ABSTRACT

Some individuals with aphasia preferably use semantically general light verbs, whereas others prefer semantically specific heavy verbs. This study aimed to test Gordon and Dell's “division of labor” hypothesis that light versus heavy verb usage depends on syntactic and semantic processes, respectively. In a retrospective analysis of data from the AphasiaBank corpus, narrative language of neurologically healthy individuals and individuals with aphasia was analyzed for the proportion of light verbs used, and its relationship with narrative measures of syntactic and semantic sophistication and verb naming scores was examined. In individuals with aphasia, light verb usage was positively correlated with a syntactic measure (developmental sentence score) and negatively associated with two semantic measures (idea density and verb naming). For healthy individuals, the number of verbs per utterance, which is a measure of syntactic complexity, predicted light verb use. These findings suggest that light verb usage in aphasia observes an inverse relationship with syntactic and semantic abilities, supporting the division of labor hypothesis.

KEYWORDS: Aphasia, light verbs, narratives, verb complexity

Learning Outcomes: As a result of this activity, the reader will be able to (1) identify the difference between light and heavy verbs; (2) discuss how syntactic impairments manifest in aphasia and influence light verb retrieval; and (3) describe ways of measuring syntactic and semantic abilities in narrative speech.

Difficulties in retrieving and processing verbs have been reported across a variety of neurologic conditions, including Parkinson disease, progressive supranuclear palsy, motor neuron disease, and particularly in aphasia.1–3 In aphasia, verb retrieval struggles are reported
more frequently than noun retrieval deficits. In a review of 280 individual scores, 75% of the persons with aphasia (PWA) performed more poorly on verbs compared with nouns. The reason for the vulnerability of verbs in aphasia is unclear, and therefore poses an impediment for targeted intervention of word retrieval deficits in aphasia. Intervention of verb retrieval deficits is crucial for subsequent treatment of sentence production because verbs form the core of a sentence.

One account of verb deficits is that verbs are more complex and hence more vulnerable to brain damage. However, this argument is undermined by the numerous reports of double dissociations between verb and noun retrieval in individuals and in group studies. A neuroanatomical explanation for verb deficits has been elusive because they have been associated with a variety of lesion locations. A third account of verb deficits in aphasia is that these are a component of a broader linguistic deficit, particularly agrammatism. Agrammatic language is characterized by impoverished sentence structure and functional morphology along with a paucity of verbs. However, verb-specific deficits have been found in persons who do not produce agrammatic language, such as those with fluent aphasia, and not all agrammatic individuals show verb deficits. One problem in examining the relationship between verb deficits and agrammatism is that both of these symptoms are viewed as dichotomous; a PWA either has or does not have agrammatism or does or does not have a verb deficit. This categorical classification is problematic because there is no agreed upon objective measure (or set of cutoff scores) for either symptom. Therefore, in the present study, we examine the relationship between grammatical abilities and verb usage by treating these as continuous variables.

WITHIN-VERB DIFFERENCES IN APHASIA

To elucidate the source of verb deficits in aphasia, investigators have examined dimensions along which verbs vary, such as transitivity, imageability, instrumentality, and noun homophony. The logic is that these variables denote representational complexity of verbs, thus potentially influencing verb breakdown in aphasia. Syntactic complexity of a verb is often represented by verb argument structure (VAS), which refers to the number of arguments a verb requires and the number of different argument alternations the verb takes. For instance, verbs such as sleep and bark require a single argument, which is the agent of the action (the dog slept/barked). Other verbs may require two (e.g., wash, push) or three (e.g., give, keep) arguments. Still other verbs can alternate between transitive and intransitive (or dative) contexts (e.g., the ice cream melted versus the candlemaker melted the wax). Some studies have found a preferential usage of verbs with simpler VAS by persons with agrammatic aphasia. However, a corpus-based study of 173 narratives from the AphasiaBank database found no effect of argument structure complexity or difference in usage between PWA and healthy controls.

