years are not productive with the passive and are consistent with the view that children's earliest syntactic constructions are structured by the particular verbs they occur with. Importantly, the particular items to which children apply a particular syntactic pattern correctly tend to be those which are heard in this pattern most frequently in the input. The role of frequency during the item-based learning phases is illustrated by several other studies (e.g., Arnon & Snider 2010, Bannard & Matthews 2008, Dittmar et al. 2014, Matthews et al. 2005). These results are consistent with the view that children's earliest syntactic constructions are structured by the particular verbs they occur with.

However, it should be noted that several studies indicate large individual differences in children's acquisition of the English full passive construction. These studies indicate that acquisition of the passive is a gradual process which differs from one individual to another and is not complete by middle childhood. For example, Pinker et al. (1987, Experiment 1) found that four-year-olds performed at ceiling on a comprehension task involving unfamiliar verbs in the passive voice, and many were also able to produce passives with verbs which they have encountered only in the active. Maratsos et al. (1985, Experiment 1) report that four- to five-year-olds responded correctly on 67% of the trials involving familiar action verbs, 40% of the trials with familiar mental verbs, and 47% of the trials involving novel verbs (where chance performance was 50%). In an experiment conducted by Gordon & Chafetz (1990, Study 2), children aged from 4;2 to 5;6 were 58% correct on actional passives and 29% on non-actional passives with familiar verbs, while a younger group, aged from 3;0 to 4;2, did slightly better, scoring 69% and 41% respectively. There is also evidence which suggests that mastery of the passive is not complete even by adulthood in some native speakers and that adult linguistic representations of grammar are lexically specific

Ferreira (2003), for example, used implausible passive sentences to investigate whether adults have problems processing essentially unambiguous sentences. She presented participants (university undergraduates) with four sentence types: active plausible (e.g., *The dog bit the man*); active implausible (e.g., *The man bit the dog*); passive plausible (e.g., *The man was bitten by the dog*); and passive implausible (e.g., *The dog was bitten by the man*). When participants were asked to identify the AGENT or the PATIENT/THEME of the sentences, they had no problems with the active sentences. However, participants supplied the correct answer 88% of the time with the plausible passive sentences and only 77% of the time on the implausible passives (where chance performance was 50%) suggesting some adults were inconsistent in correctly identifying who was doing what to whom in these passive constructions.

In a partial replication of Ferreira (2003) Dąbrowska & Street (2006) tested comprehension of the same four sentence types. Participants were asked to listen carefully to the test sentences and identify the 'doer' (AGENT). The researchers compared the performance of a highly educated group (post graduate students, all of whom had at least 15 years of formal education) with that of less-educated participants with no more than secondary education. In addition, the researchers tested highly educated and less educated non native speakers. The results revealed that the high academic groups were at ceiling in all four conditions. However, the lower-educated native speakers had problems with implausible passives where performance as a group was at chance. By contrast, the lower educated non native speakers were at ceiling on all sentence types. These studies indicate marked individual differences in acquisition of the passive even into adulthood.

More recent evidence of lexically specific knowledge in adults is provided by Street & Dąbrowska (2014). In this study the researchers tested comprehension of semantically reversible sentences using an online task. There were two groups of participants. The high academic attainment group were postgraduate students or recent graduates from a variety of academic backgrounds who all had at least 17 years of formal education. The low academic attainment group were employed as packers in a factory, cleaners or hairdressers and had at most 11 years of formal education. Participants were presented with simple sentences such as *Sally was bitten by Rachel* on a computer screen. Each sentence was followed by one of the NPs mentioned in the sentence (i.e., Sally or Rachel). The participants' task was to decide whether this person was the *doer* (i.e., the AGENT) or the *acted on* (i.e. the PATIENT). The test consisted of 12 actives and 12 passives with the same verbs. Half of the verbs contained active-attracting verbs (verbs which are used almost exclusively in the active voice) and the other half passive attracting verbs (which occur relatively frequently in the passive voice) as determined by collostructional analysis (Gries & Stefnowitch 2004). There were two dependent variables: decision accuracy and reaction time.

The decision accuracy data revealed that both groups were at ceiling on actives. However, whilst the high academic attainment participants were also virtually at ceiling on passives (96% correct), the low academic attainment participants on the other hand, chose the correct response on only 86% of the passive stimuli. Thus as a group their performance on passives was above chance but significantly worse than that of the HAA group or their own performance on active sentences. However, within the group there were considerable individual differences. The reaction time results revealed that the high academic attainment participants were faster than the low academic attainment group on all sentence types and that both groups were faster on actives than on passives. Furthermore, both groups were faster on passives with passive attracting verbs than on passives with active attracting verbs. This indicates that all participants, regardless of educational attainment, have lexically specific schemas for verbs which are frequently used in the passive. That is speakers know which verbs are strongly associated with the active and the passive and are able to use this information on-line and consequently, passive sentences with passive attracting verbs are processed faster than passives with active-attracting verbs. These findings support other evidence that adults are sensitive to the distributional peculiarities of individual words, suggesting that lexically-specific representations survive into adulthood (Garnsey et al., 1997, Holmes et al., 1989, MacDonald, Perlmutter & Seidenberg, 1994, MacDonald & Seidenberg, 2006, Trueswell et al., 1993, Trueswell & Tanenhaus, 1994).

The present study tests whether native speakers of differing educational background are sensitive to the distribution characteristics of notional verbs in *be* and *get* passive constructions, as established by Myachykov et al 2012, see below, and whether there are education-related individual differences in interpreting full *be* and *get* passive constructions.

3. Supercluster analysis of *be* and *get* passives

Myachykov et al. (2012) conducted a corpus study to examine the distribution of various English passive forms focusing particularly on the notional verb with which these passive forms occur. They identified 1316 verbs with passive voice counts in both the British National Corpus (BNC) and Corpus of Contemporary American (COCA). The authors then split the frequency counts per verb into 16 categories, taking into consideration whether the regional variant was American or British English, whether the passive occurred in spoken or written English, whether the passive auxiliary was *be* or *get* and whether the passive was full (including *by* phrase) or truncated (excluding *by* phrase). This revealed a high degree of verb-dependent clustering with different notional verbs contributing differently to the counts per category.

