Title: Verb use in aphasic and non-aphasic personal discourse: What is normal?

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Highlights:
Heavy and light verbs were produced in equal proportions in aphasic and non-aphasic discourse
Relational, material and mental verbs were prevalent in both speaker groups
Verb argument structure differentiated aphasic from non-aphasic speakers' discourse
Heterogeneity in both speaker groups challenges what is considered normal and typical
Findings suggest multiple discourse sampling is needed in aphasia

Abstract

Sentence and discourse analysis research provides evidence of both impaired and intact ability in verb production in aphasia, based on comparisons made within aphasic subtypes, and between aphasic and control speakers. Comparisons are complicated due to variation in elicitation tasks and genre, participant sample size, and aphasia subtype, as well as methodological differences in determining fluency. In this study, we examined the impact of aphasia on speakers' capacity to talk about their quality of life, applying three analytical methods to 58 speakers' discourse (29 predominantly fluent aphasic speakers; 29 non-aphasic speakers). Both speaker groups produced similar quantity, weight, and type of verbs, with substantial overlap in verb tokens. Relational, material and mental verbs were prevalent. Aphasic speakers had significantly lower predicate argument structure scores, and produced significantly more 0 argument structures, more [Aux+0] constructions, fewer 1 argument structures in general and fewer 1 argument structures with clausal embedding, compared to non-aphasic speakers. This study provides evidence for intact (semantic weight and type) and

impaired (PAS) verb production in aphasia. The heterogeneity within both participant samples challenges assumptions of normality and typicality.

1. Introduction

1.1 Novel connections in aphasia research

This study connects two distinct research fields in aphasia: linguistic analysis of discourse and quality of life. The former has traditionally focused on analysis of event descriptions, procedural narratives, and fairytale recounts, with a substantial body of evidence accumulated over a number of decades from behavioural studies, and increasingly from neuroimaging studies. By contrast, the latter has developed only more recently since the mid 1990s, with a primary quantitative focus on predictors, methodological concerns (e.g. reliability of informants), and intervention outcomes. In both fields, there is increasing use of personal narratives as data, and thus identifying the linguistic impact aphasia has on discussing one's quality of life motivated the analysis undertaken in this paper.

As verbs play an integral role in personal narratives, they were the focus of analysis, from both syntactic (verb argument structure) and semantic (heavy/light verbs; Halliday's categories) perspectives. The research literature is reviewed with respect to verb production ability and deficit at the sentence level. Although it could be argued sentence level analysis may not reflect a speaker's broader discourse ability, recent research has indicated strong associations between microlinguistic features, such as sentence production, and overall macrolinguistic features, such as relevance and cohesion (Sherratt, 2007).

1.2 Challenges in synthesizing the evidence base

A coherent understanding of verb production in aphasia is difficult to achieve, despite the extensive literature that exists. The collective knowledge about verb production ability and deficit is influenced by factors relating to genre, sample size, aphasia type, determinants of fluency, and points of comparison. Firstly genre exerts a significant influence over verb production (Armstrong, 2000), thus attention to the nature of the elicitation tasks is important. A variety of tasks has been used, including single word naming from picture and video (Berndt, Mitchum, Haendiges, & Sandson, 1997); sentence production elicited from short stories of three sentences in length (Barde, Schwartz, & Boronat, 2006; Breedin, Saffran, & Schwartz, 1998); procedural narratives (Ulatowska, North, & Haynes, 1981; Ulatowska, Doyel, Freedman-Stern, Macaluso-Haynes, & North, 1983); Cinderella narrative (Berndt, Haendiges, Mitchum, & Sandson, 1997; Saffran, Berndt & Schwartz, 1989; Webster, Franklin, & Howard, 2007); describing the experience of the stroke, job or last holiday (Armstrong, 2001; 2005; Armstrong, Ciccone, Godecke, & Kok, 2011; Bastiaanse, 2011); and describing a happy event (Armstrong, 2005). Whilst it is important to distinguish between tasks eliciting objective information (picture naming) versus personal information, it is equally important to discriminate further within the personal narrative genre, i.e. tasks eliciting *factual* language (describe what you do on a typical Sunday) versus tasks eliciting *evaluative* language (describe a happy event) (Armstrong, 2005). Secondly, findings are based on relatively small samples of aphasic speakers. These include studies with two participants (Armstrong et al., 2011), four and five participants respectively (Armstrong, 2001; 2005), eight participants (Breedin et al., 1998), 11 participants (Berndt, Mitchum et al., 1997), and 16 participants (Gordon, 2008), as well as small sub-groups within aphasic speaker samples (e.g. Berndt, Mitchum et al., 1997; Breedin et al., 1998). Whilst studies with larger samples do exist (N = 22 participants, Webster et al., 2007; N = 23 participants, Barde et al., 2006),

more research with larger numbers of individuals with aphasia is still needed. Thirdly, aphasia type and fluency in relation to verb impairment is an important consideration. Whilst much of the verb impairment literature is based on distinctions between agrammatic and paragrammatic speakers, and differences have been noted (see subsequent paragraphs below), larger studies report no distinctive patterns of verb impairment for fluent and non-fluent aphasic speakers (Cameron, Wambaugh, & Mauszycki, 2010; Webster et al., 2007). Additionally, there are methodological challenges, as researchers use different methods for determining fluency in aphasia, e.g. using BDAE Melodic Line, Phrase Length and Articulatory agility (Armstrong, 2005), using clinician report (Edwards & Bastiaanse, 1998), or by making judgments about the relationship between rate of speech and sentence production (Webster et al., 2007). Finally, some studies report verb deficits by comparing within aphasia subtypes, and other studies compare between aphasia and control speakers yielding a complex picture. More research is needed with large samples of speakers, comparing aphasic speakers with non-aphasic and unimpaired speakers, on discourse that is drawn from everyday life. What is further lacking in the literature is a solid evidence base from *unimpaired* speakers, which begs the question 'what is normal?'