Along the semantic dimension, complexity of verbs has been investigated with variables such as imageability, manipulability, and verb weight. Variables such as imageability and manipulability refer to a single semantic attribute, whereas verb weight denotes the overall semantic specificity or complexity of a verb. At one extreme are light verbs, a specific subset of semantically underspecified verbs whose meaning can vary widely according to context. Heavy verbs are the more specific, semantically complex verbs, usually including all verbs that are not considered light. For example, jog, bake, and donate are heavy whereas go, make, and give are light. Other criteria used to identify light verbs are those that are highly frequent, often grammaticalized cross-linguistically (i.e., verbs that were once lexical but became closed-class morphemes, such as auxiliary verbs), and take a diverse number and variety of complements. Thus, whereas light verbs are semantically underspecified, these are syntactically more complex. In contrast, heavy verbs are used in a rather limited variety of syntactic constructions, hence are, in general, syntactically less diverse.

The contrasting semantic and syntactic complexities of heavy and light verbs were formalized by Gordon and Dell into a connectionist model of sentence production called the “division of labor” hypothesis. According to this model, a division
of labor between syntactic and semantic mechanisms guides lexical activation during language production. For instance, a speaker’s conceptual–semantic intentions may increase the activation of lexical nodes that correspond to specific events or entities. Simultaneously, a syntactic network is also activated that contributes information about which types of words are syntactically appropriate at that particular point in the utterance, such as verb, noun, or auxiliary. In the case of verbs, a situation with high syntactic constraints and underspecified conceptual–semantic constraints will yield selection of light verbs (e.g., give), whereas higher conceptual–semantic activation will result in retrieval of a heavy verb (e.g., donate).

In Gordon and Dell’s connectionist model, a lesioning of the syntactic system will result in a selective impairment of light verbs in aphasia and a reliance on heavy verbs in language production. This syntactic lesioning is analogous to the syntactic impairment found in agrammatic aphasia. Conversely, an impairment to the semantic system with the syntactic system remaining intact would result in a scarcity of heavy verbs and an overuse of light verbs. This is illustrated in the Appendix with language samples from two PWA; Scale02a exclusively produces heavy verbs and fragmented utterances. In contrast, Star03a produces several complete utterances but mainly light verbs. The syntax–semantics division is a promising theoretical account of verb impairment in aphasia that we test in the present study.

Previously, the influence of verb weight on retrieval in aphasia has been examined using sentence or story completion tasks where participants fill in a missing verb, and by analyzing narrative language. Across these studies, of 40 individuals with aphasia tested with the sentence- or story-completion paradigm, 28 showed a numerical (but not statistically significant) advantage for heavy verb naming, whereas the remaining 12 demonstrated comparable performance for heavy and light verbs. In narrative language, 15 of 19 participants with aphasia showed an advantage for heavy verbs, whereas the remaining 4 showed an advantage for light verbs. Crucially, across these studies, there was no consistent relationship between the presence of agrammatism and light verb use. Hence current evidence is inconclusive regarding the use of light verbs and the division of labor between syntactic and semantic impairments.

In PWA, patterns of light verb use could be explained in ways other than the division of labor hypothesis. Notably, light verbs are semantically diverse, or highly variable in meaning across contexts, which poses a challenge for persons with semantic access deficits. Hence, contrary to the division of labor, the semantic diversity of light verbs predicts an association between semantic deficit and limited light verb use. Another account is that the heavy verb preponderance seen in most individuals with aphasia was also found in healthy adults.

Therefore, it is possible that individuals with aphasia who are less impaired overall exhibit this typical pattern, whereas an increased proportion of light verbs is seen in the more severely impaired. Heavy verbs might be more difficult than light verbs for more severely impaired individuals because their enriched semantic representations may simply present an increased processing load. A factor that may favor light verb use is their earlier age of acquisition and higher usage frequency than heavy verbs. Thus, it is possible that the heavy–light differences are not an effect of syntax–semantics as Gordon and Dell propose, but a result of other factors such as semantic diversity, aphasia severity, or lexical frequency.