The researchers then conducted a principal component analysis which revealed that the 16 categories were further reducible into four orthogonal components that could be identified as truncated and full *be* passive and truncated and full *get* passive. These four principal components were then used as clustering dimensions in order to partition the 1316 verbs into clusters of syntactically similar verbs. This analysis identified 11-clusters which displayed highly distinct patterns across the four passive-type components. In three of the eleven clusters the notional verbs ‘preferred’ *be* passives over *get* passives, full *be* passives over truncated *be* passives, and truncated passives over full passives when they occurred with a *get* passive auxiliary. In four clusters the notional verbs ‘preferred’ truncated passives over full, but had only a mild ‘preference’ for *be* passives if they occurred in a truncated passive construction. When the *by* phrase was included they showed a stronger preference for *be* passives. In the remaining four clusters the notional verbs showed a strong 'preference' for *be* passives regardless of truncation and a strong preference for truncated passives regardless of the passive auxiliary. Thus, whilst passive verb uses are consistent across regional variants, use of different passive forms (*be* or *get*, full or truncated) is constrained by the notional verb.

The aim of the present study is to test whether native speakers of English, of different educational backgrounds, are sensitive to these distributions. In particular, I am interested to know whether speakers experience a processing burden when reading *get* passive sentences which contain notional verbs which show a strong preference for *be* passive constructions and whether this processing burden diminishes when reading *be* and *get* passives which contain notional verbs that do not show a strong preference for *be* or *get* passivisers. If this is the case, these findings would lend empirical support to usage-based approaches as well as providing experimental support for corpus based studies such as Myachykov et al. (2012). I will also test whether there are education-related differences in interpretation of *be* and *get* passive constructions.

4. Experiment 1

4.1 Predictions

Experiment 1 measures participants' reading time on a self-paced reading task which compares processing of full *be* and *get* passive sentences containing verbs strongly associated with full *be* passive constructions, and truncated *be* and *get* passive constructions containing notional verbs which show only a minimal preference for either construction, as determined by supercluster analysis (see e.g., Myachykov et al. 2012). The experiment was designed to test usage-based and nativist/generativist predictions regarding processing and interpretation of the English *be* and *get* passive constructions. Usage-based accounts predict that participants' performance will be influenced by frequency and lexical specificity. Therefore, I expect participants to process *be* full passives faster than *get* full passives when the notional verb shows a strong preference for *be* passives. In particular, I expect differences in response time to be manifest at the notional verb, since this follows the passiviser (*be* or *get*), and possibly at *by*, since this is a strong cue of passivisation. However, for *be* and *get* truncated passive constructions where the notional verb shows minimal preference for either construction there will be no significant difference in processing. By contrast generativist accounts predict no differences in response times regardless of the notional verb, since on these accounts *be* and *get* passive auxiliaries are arbitrary and interchangeable.

I also predict that participants who have more overall experience of processing passive constructions will interpret them more reliably. That is, I predict that participants with high academic attainment, who are more likely to read and be skilled readers, and thus likely to have encountered more passives will be more accurate when interpreting *be* and *get* full passive sentences than participants with low academic attainment. By contrast nativist accounts predict no experience-related differences in the interpretation of *be* and *get* passives in adult native speakers, since the necessary formal operations such as ‘movement’ which facilitate passivisation in ambient languages are considered part of an innate Universal Grammar, and thus, all typically developing native speakers should have mastered passive constructions by adulthood.

However, it is possible that any observed differences in performance are attributable to individual differences in parsing ability rather than linguistic knowledge. Differences in interpretation of passives could be accommodated by a two-stage processing theory such as LAST (Late Assignment of Syntax Theory; see Townsend and Bever, 2001) according to which sentence processing involves two distinct phases. In the first phase, the processing system constructs a ‘‘pseudoparse’’, a rough analysis based on superficial probabilistic cues and heuristics such as the so-called NVN strategy for assigning thematic roles to predicates (see Bever, 1970, Townsend & Bever, 2001). The pseudoparse is then used to guide the true parse, an algorithmic process which accesses syntactic knowledge to construct a complete syntactic representation. Constructing the true parse is slower and computationally more demanding, and thus may not be carried out in certain circumstances (e.g., under time pressure, or when processing resources are limited). Under this approach, the low academic attainment participants would be assumed to have the same grammatical knowledge as the higher academic attainment group, but be less likely to perform the true parse. Thus, two-stage processing theories such as LAST predict a speed-accuracy trade-off for passives: since the true parse requires additional processing time, participants who are more accurate should respond more slowly than the less accurate participants (see Discussion section for discussion of parallel processing accounts which do not predict a speed x accuracy trade-off). However, following Street & Dąbrowska (2014), I predict that response time will not be a significant predictor when interpreting *be* and *get* passives.

4.2 Method

4.2.1 Participants

Forty-six adults (23 males and 23 females) aged 17–55 participated in the experiment. The high academic attainment native speaker group comprised 27 participants who all had graduate qualifications from a variety of academic disciplines (and hence at least 15 years of formal education). The remaining 19 participants were non-graduate native speakers of English and had had at most 11 years of formal education and were employed in various unskilled manual labour positions (e.g. packers at a factory, building site labourers, hairdressing assistants, supermarket shelf stackers).

4.2.2 Materials

There were 24 sentences in total: 8 x full *be* passives (e.g., *The girl was distracted by the boy*), 8 x full *get* passives (e.g., *The girl got distracted by the boys*) and 8 x active transitive with adverbial phrase (e.g., *The girl saw the boy in the classroom*). The active sentences served as fillers/distractors. There were four versions of the test, each containing eight sentences for each of the three conditions, and within any one version there were no repeats of the same action involving the same NPs, i.e., in any one version no NP (e.g., the boy or the girl) appears with the same verb twice. For the test conditions there are four possible descriptions (e.g., *The boy was distracted by the girl, The boy got distracted by the girl, The girl was distracted by the boy, The girl got distracted by the boy*). Each of the four possible descriptions appeared in a different version of the test. For the control condition there are only two possible descriptions (e.g., *The girl saw the boy in the classroom, The boy saw the girl in the classroom*). These sentences were divided such that if one description (e.g., the girl saw the boy) appeared in versions 1 and 3, the other description (e.g., the boy saw the girl) appeared in versions 2 and 4. Ultimately, each participant read 24 sentences: 8 *be* passives, and 8 *get* passives, and 8 active transitive with no repeats of the same NP with the same verbs.

There were also 24 True/False statements, one for each of the 24 test sentences. The True/False statements for each sentence were in the active voice and were the same across the four test versions. For example, for the *be* and *get* passives above the True/False statement was 'The girl distracted the boy, True or False? In version 1 and 2 of the task the correct response was True, whilst in version 3 and 4 it was False. In any version of the task there were an equal amount of true and false correct responses. These were counterbalanced with regard to whether they occurred on the left or right of the screen. The order of sentences was randomized for each participant. A complete list of sentences used in one version of the test is given in Appendix I.

4.2.3 Procedure

The experimental session began with participants reading written instructions displayed on a laptop screen. Participants were informed that their task was to read a series of sentences one word at a time and that once they had read each word they needed to press the 'next' button on the serial response box to see the next word and so on until the end of the sentence. On activation of the next word (pressing the 'next' button on the serial response box) the previous word disappears such that at any one time there is only one word of the sentence on the screen. After the final word in the sentence had been read there would be a short fixation (+++) and then participants would be presented with a true/false statement relating to the sentence they had just read. For example, in version 1 or 2 of the task if participants read *The girl was distracted by the boy* the sentence would be followed by a statement such as *The boy distracted the girl. True or false?* In version 3 and 4 of the task if participants read *The girl was distracted by the boy* the sentence would be followed by a statement such as *The girl distracted the boy. True of false?* The participants' task then was to decide if the statement was true of false. If they thought the statement was true, they pressed a button marked 'True' on the serial response box, and if they thought the statement was false, they pressed a button marked 'False' on the Serial Response Box. Once participants had answered either True or False the first word of the next sentence appeared on screen (after a short fixation). A complete transcript of the written instructions is given in Appendix II. Before the test trials began all instructions were clarified (and concept checked) verbally by the experimenter. Participants then completed four practice trials in which they read simple locative sentences such as *The red car is in the street* and answered true/false statements such as *The car was red. True or false?* These were supervised by the experimenter to ensure that participants had understood the task. Participants were tested individually, with each testing session lasting approximately 7 minutes. The stimuli were presented using E-prime software (Psychology Software Tool, Pittsburgh, PA), which also recorded the participants' decision accuracy and reaction times, using a model #200A serial response box.

5. Results

5.1 Response Time

Mean response times, standard deviations and range for all conditions by groups are summarised in Table 1, below. As can be seen from the descriptive statistics all participants are faster when processing notional verbs when these are preceded by a *be* passiviser compared to when they are preceded by a *get* passiviser. However, this effect of lexical specificity has disappeared by the *by* phrase. The descriptive statistics also indicate that the higher academic attainment group are faster overall than the low academic attainment group.

Table 1. *Mean Response Time and Standard Deviations (in milliseconds) and range of sentences by passiviser and by group*

Group	Passiviser	AuxRT	VerbRT	byRT	TheRT
HAA	be	459(209) 178-1355	504(212) 128-1149	518(291) 127-1927	488(273) 112-1679
	get	489(260) 186-1564	555 (261) 130-1643	520 (311) 122-2800	485(259) 144-1673
LAA	be	555(355) 146-2176	584 (290) 128-3280	557 (338) 127-1951	533(362) 162-2776
	get	546(308) 238-2010	711 (281) 172-1102	566 (312) 189-2184	530(391) 220-3186

To analyse the data further a linear mixed effects model was fit to the response times for passiviser (AuxRT), notional verb (VerbRT), *by phrase* (byRT) and *the* (TheRT) with *lmer* from package lme4 (using optimizer "bobyqa", https://cran.r-project.org/web/packages/lme4/lme4.pdf) in R (version 3.4.0 R Core Team, 2017). This revealed significant differences in response time for the notional verb (detailed below), but not for the passiviser (Aux RT), the *by* phrase (byRT) or *the* (TheRT). For the notional verb RTs, visual inspection of the response time latencies using quantile-quantile and density plots revealed outliers; reaction times longer than 1600 milliseconds were excluded from further analysis, leaving 715 observations. As random effects, I had intercepts for subjects and items (verbs); by-subject slope adjustments for the effect of condition did not significantly improve the model. As fixed effects, Condition (*be/get* passive) and Education (HAA/LAA) were entered into the model. The *be*-passive condition is the reference category. Estimates, errors, and t-values/z-values for the relevant variables for the notional verb are presented in Table 2, below.

Table 2. *Estimates, errors, t-values/z-values for variables for Verb RT. *T-values larger than absolute 1.96 indicate significance.*

	Estimate	Std. Error	t value
(Intercept)	6.18005	00.06346	97.39*
Condition get passive	0.05048	0.02007	2.51*
Education	0.08506	0.12409	0.685

With Condition and Education entered into the model as a fixed effect the analysis revealed that Condition (*be*/*get* passive) is a significant predictor of RTs for the notional verb (for both groups). Education was not a significant predictor of RTs for the notional verb. That is, the results support the descriptive statistics showing that all participants are slower processing the notional verb if it occurs after a *get*-passiviser. However, whilst the HAA participants are faster, they are not significantly faster processing the notional verb than the LAA participants.

5.2 Decision accuracy

Mean proportion of correct responses, standard deviations and range for all conditions by groups are summarised in Table 3. As can be seen from the descriptive statistics both groups are at ceiling on the Active condition, although the lower educated group are performing better than the higher academic group. Furthermore, the ranges and variances for each group are very similar. However, in the *be* and *get* passive condition only the high academic attainment native speakers are at ceiling as a group. The low academic attainment group has the lowest mean proportion of correct responses, with greater variation within the group than the high academic participants.