To summarize, although the difference in semantic complexity of verbs could have a crucial influence on verb retrieval and sentence production, only four studies have examined this issue, with inconsistent findings. Two ways in which the present limitations can be addressed are to use larger sample sizes that would allow for more statistically robust effects and to consider verb use and syntactic and semantic abilities as continuous rather than categorical measures. Hence people are not classified a priori as agrammatic or verb impaired.

THE PRESENT STUDY

The purpose of this study is to test the division of labor hypothesis model as well as alternative accounts of light and heavy verb distinctions in PWA. Additionally, the neurotypical pattern of light and heavy verb use is unclear: both a preponderance of heavy verbs and comparable
Heavy–light distribution has been reported. Therefore, we first sought to establish the pattern of heavy and light verb use in the narrative language of neurologically healthy English-speaking adults and PWA. We predicted that less than half of the verbs used by neurologically healthy individuals would be light. According to Gordon and Dell’s model, aphasic individuals are expected to show different patterns of light verb production based on their relative impairment of syntactic and semantic processes. Therefore, we predicted that, as a group, PWA would be more variable (i.e., greater variance) in the proportion of light verbs used compared with neurologically healthy individuals.

Second, to test the central predictions of the division of labor hypothesis, we examined if measures of syntactic ability or semantic ability predict the proportion of light verbs used in narrative speech. The two outcomes that would support the division of labor are an association between a lower use of light verbs and low performance on syntactic measures, and high performance on semantic measures. If the increased semantic diversity of light verbs presents problems for individuals with semantic access deficits, then lower semantic performance would be associated with lower proportion of light verbs. If aphasia severity exerts a stronger influence on verb production, then there would be an inverse relationship between the proportion of light verbs used and aphasia severity—that is, less severe individuals would be more consistent with the neurotypical pattern of lower light verb use.

The previous questions were investigated with narrative language, to avoid confounds associated with elicitation of verbs in isolation, which may favor the more imageable heavy verbs. Measures of semantic and syntactic performance were also obtained from the same narrative language samples to be consistent with the context in which heavy and light verbs are produced. Numerous measures of semantic and syntactic ability in narrative language have been proposed in prior literature, in studies of both language acquisition and aphasia. After reviewing a variety of possible measures, three different measures each were selected for syntactic and semantic analysis. One measure of syntactic ability was the proportion of grammatical utterances, which is commonly used to describe agrammatism and quantifies the syntactic impairment. The number of verbs per utterance captures syntactic complexity because utterances with more than one verb, such as embedded clauses, are syntactically complex. As a global measure of syntactic ability, developmental sentence scoring was selected. Although this measure has been traditionally used to quantify children’s syntactic development, it can be used to provide an overall view of any individual’s morphosyntactic abilities because it takes into account utterance complexity, grammatical accuracy, and the use of function words.

Semantic measures included vocabulary density (VOCD), which measures the diversity of words used by a speaker. Ratios of different words to total word tokens, such as type-token ratio are correlated with the length of the language sample, and hence VOCD calculates the probability of new vocabulary given a sample length and yields a more stable measure of lexical diversity. Second, we quantified the lexical completeness of the narrative. For stories that are commonly retold as a means of assessing narrative language, such as the Cinderella story used in previous studies of light verb usage and in this study, a core lexicon of key words that make the story semantically complete has been published. So we measured the proportion of words from this core lexicon that occurred in each narrative. The third semantic measure was propositional idea density (ID), which has been used in the analysis of the Nun Study of Aging and Alzheimer disease. It is calculated as the number of propositions (nonmodal verbs, adverbs, adjectives, prepositions, and subordinating conjunctions) expressed over total number of words in a sample.