Table 3. *Proportion of correct responses, (standard deviations) and range for each condition by group*

	Construction		
	Active	Be passive	Get passive
Group			
HAA			
Mean (SD)	94 (6)	94 (23)	92 (27)
Range	0-100	0-100	0-100
LAA			
Mean (SD)	97 (5)	76 (43)	73 (42)
Range	0-100	0-100	0-100

The data were analyzed using R version 3.4.0 (R Core Team, 2017) and g*lmer* from package *lme4* (https://cran.r-project.org/web/packages/lme4/lme4.pdf) using “bobyqa” as optimizer to perform a binary logistic regression analysis of the relationship between accuracy on the one hand, and passiviser and level of education on the other. Subjects and Items were entered as random effects. As fixed effects, passiviser, level of education, and question response time, with condition as the interaction term, were entered into the model. Estimates, standard errors, t-values/z-values and p values for the relevant variables are presented in Table 4 below

Table 4. *Estimates, standard errors, t-values/z-values and p-values for variables*.

	Estimate	Std. Error	t/z value	p value
(Intercept)	3.280e+00	6.613e-01	4.960	7.06e-07 ***
Question RT	4.789e-05	5.717e-05	0.838	0.4023
Education	-1.010e+00	4.006e-01	-2.522	0.0117 *
Condition	-1.093e-01	2.101e-01	-0.520	0.6031

Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

The analysis revealed that Education is a significant predictor of decision accuracy whilst Condition (passiviser) is not a significant predictor of decision accuracy. That is, the results support the descriptive statistics in Table 3 which indicate that whilst all participants have more difficulty interpreting passives compared to active transitives, it is the low academic group that has most problems with interpreting full passive constructions, regardless of the passiviser. The analysis also reveals that participants’ response time to questions is not a significant predictor of their decision accuracy.

5.3 Individual differences

As can be seen from the standard deviations and ranges in Table 3 there were considerable individual differences, particularly in the low academic attainment participants’ performance on *be* and *get* passive sentences. There were a total of 8 *be* and 8 *get* passive sentences. According to the binomial distribution (p < .05), above chance performance requires 12 out of 16 correct responses, and a score of 11 or less would be below chance. At this criterion, seven of the low academic attainment participants (i.e. 58%) were below chance. Five (i.e., 26%) performed at chance and eight (i.e., 42%) performed above chance. By comparison only three of high academic attainment group (i.e., 11%) performed below chance. Twenty-four (i.e., 89%) performed above chance..

6. Experiment 2

6.1 Predictions

The results of Experiment 1 provide support for usage-based and constraint based approaches since participants are sensitive to the distributions of verbs to *be* and *get* full passive constructions. However, these approaches also predict that where the notional verb shows no strong ‘preference’ for either *be* or *get* passive constructions, there should be no significant difference in processing/response time of the notional verb. This was put to the test in Experiment 2. To do this I tested participants' processing of truncated passives (e.g., *The painting was hung on the wall*) which contained verbs which showed only a minimal 'preference' for either *be* or *get* passives, according to Myachykov et al. 2012).

With regard to decision accuracy, I predict that, in contrast to performance on full *be* and *get* passives, there will be no education-related differences in interpreting *be* and *get* truncated passives. This is due in part to the fact that truncated *be* and *get* passives are more frequent than full passives in everyday spoken language, and therefore linguistic experience of these constructions is less likely to be a function of educational attainment. Relatedly, the truncated passive construction is analogous to the adjective complement construction (cf. the window was broken / the window was open/opened) which are also more frequent in everyday spoken language than full passives. And thus from a usage-based perspective, truncated passive constructions belong to a larger neighbourhood of more frequently occurring constructions than full passive constructions.

6.2 Method

6.2.1 Participants

Thirty five adults (15 males and 20 females) aged 17–55 participated in the experiment. The high academic attainment native speaker group comprised 17 participants who all had graduate qualifications from a variety of academic disciplines (and hence at least 15 years of formal education). The remaining 18 participants were non-graduate native speakers of English and had had at most 11 years of formal education and were employed in various unskilled manual labour positions (e.g. packers at a factory, building site labourers, hairdressing assistants, supermarket shelf stackers).

6.2.2 Materials

There were 24 sentences in total: 8 x *be* truncated passives (e.g., *The man was punched in the face*), 8 x *get* truncated passives (e.g., *The man got punched in the face*) and 8 x active transitive with adverbial phrase (e.g., *The boy saw the girl in the classroom*). The active sentences served fillers/distractors. There were two versions of the test, each containing eight sentences for each of the three conditions, and within any one version there were no repeats of the same action involving the same NPs, i.e., in any one version no NP (e.g., the painting) appears with the same verb twice. For the test and filler conditions there are two possible descriptions (e.g., *The man was punched in the face, The man got punched in the face*, *The boy saw the girl in the classroom*, *the girl saw the boy in the classroom*). Each of the two possible descriptions appeared in a different version of the test. Ultimately, each participant read 24 sentences: 8 *be* truncated passives, and 8 *get* truncated passives, and 8 active transitive with no repeats of the same NP with the same verbs.

There were also 24 True/False statements, one for each of the 24 test sentences. The True/False statements for each sentence were in the active voice and were the same across the test versions. For example, for the *be* and *get* passives above the True/False statement was 'The man was punched in the face, True or False? In version 1 of the task the correct response was True, whilst in version 3 and 4 it was False. In any version of the task there were an equal amount of true and false correct responses. These were counterbalanced with regard to whether they occurred on the left or right of the screen. The order of sentences was randomized for each participant. A complete list of sentences used in one version of the test is given in Appendix III.

6.2.3 Procedure

The procedure was the same as Experiment 1, above.

7. Results

7.1 Response Time

Mean response times, standard deviations and range for all conditions by groups are summarised in Table 7, below. As can be seen from the descriptive statistics there is very little difference between conditions (*be* or *get* passive) or between groups.

Table 7. *Mean Response Time, Standard Deviations (in milliseconds) and ranges of sentences by passiviser and by group*

Group	Passiviser	AuxRT	VerbRT
HAA	be	532 (305) 163-2949	540 (254) 159-1392
	get	502 (209) 182-1414	522 (279) 118-2007
LAA	be	602 (241) 191-1719	692 (195) 195-1904
	get	605 (237) 175-1663	656 (266) 204-1728

To analyse the data further a linear mixed effect model was fit to the response times with the passiviser (AUX RT) and the notional verb (VerbRT) as predictors with *lmer* from package lme4 (using optimizer "bobyqa", https://cran.r-project.org/web/packages/lme4/lme4.pdf) in R (version 3.4.0 R Core Team, 2017).

Visual inspection of the response time latencies using quantile-quantile and density plots revealed outliers; reaction times longer than 900 milliseconds were excluded from further analysis, leaving 560 observations[1]. As random effects, I had intercepts for subjects and

[1] Following the procedure recommended in Baayen & Milin (2010) outlier identification was based on visual inspection, and is relative to the other data points. Overall, RTs in Experiment 1 were longer than those in Experiment 2 which explains why two different cut-off levels (1600ms and 900ms) were used.

items; by-subject slope adjustments for the effect of condition did not significantly improve the model. As fixed effect, condition was entered into the model. Estimates, errors, and t-values/z-values for the relevant variables for the passiviser (AuxRT) and the notional verb (VerbRT) are presented in Table 8, below.

Table 8. *Estimates, errors, t-values/z-values for variables for passiviser (AuxRT) notional verb (VerbRT). T-values larger than absolute 1.96 indicate significance*.

	Estimate	Std. Error	t value
Aux RT			
(Intercept)	6.23804	0.03805	163.951*
Condition get-passive	-0.01254	0.01813	-0.692
Verb RT			
(Intercept)	6.29130	0.05726	109.877*
Conditionget passive	-0.04166	0.02782	-1.497

With condition entered into the model as a fixed effect the analysis revealed no significant difference in response times for the passiviser (AuxRT) or the notional verb (VerbRT). That is, the results support the descriptive statistics showing that all participants process the notional verb approximately the same speed regardless of the verb occurring in a be passive or get passive construction.

7.2 Decision accuracy

Mean proportion of correct responses, standard deviations and ranges for all conditions by groups are summarised in Table 9. As can be seen from the descriptive statistics both groups are at ceiling on all conditions, indicating that, unlike interpretation of full passives, there are no significant differences between groups or between conditions when participants interpret truncated passives. Furthermore, the ranges and variances for each group are very similar.

Table 9. *Proportion of correct responses for each condition by group*

	Construction		
	Active	Be passive	Get passive
Group			
HAA			
Mean (SD)	94 (6)	96 (20)	98 (14)
(Range)	0-100	0-100	0-100
LAA			
Mean (SD)	97 (6)	97 (18)	99 (11)
(Range)	0-100	0-100	0-100

The data were analyzed using R version 3.4.0 (R Core Team, 2017) and glmer from package lme4 (https://cran.r-project.org/web/packages/lme4/lme4.pdf) using “bobyqa” as optimizer to perform a binary logistic regression analysis of the relationship between accuracy on the one hand, and passiviser and level of education on the other. Subjects and Items were entered as random effects. As fixed effects, question response time, level of education, and condition as the interaction term, were entered into the model. Estimates, standard errors, t-values/z-values and p values for the relevant variables are presented in Table 10 below.

Table 10. Estimates, standard errors, t-values/z-values and p-values for variables.

	Estimate	Std. Error	t/z value	p value
(Intercept)	3.439e+00	.021e+00	13.369	0.000754 ***
Question RT	2.084e-05	1.618e-04	0.129	0.897557
Education	3.458e-01	5.433e-01	0.636	0.524473
Condition	8.499e-01	5.520e-01	1.540	0.123645

Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

The analysis revealed that neither Education nor Condition was a significant predictor of decision accuracy. That is, the results support the descriptive statistics in Table 9 which indicate that there was no significant difference in participants’ performance when interpreting truncated passives regardless of the passiviser or level of education. The analysis also revealed that participants’ response time to questions was not a significant predictor of their decision accuracy.

8. Discussion

The main aim of the present study was to test usage-based and generativist predictions regarding processing and interpretation of *be* and *get* full and truncated passive constructions. The results show that native speakers of English are sensitive to frequency distributions of verbs to constructions in the input. In Experiment 1 all participants are faster processing the notional verb in *be* full passive sentences when these sentences contain verbs which have been shown to prefer *be* full passive constructions to *get* full passive constructions. By contrast, there was no significant difference in processing speed of notional verbs in *be* and *get* constructions when the sentences contained verbs which showed little preference for either *be* or *get* passives constructions. The results of Experiment 1 also provide further evidence of individual education-related differences in interpreting non-canonical constructions such as the English full passive. As we have seen the higher educated participants were significantly more accurate in interpreting who did what to whom in full passive constructions than the lower educated participants, regardless of passiviser. It is worth noting here that these results do not support claims that speakers of lower-SES dialects, like the lower educated participants in the present study, should be better at processing and interpreting *get* passives than *be* passives on the basis that the *get* passive construction is more frequent in lower-SES dialects than the *be* passive construction. Mients (2003) established that this was not the case for lower-SES dialects of British English and, therefore, I did not expect the lower educated participants in the present study to perform better on *get* passives than *be* passives. For discussion of social class use of *be* and *get* passives in American English dialects see Fisher and Sneller (2015).

Overall, the results of Experiment 1 are problematic for generativist approaches because these approaches predict no differences processing the notional verb in full passive constructions since *be* and *get* are considered interchangeable – they both fit requirements of being auxiliaries in the abstract auxiliary slot in the formal passivisation movement rule. The results are also problematic for nativist approaches because these approaches predict no education-related differences in interpreting full passives since the posited underlying mechanism for producing passives, i.e., 'movement', is innate and, therefore, passives should be mastered by late childhood. It is possible to argue that the results of the present study are a consequence of linguistically irrelevant performance factors such as willingness to cooperate with the experimenter, lack of experience with formal testing, ability to perform the experimental task or by appealing to limitations in processing capacity. However, as argued elsewhere (e.g., Dąbrowska & Street 2006, Street & Dąbrowska 2010, Street & Dabrowska 2014, Street 2017), these explanations are unsatisfactory in accounting for the individual, education-related differences found in the present study.