**METHODS**

This study was a retrospective analysis of data available on AphasiaBank, an online database of transcriptions of discourse produced by PWA secondary to a cerebrovascular accident as well as neurologically healthy individuals. Both aphasic and nonaphasic participant data on AphasiaBank was gathered according to a
prespecified protocol, with scores on the Western Aphasia Battery–Revised (WAB-R), the short form Boston Naming Test–2nd Edition (BNT), the Verb Naming Test (VNT) from the Northwestern Assessment of Verbs and Sentences–Revised, and the nonstandardized AphasiaBank Repetition Test available from each aphasic participant, as well as narrative language samples from all participants. The narrative language elicitation protocol AphasiaBank is described by MacWhinney et al. This study used a sample of discourse from each participant elicited by the retelling of the Cinderella story rather than those elicited by picture description, given that stories generate richer language than single pictures and to be consistent with past research.

Participants
Participants were included whose transcripts contained at least 100 words to obtain a representative language sample. This criterion yielded 164 monolingual PWA (86 male, 78 female, mean age = 61.0) and a control group of 166 monolingual English speakers without aphasia (76 male, 90 female, mean age = 63.3). Participants with aphasia were more than 1-year post–cerebrovascular accident, control participants had no history of neurologic impairment, and no participants had a history of a cognitively deteriorating condition. Experimental and control groups were matched for age (t[328] = 1.42, p > 0.05), years of education (t[328] = 1.07, p > 0.05) and gender distribution (Fisher exact test, p > 0.05).

Data Analysis
Narrative samples in the AphasiaBank database have already been previously transcribed word-for-word in the CHAT format by the researchers who were involved in the originally collected samples. Words have been tagged with morphosyntactic roles and coded for aphasic errors such as semantic paraphasias and neologisms. Utterances have been coded with utterance-level errors, including the presence of grammatical errors. Computerized language analysis (CLAN) was used to conduct automated analyses of the narratives, as described later.

Proportion of Light Verbs
Light verbs were defined based on several factors, including those that are previously defined as light in at least two empirical studies (developmental and aphasia literature), are highly frequent in English corpora, take diverse noun complements, and share the feature of frequently grammaticalizing cross-linguistically. The final list of nine light verbs is as follows: come, do, get, give, go, have, make, put, and take. Auxiliaries, modals, and copulas are neither considered as light or heavy verbs due to their grammatical functions. The FREQ program in CLAN was used to obtain counts of light and heavy verbs. The total number of light verbs was then divided by the total number of verbs in the sample to obtain the proportion of light verbs.

Syntactic and Semantic Measures
We used three syntactic measures: proportion of grammatical errors, number of verbs per utterance, and developmental sentence score (DSS); and three semantic measures: VOCD, proportion of words from the Cinderella core lexicon, and propositional ID. The EVAL program in CLAN was used to obtain the number of utterances with grammatical errors and the average number of verbs per utterance. The DSS was obtained from the KidEVAL program. To obtain the proportion of words from the Cinderella core lexicon present in each narrative sample, the 10 most frequent nonlight verbs and 10 most frequent nouns were selected from the core lexicon of another syntactic measure used in language acquisition research, the Index of Productive Syntax (IPSyn) measures the presence of 56 syntactic structures without weighting for age of acquisition. However, the IPSyn score is traditionally based on 100-utterance samples, an unfeasible length for the aphasic Cinderella narratives used in this study, which averaged to of 37 utterances (range was 10 to 87). IPSyn scores were more strongly correlated with narrative sample length (r = 0.525, p < 0.01) than DSS scores (r = 0.376, p < 0.01). Therefore, DSS was selected in this study as a global indicator of syntactic ability.

Grammatical errors in the AphasiaBank transcripts were originally represented by the [+gram] code, whereas DSS counted grammatical errors with the [+] code. To accurately calculate DSS, transcript codes were altered to reflect grammatical errors with the [+] code.
MacWhinney et al. Both nouns and verbs were chosen to prevent possible impact of noun- or verb-specific lexical impairments on proportional scores, and light verbs were excluded as they do not contribute informational content to the Cinderella story. The total number of word types from this core lexical set present in each sample was counted for each participant using the FREQ program. VOCD and ID were calculated automatically from KidEVAL and EVAL respectively. ID calculation uses the Computerized Propositional Idea Density Rater software, which is available in CLAN. Separate multiple regression analyses were used to identify predictors of light verb usage in the neurologically healthy and aphasia groups. Five predictor variables were used for the healthy group: the number of verbs per utterance, DSS, VOCD, the proportion of the core lexicon present, and ID for their narrative samples. In addition, predictor variables for the aphasic group included scores on the BNT, the VNT, and the AphasiaBank Repetition Test (part II.B, the total number of words correct).

RESULTS
There was no significant correlation between the total number of verbs and number of light verbs in the data, precluding effects of overall sample length on the syntactic or semantic measures (aphasic group, $r = 0.10$, $n = 164$, $p > 0.05$; control group, $r = -0.05$, $n = 166$, $p > 0.05$). The WAB-R Aphasia Quotient and the proportion of light verbs used were not significantly correlated ($r = 0.013$, $p > 0.05$), suggesting that the severity of aphasia did not influence the proportion of light verbs used. There was also no difference between WAB aphasia classification (Broca’s $n = 23$, Wernicke’s $n = 15$, conduction $n = 30$, anomic $n = 72$, and nonaphasic [i.e., aphasia severity low enough to preclude classification on the WAB-R] $n = 20$) and proportion of light verbs ($F[4, 155] = 1.14$, $p > 0.05$).

Light Verb Proportions
The mean proportion of light verbs used by controls was 0.38 (standard deviation = 0.09), with a normal distribution (Shapiro-Wilks test, $W = 0.99$, $p > 0.05$, see Fig. 1). The proportion of light verbs used by aphasic individuals was similar to the control group but with the wider

Figure 1 Histograms of the proportion of light verbs produced by the aphasic and control groups.
The VNT score was also negatively associated with light verb proportion, indicating that a higher DSS score (i.e., higher syntactic ability) was related to increased use of light verbs. ID was negatively associated with light verb proportion, meaning that a negative relationship. That is, as the number of verbs per utterance (i.e., syntactic complexity) increased, the number of light verbs used decreased.

For the aphasic group, the nine predictor variables was statistically significant ($F [5, 160] = 2.91, p < 0.05, R^2 = 0.08, R^2_{Adjusted} = 0.05$). Only one variable, the number of verbs per utterance, emerged as a significant predictor of light verb proportion ($t [165] = -2.86, p < 0.01$) with a negative relationship. That is, as the number of verbs per utterance (i.e., syntactic complexity) increased, the number of light verbs used decreased.

For the aphasic group, the nine predictor variables was statistically significant ($F [9, 154] = 4.47, p < 0.01, R^2 = 0.21, R^2_{Adjusted} = 0.16$). Three predictors were significant, DSS ($t [163] = 2.64, p < 0.01$), ID ($t [163] = -2.01, p < 0.05$), and VNT scores ($t [163] = -2.50, p < 0.05$). DSS was positively associated with light verb proportion, meaning that a higher DSS score (i.e., higher syntactic ability) was related to increased use of light verbs. ID was negatively associated with light verb proportion, indicating a higher ID score (i.e., greater semantic ability) was related to decreased use of light verbs.

Thus, both DSS and ID varied in a direction that was consistent with the Gordon and Dell model. The VNT score was also negatively associated with light verb proportion, indicating that better verb naming was associated with lower occurrence of light verbs in narrative language.

**Correlations among Syntactic and Semantic Measures in Aphasia**

DSS correlated significantly with both other syntactic measures (for the number of verbs per utterance, $r = 0.77, p < 0.001$; for the proportion of grammatical utterances, $r = 0.35, p < 0.001$, using $\alpha$ level of 0.001). ID significantly correlated with VOCD ($r = 0.32, p < 0.001$, using a Bonferroni adjusted $\alpha$ level of 0.001), but not with the proportion of the core lexicon used ($r = -0.108, p > 0.05$, using $\alpha$ level of 0.001).