In Experiment 2, as predicted by usage-based accounts, the effect of the passiviser (*be* or *get*) in processing passive constructions and the effect of education in interpreting passive constructions disappeared when participants processed and interpreted truncated passive sentences containing notional verbs which showed no preference for either *be* or *get* passive constructions. The results are also inconsistent with the proposal that individual differences in the comprehension of passive sentences are attributable to differences in parsing ability, specifically the contention that mistakes in the comprehension of passives arise when listeners abort processing after the pseudoparse and never compute the true parse, such as LAST (Late Assignment of Syntax Theory; see Townsend and Bever, 2001). Such an account would predict that response time would be a significant predictor of accuracy, but there is no evidence of this in this data.

There are, however, dual processing mechanisms which do not predict a speed x accuracy trade-off. Lim & Christianson (2013[a,b]), for example, provide graphical representations of a parallel processing mechanism in which the building and integration of both the heuristic and algorithmic parses are generated in parallel online, and in which the algorithmic parse can be accessed for offline post-interpretive tasks[2]. Such a mechanism would not predict response time to be a significant predictor of accuracy and therefore could help explain the findings of the present study. This would depend though on what is meant by offline post-interpretive processes. If this is what typical real language users do to arrive at the correct interpretation of sentences, it suggests offline post-interpretive processes are a very important part of normal language processing of more difficult constructions such as the English full passive construction. This may not be odds with Lim & Christianson's overall account of language acquisition and processing, however, it is problematic for theories of

[2] Although initially posited as a two-stage model, LAST could be interpreted as a parallel processing mechanism in the same manner as that of Lim & Christianson (2013a,b).

language acquisition that posit an innate language acquisition device and an innate parsing mechanism such as LAST.

The results of Experiments 1 and 2 therefore provide support for usage-based approaches to language processing and acquisition and are consistent with findings from other studies. With regard to lexical specificity, the notional verb response times are consistent with the idea that frequency and experience are key factors in processing and acquisition and converge with previous data showing that native speakers are sensitive to distributions in the input that continue into adulthood (MacDonald, et al. 1994; MacDonald & Seidenberg, 2006; Trueswell & Tanenhaus, 1994, MacDonald & Christiansen 2002, Street & Dąbrowska 2014). With regard to decision accuracy, the findings are also consistent with earlier research. The overall performance on full passives in both the low- and high-academic attainment group is similar to that observed in studies which have tested low and high academic attainment participants' processing of low frequency and/or non-canonical constructions, such as implausible and reversible passive constructions (Ferreira 2003, Dąbrowska & Street 2006, Street & Dąbrowska 2010) constructions containing universal quantifiers (Brooks & Sekerina 2005/6, Street & Dąbrowska 2010), and Object Relative Clauses (Street, 2017).

For usage-based theorists, part of the answer to why we see group and individual differences in response time and decision accuracy lies in the degree of entrenchment of linguistic representations, which in turn is a function of the amount and type of experience with particular constructions, as well as learner internal factors (for discussion of type of linguistic experience and learner internal factors see Street & Dąbrowska 2010, 2014 and Dąbrowska 2012, for full discussion of the role of frequency and entrenchment in usage-based approaches see Divjak in press). As noted in the introduction, English full passive constructions are much more frequent in formal written texts than in naturalistic speech and *be* passive constructions are considerably more frequent than *get* passive constructions. Since full passives are more frequent in formal, academic, written texts, the higher educated participants have more relevant experience of passives than the lower educated group. They are more likely to encounter more types of verb used in full passive construction, resulting in a more entrenched VERB-general passive schema. They also encounter more tokens of the full passive construction, resulting in a more entrenched VERB-specific passive schema.

Nevertheless, entrenchment is a matter of degree, and thus, performance on relatively infrequent structures varies considerably. As the results indicate, participants are significantly faster processing the notional verb in *be* passive constructions when the notional verb 'prefers' *be* passives. Furthermore, whilst the higher educated participants are significantly more accurate than the lower educated participants, there are also considerable individual differences – patterns of performance that have been found in several other studies (see above).

9. Conclusion

The results of the present study support two fundamental claims of usage-based models: that much of our linguistic knowledge is lexically specific, and that frequency plays a crucial role in shaping speakers' mental grammars. More experience with a particular construction results in greater entrenchment, and hence more reliable performance. The results indicate that speakers know which verbs are strongly associated with be (and get) passives and are able to use this information on-line. The findings also indicate that mastery of the English full-passive is a gradual process. As the learner is exposed to more exemplars of the passive so their mental representation of the construction becomes entrenched. This allows for easier access to the construction and hence results in more reliable performance on both comprehension and production tasks. Entrenchment is in part a function of amount of linguistic experience. This, along with other factors, such as type of linguistic experience as well as learner internal factors, may explain the large individual differences in processing and comprehension of English full passive seen in children and adult studies.

By contrast, the response time data are problematic for theories which posit abstract formal rules, which should not be sensitive to the frequencies of the passivizing auxiliaries be and get in the input. The response time data are also problematic for two-stage processing theories of sentence processing. The decision accuracy data is problematic for theories which claim first language convergence and that all first language learners master the constructions of their language at a young age. It would seem that achieving full mastery of the passive requires a considerable amount of experience with this construction.