**Standardized Difference Score**

For individuals with aphasia, in accordance with the Gordon and Dell model, it was suspected that a measure of relative syntactic or semantic impairment might provide more insight into the proportion of light verbs used rather than absolute measures of syntactic or semantic ability because most individuals exhibit varying degrees of both semantic and syntactic impairments. Hence a difference score was calculated for each aphasic individual by first converting their ID and DSS scores into $z$ scores, and then subtracting the standardized DSS score from the standardized ID scores. A positive difference score indicated relative greater syntactic impairment, a negative score indicated relative semantic impairment, and a score of 0 indicated equal severity of semantic and syntactic impairment.

A Spearman correlation analysis between the standardized difference score and the proportion of light verbs used showed a significant small negative association between the two variables ($r = -0.17, p < 0.05$). That is, for persons with relatively greater syntactic impairment, the proportion of light verbs decreased, as predicted by Gordon and Dell.

**DISCUSSION**

The main goal of this study was to test Gordon and Dell’s division of labor hypothesis of light verb use. This was achieved by identifying the pattern of verb production in neurologically healthy and aphasic individuals’ narratives and comparing the use of light verbs with measures of syntactic and semantic ability for both groups. The main findings were that aphasic and neurologically healthy individuals produced similar average proportions of light verbs (~38% of all verbs), but individuals with aphasia, as a group, were more variable. For individuals with aphasia, the proportion of light verbs showed no relationship to aphasia severity or
subtype of aphasia. Narrative language measures of syntactic and semantic ability were significantly associated with the proportion of light verbs used. These findings will be discussed in the following sections.

**Predictors of Light Verb Use**

Neurologically healthy individuals showed an association between increased light verb use and increased syntactic complexity, as represented by verbs per utterance. That is, individuals using more syntactically complex language also used more heavy verbs. This finding is inconsistent with Gordon and Dell’s proposal, and it suggests that individuals who produced syntactically complex language more often produced semantically specific verbs. In other words, some neurologically healthy speakers produced overall more sophisticated narrative language than others.

For individuals with aphasia, four findings were consistent with Gordon and Dell’s proposal: light verbs’ positive correlation with DSS and negative correlations with ID, ID/DSS difference score, and VNT. The latter test mainly elicits heavy verbs such as *wash* and *pour*. These results extend previous studies that considered syntactic impairment as a categorical variable by focusing on persons with agrammatic aphasia. Here we use a large data set to show that grammatical ability in aphasia is a continuum that is consistently associated with light verb use. A novel aspect of this study is to show the inverse relationship between semantic ability and light verb usage in aphasia. Prior support of the inverse relationship between semantic ability and light verb use came from persons with probable Alzheimer disease.

Although six measures were used to measure syntactic and semantic ability in narratives, light verb usage was positively correlated with only one syntactic measure, the DSS, and negatively correlated with one semantic measure, ID. A possible explanation for why DSS and ID were associated with light verb use but not other measures of syntactic and semantic ability is that the calculations of ID and DSS are more global compared with the other four syntactic and semantic measures. For example, DSS takes into account the proportion of grammatical utterances (grammatical accuracy), the number of verbs per utterance (syntactic complexity), and occurrence of various functional morphemes, all of which capture symptoms of agrammatic aphasia. The DSS gives greater weight to morphosyntactic forms that are acquired later, and presumably these are syntactically more complex and problematic for persons with agrammatic aphasia.

In contrast, the other syntactic measures (proportion of verbs per utterance and grammatical utterances) measure one aspect of agrammatism. Similarly for semantic measures, ID, calculated as the average number of propositions controlling for sample length, is a more global measure than VOCD or the proportion of the core lexicon present. However, a cautionary note is that ID has been suggested to be sensitive to syntactic as well as semantic production because its count of propositions includes content words and select function words: verbs, prepositions, adjectives, adverbs, and coordinating conjunctions.

**Clinical Implications of the Study**

Verb retrieval in healthy speakers and those with aphasia is complex and incompletely understood. Some factors that were known to contribute to verb retrieval were imageability, semantic features such as manipulability, and frequency. This study contributes to our understanding of verb retrieval by empirically supporting verb weight as a relevant dimension of verb retrieval and by providing empirical support to the division of labor hypothesis. The practical relevance of this study is that it provides clinicians who work with PWA additional clues about the underlying nature of deficit in their clients. The language samples in the Appendix illustrate the association between syntactic structure and heavy verb usage. Clinicians can also use automated calculations of objective measures such as DSS and ID, not only to capture overall syntactic and semantic abilities but also to examine their influence on verb retrieval. Remediation of verb retrieval deficits is important because, as pointed out earlier, these are much more frequent than noun retrieval.
impairments in aphasia. Furthermore, verbs form the framework of a sentence; when a verb is retrieved from the mental lexicon, its VAS influences which arguments (or other entities) need to be strung together to formulate a complete sentence. Hence addressing verb retrieval in PWA is functionally significant. Several studies have found improvement in sentence production following verb retrieval intervention.

There are a few points of caution in applying the findings of this study to theorizing and clinical practice. First, although this study showed a relationship between light verb retrieval in narrative language and the VNT, other studies have shown poor or modest correspondences between narrative and confrontation naming tasks. Furthermore, although we argued in favor of treating syntactic and semantic abilities as continuous variables, one could make a similar case for verb weight as a continuous variable (and not light versus heavy categories). Maouene et al. have attempted to address this concept, quantifying verb weight continuously as a function of the diversity of complements following the verb. Other important factors, however, could be factored into quantification of the “lightness” of a verb, such as its frequency and the extent of its grammaticalization. By creating a system for quantifying verb weight continuously, future studies could examine the relationship between syntactic ability, semantic ability, and verb weight in narrative language more precisely.

To conclude, overall this study supports the view that, in aphasia (but not in neurologically healthy adults), there is a trade-off between light verb/syntactic abilities and semantic abilities in narrative language. This study contributes to the understanding of factors underlying verb specific deficits in aphasia, a problem that has proved complex and remains poorly understood. It is clear that a multitude of factors are involved in the lexical retrieval of verbs: word frequency, imageability, morphological complexity, and now semantic complexity have all been shown to play a role across studies of verb retrieval, and further study of these factors will help fully comprehend the representational processes underlying the production of verbs.

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APPENDIX

Selected Transcripts of the Cinderella Story

The following two transcripts illustrate the almost exclusive use of either heavy or light verbs, and the associated syntactic well-formedness. Error codes in transcripts have been deleted to improve readability. Verbs are italicized.

Participant Scale02a, Using Mainly Heavy Verbs

Um, middle-aged woman and, um, mid-uh, early twenties um, uh, no, um, 10 years old. . . . And um, older gentleman. And uh, a paint, a painting sunlight, beautiful sunlight. . . . Uh, next, um, um, next um, a bad um, um, older woman and um, mid-twenties dark, dark, stern fighting and lovely uh, girl. . . . Um, um, older women and um, mid-twenties um, uh, cursing and stuff. . . . Next um, um, fairy, uh, father [fairy godmother] uh . . . Um, cot [god] . . . A woman, uh, father [fairy godmother]. Next um, horses and um, uh, a chariot um, uh, horses and ride to the uh, castle. And um, uh, gaily um, um, waltzing the, what called, polka and um, uh, music.

Participant Star03a, Producing Only Light Verbs

Uh, the story was um, (a) bout Cinderella. And she uh, was uh, having a different stuff uh, with the maid of the house. And the, the lady in the house uh, with uh, her two uh, thing were, were angry at Cinderella. And so uh, then they had a uh, uh, difference with Cinderella. And Cinderella had uh, some differences with them. And uh, uh, so, and uh, Cinderella had a big uh, um, big deal with uh, the prince. And Cinderella was doing okay. But then she was, she bad their deal... out. And she bad, the uh, prince, uh bad them. All of them bad the table, table and, and so forth.