Appendix I

List of sentences used in one version of the test in Experiment 1

The nurse was vaccinated by the doctor
The forward was tackled by the defender
The man was shoved by the boy
The man was pulled by the horse
The woman was fed by the man
The man was trained by the woman
The soldier was beaten by the sailor
The boy was distracted by the girl
The man got stopped by the woman
The dog got bitten by the cat
The rioter got attacked by the policeman
The gunman got killed by the soldier
The man got filmed by the woman
The teacher got assisted by the student
The policeman got interviewed by the journalist
The politician got welcomed by the mayor
The woman photographed the man in the park
The boy saw the girl in the classroom
The man met the woman at the station
The woman took the cat to the vets
The man dug a hole in the garden
The man made soup in the kitchen
The girl did her homework in the library
The boy threw the ball in the air

Appendix II

Written instructions for Experiments 1 and 2

You will see a word on the screen. The word forms part of a sentence.
When you recognise the word, press the button marked ‘Next’ on the response box.
Then the next word will appear.
The words will stay on screen until you press ‘Next’.
Once you have read all the words in a sentence, this sign ‘+++’ will appear for 2 seconds followed by a True / False question about the previous sentence.
To answer the question press either the ‘True’ or ‘False’ button marked on the response box.
The question will remain on screen until you press either ‘True’ or ‘False’.
Then you will see this sign ‘+++’ and the first word of the next sentence will appear.
The first 4 sentences are to practice.
Press ‘Next’ to begin the session.

Appendix III

List of sentences used in one version of the test in Experiment 2

The shirt was scrubbed in the sink
The bag was unpacked in the bedroom
The watch was repaired in the shop
The man was punched in the face
The book was shipped to the UK
The onion was chopped in the kitchen
The car was fixed in the garage
The room was locked in the morning
The painting got hung on the wall
The present got wrapped at the table
The cake got eaten at the table
The boy got burnt on the arm
The car got stopped at the junction
The boy got trapped in the room
The man got bitten on the leg
The man got attacked in the street
The woman photographed the man in the park
The girl kicked the boy in the leg
The solider pushed the sailor in the street
The dog chased the boy to the shop
The boy saw the girl in the classroom
The man met the woman at the station
The man carried the boy on his back
The woman took the cat to the vets
The man dug a hole in the garden
The man made soup in the kitchen
The girl did her homework in the library
The boy threw the ball in the air

References

Abbot-Smith K, Chang F, Rowland C, Ferguson H, Pine J., 2017. Do two and three year old children use an incremental first-NP-as-agent bias to process active transitive and passive sentences?: A permutation analysis. PLoS ONE 12 (10): e0186129. https://doi.org/10.1371/journal. pone.0186129

Abbot-Smith, K., & Tomasello, M. 2006. Exemplar-learning and schematization in a usage-based account of syntactic acquisition. *Linguistic Review*, *23*(3), 275–290.

Arnon, I. & Snider, N. 2010. More than words: Frequency effects for multi-word phrases. *Journal of Memory and Language*, 62, 67-82.

Atkinson, M., 1996. Now, hang on a minute: Some reflections on emerging orthodoxies. In H. Clahsen, *Generative perspectives on language acquisition*. Erlbaum.

Baayen, R. H., & Milin, P. 2010. Analyzing reaction times. *International Journal of Psychological Research*, 3(2), 12-28.

Bannard, C., & Matthews, D. 2008. Stored Word Sequences in Language Learning : The Effect of Familiarity on Children's Repetition of Four-Word Combinations. *Psychological Science*, 19(3), 241-248.

Barlow, M., Kemmer, S., 2000. *Usage-Based Models of Language*. Cambridge University Press, Cambridge.

Behrens, H. 2009. Usage-based and emergentist approaches to language acquisition. *Linguistics*, 47, 383–411.

Bever, Thomas G 1970. The cognitive basis for linguistic structures. In J. R. Hayes (Ed.), Cognition and the Development of Language (pp. 279-362). New York, NY: Wiley.

Brooks, P. J., Sekerina, I., 2005/2006. Shortcuts to quantifier interpretation in children and adults. Language Acquisition 13, 177–206.

Brooks, P., and Tomasello, M., 1999. Young children learn to produce passives with none verbs. Developmental Psychology, 35 (1), 29–44.

Bybee, J. 2010. Language, Usage and Cognition. Cambridge: Cambridge University Press.

Chomsky, N., 1957. Syntactic Structures. Mouton: The Hague

Chomsky, N., 1967. Remarks on Nominalization. In Jacobs, R. A., and Rosenbaum, P. S. (eds.), Readings in English Transformational Grammar. Ginn and Company, 184–21.

Chomsky, N., 1971. Deep Structure, Surface Structure, and Semantic Interpretation. In Steinberg, D. D., and Jakobovits L. A. (eds.), Semantics: An Interdisciplinary Reader in Philosophy, Linguistics and Psychology. Cambridge, Cambridge University Press, 183–216.

Chomsky, N. 1975. Reflections on language. New York: Pantheon

Chomsky, N., 1995. The Minimalist Program. Cambridge: MASS, MIT Press.

Clahsen, H., 1996. Generative perspectives on language acquisition: Empirical findings, theoretical considerations, and cross-linguistic comparisons, Amsterdam: Benjamins.

Cunningham, A., & Stanovich, K. 1998. What reading does for the mind. American Educator, Spring/Summer, 1-8

Dąbrowska, E. 1997. The LAD goes to school: A cautionary tale for nativists. Linguistics, 35, 735-766.

Dąbrowska, E. 2008. The effects of frequency and neighbourhood density on adult speakers' productivity with Polish case inflections: An empirical test of usage-based approaches to morphology. Journal of Memory and Language, 58, 931-951.

Dąbrowska, E., 2012 Different Speakers, Different Grammars: Individual Differences in Native Language Attainment. Linguistic Approaches to Bilingualism, vol 2, 3. Pp 219-253
Dąbrowska, E., Street, J., 2006. Individual differences in language attainment: Comprehension of passive sentences by native and non-native English speakers. Language Sciences 28, 604–615.
Dąbrowska, E., Street, J. A., & Farmer, T. (under review). (Non)Convergence in L1 and L2 acquisition.
Dittmar, M., Abbot-Smith, K., Lieven, E. & Tomasello, M. 2014. Familiar verbs are not always easier than novel verbs: How German pre-school children comprehend active and passive sentences. Cognitive Science,38, 1, 128-151 DOI:10.1111/cogs.12066
Divjak, D., (in press). Frequency in language: memory, attention and learning. Cambridge; CUP
Ellis, N.C., 2005. At the interface: dynamic interactions of explicit and implicit language knowledge. Studies in Second Language Acquisition 27, 305–352.
Ferreira, F., 2003. The misinterpretation of noncanonical sentences. Cognitive Psychology 47, 164–203.
Garnsey, S. M., Pearlmutter, N. J., Myers, E., & Lotocky, M. A. 1997. The contribution of verb bias and plausibility to the comprehension of temporarily ambiguous sentences. Journal of Memory and Language, 37, 58–93.
Holmes, V. M., Stowe, L., and Cupples, L., 1989. Lexical expectations in parsing complement-verb sentences. Journal of Memory and Language 28, 668-689.
Goldberg, A. E., Casenhiser, D., and Sethuraman, N., 2004. Learning Argument Structure Generalizations. Cognitive Linguistics 15, 289–316.
Gordon, P., Chafetz, J., 1990. Verb-based versus class-based accounts of actionality effects in children's comprehension of passives. Cognition 36, 227–254.
Gries, S. Th., and Stefanowitsch, A., 2004. Extending collostructional analysis. A corpus-based perspective on 'alternations'. International Journal of Corpus Linguistics 9, 97–129.
Hermon, G., 2002. General introduction: what can acquisition teach us about our language faculty? Available from http://www.ling.udel.edu/bruening/ Courses/2001-2/496/hermonHO.pdf.
Langacker, R. W., 2000. A dynamic usage-based model. In Barlow, M., Kemmer, S. (eds.), Usage-Based Models of Language, CSLI Publications, Stanford, CA, pp. 1–63
Lidz, J., & Williams, A. 2009. Constructions on holiday. *Cognitive Linguistics*, 20, 177–189.
Lim, H. L., & Christianson, K. 2013a, Integrating meaning and structure in L1–L2 and L2–L1translationsSecond Language Research 29(3) 233–256
Lim, H. L. & Christianson, K. 2013b, Second language sentence processing in reading for comprehension and translation. Bilingualism: Language and Cognition 16 (3), 2013, 518–537
MacDonald, M. C., & Seidenberg, M. S. 2006. Constraint satisfaction accounts of lexical and sentence comprehension. In M. J. Traxler. & M. A. Gernsbacher (Eds.), Handbook of Psycholinguistics (2nd ed., pp. 581-611). London: Elsevier.
MacDonald, M. C., Pearlmutter, N. J., & Seidenberg, M. S. 1994. The lexical nature of syntactic ambiguity resolution. Psychological Review, 101, 676-703.
Maratsos, M., Fox, D. E. C., Becker, J. A., Chalkley, M. A., 1985. Some restrictions on children's passives. Cognition 19, 167–191.

Matthews D, Lieven E, Theakston A & Tomasello M (2005) The role of frequency in the acquisition of English word order. Cognitive Development, 20(1), 121-136

Meints, K., 2003. To get or to be ? Use and acquisition of get versus be passives: evidence from children and adults. In Motivation in Language: Studies in Honor of Gunter Radden, Vol. 243, 123.

Myachykov, A., Thompson, D., Ferreira, F. and Scheepers, C. 2012. Lexical restrictions on passive uses in English: a large-scale corpus investigation [Poster]. In: AMLAP 2012: Architectures and Mechanisms for Language Processing, Riva del Garda, Italy, 06-08 Sep 2012.

Nowak, M. A., Komarova, N. L., & Niyogi, P. 2001. Evolution of universal grammar. Science, 291, 114–118.

Pinker, S., 1984. Language Learnability and Language Development. Cambridge, MA, Harvard University Press.

Pinker, S., Lebeaux, D. S., Frost, L. A., 1987. Productivity and constraints in the acquisition of the passive. Cognition 26, 195–267

Radford, A., 1990. Syntactic Theory and the Acquisition of English Syntax. Cambridge: MA: Blackwell.

Reali, F., & Christiansen, H., 2007. Processing of relative clauses is made easier by frequency of occurrence. Journal of Memory and Language 57, 1-23

Roland, D., Dick, F., & Elman, J. L. 2007. Frequency of basic English grammatical structures: A corpus analysis. Journal of Memory and Language, 57, 348-379.

Sparks, R., 2012. Individual differences in L1 achievement impact L2 learning. Linguistic Approaches to Bilingualism, vol 2, 3. Pp 314-318

Sneller, B., & Fisher, S., 2015. When GET Got Noticed: The Emerging Salience of GET-Passives *University of Pennsylvania Working Papers in Linguistics*: Vol. 21 : Iss. 1 , Article 34.

Stanovich, K. 2000. Progress in understanding reading: Scientific foundations and new frontiers. New York: Guilford

Stefanowitsch, A., and Gries, S. Th., 2003. Collostructions: investigating the interaction of words and constructions. International Journal of Corpus Linguistics 8, 209–243

Street, J. A., & Dąbrowska, E., 2010. More individual differences in language attainment: How much do adult native speakers of English know about passives and quantifiers? Lingua, 120, 2080–2094.

Street, J. A., & Dąbrowska, E. 2014. Lexically specific knowledge and individual differences in adult native speakers' processing of the English passive. Applied Psycholinguistics, 35, 97-118.

Street, J. S., 2017.

Tomasello, M. 2003. Constructing a Language: A Usage-Based Theory of Child Language Acquisition. Harvard University Press, Cambridge, MA

Townsend, D. J., Bever, T. G., 2001. Sentence Comprehension: The Integration of Habits and Rules. MIT Press, Cambridge, MA.

Trueswell, J. C., & Tanenhaus, M. K. 1994. Toward a lexicalist framework for constraint-based syntactic ambiguity resolution. In C. Clifton, Jr. & L. Frazier (Eds.), Perspectives in Sentence Processing (pp. 155-179). Hillsdale, NJ: Lawrence Erlbaum Associates.