1.3 Verb production in aphasia

There is evidence that aphasic speakers find verbs with increasing numbers of arguments more difficult to retrieve, and perform poorly compared to controls (Edwards & Bastiaanse, 1998; Thompson, 2003; Whitworth, 1995). This has been noted in assessment contexts investigating thematic roles (Whitworth, 1995) and personal narrative tasks (describing the onset of aphasia; talking about last trip to hospital; Edwards & Bastiaanse, 1998), compared with controls. Aphasic speakers (N = 2; anomic; non-fluent) produced a greater number of utterances with an undetermined thematic structure, a greater number of one-argument structures, and fewer two-argument structures, compared to controls (Whitworth, 1995). Aphasic speakers (N = 10 English fluent) produced significantly fewer embedded clauses compared to English matched controls (Edwards & Bastiaanse, 1998). In contrast, Webster, and colleagues (2007) found less clear differences between their 22 aphasic speakers and 20 matched controls, on the Cinderella narrative. Overall, aphasic speakers produced significantly fewer thematically complex utterances than controls, however the majority (n = 16) had a predicate argument structure score within the normal range. Whilst aphasic speakers produced significantly fewer structures with clausal (thematic) embedding compared to controls, clausal embedding was variably produced by controls. Similarly, aphasic speakers produced less language than controls, however, some individual aphasic speakers were within the normal range. Webster et al. (2007) also identified that aphasic speakers' performance on their analyses did not reflect the fluent/non-fluent distinction because of wide variability.

Verb classification according to semantic weight was of interest in this study, as there is no published research investigating semantic weight in aphasic versus control speakers. Verb production in aphasia has typically been investigated in relation to noun production, and in relation to aphasic subtype/profile. This evidence base is appraised below. Differentiation is made between general verbs that contain limited information which are semantically 'light' e.g., *come, go, make, take, get, give, do, have, be* (Berndt, Haendiges et al., 1997), and verbs that convey meaning which are semantically 'heavy'. Berndt et al. (1997) studied verb production ability in 10 aphasic speakers (5 with selective verb impairment; 5 with noun impairment) using the Cinderella narrative, and found the former produced a higher proportion of light or semantically empty verbs than the latter. Breedin et al. (1998) explored

verb semantic weight in 8 aphasic speakers (3 with agrammatic aphasia) using a verb pair (e.g. CAME = simple/light; DROVE = complex/heavy) sentence stories task, and found the majority (n = 6) had more difficulty producing semantically simple verbs than more complex verbs. Barde and colleagues (2006) compared verb production performance in agrammatic (n = 12) and non-agrammatic (n=11) speakers on the same task, and found that the former showed a light verb production deficit that was not evident in the latter. Gordon (2008) compared the weight of verbs used by non-fluent (n=8) and fluent (n=8) aphasic speakers using a Norman Rockwell picture description task, and found that the former used more heavy verbs than the latter. She further found that linguistic severity (BDAE rating) was not significantly correlated with the heavy-light verb ratio in either aphasic group, although it is uncertain whether this reflects over-reliance on one verb type, or under-use of the other verb type. Gordon and Dell (2003) explored light and heavy verb production in a computer simulation modelling experiment, creating an unlesioned and two lesioned models. The simulated lesions were either semantic or syntactic, intended to mimic anomic and agrammatic aphasia respectively. Their models showed that the anomic or semantically-lesioned model was more impaired in producing heavy verbs, whereas the agrammatic or syntactically-lesioned model were more impaired in producing light verbs. They described their connectionist model as representing light and heavy verbs on a "continuum of dependence of lexical production on syntax and semantics" (Gordon & Dell, 2003, p9). In summary, although there is a common perception evident in the literature that speakers with aphasia tend to rely on light verbs, there is no such consensus arising from the evidence base. Findings for semantic weight by aphasic subtype are complex and equivocal but tend to suggest that people with fluent aphasia or anomia have more difficulty produce heavy verbs than do people with non-fluent aphasia.

Whilst not measures of semantics, verb frequency and verb diversity are also of relevance to this study, and again there appears to be variation in findings for speakers with aphasia. Comparisons between aphasic speakers and controls, using group analyses, indicates that aphasic speakers (n=5, 3= non-fluent, 2=fluent) produced verbs of similar frequency (Celex database) to controls (n=5; Bird & Franklin, 1996) on the Cinderella narrative, and conversely that aphasic speakers (n=10 fluent) produced verbs less frequently and less diversely than controls (n=10; Edwards & Bastiaanse, 1998) on personal narrative tasks. Single case analysis revealed that one aphasic speaker in Bird and Franklin's study was indeed statistically different to controls (producing verbs with higher frequency), but conversely in Edwards and Bastiaanse's study, six aphasic speakers (categorised as fluent by their clinicians) produced verbs with similar frequency and diversity as controls (this group analysis finding was heavily influenced by four aphasic speakers). Bastiaanse (2011) compared Dutch mild to moderate anomic aphasic speakers (n=8) with controls (n=8) on personal narrative tasks, and found aphasic speakers used a normal variety of lexical verbs in spontaneous speech, and produced lexical verbs with same word frequency as controls. Finally, comparisons of English, Dutch and Hungarian aphasic speakers (n=2 of each) found 5 of the 6 had reduced lexical diversity compared to controls using conversation about daily activities as the elicitation task (Bastiaanse, Edwards, & Kiss, 1996). Because of the different elicitation tasks, resulting differences in narrative genres and different aphasia subtypes in the literature reviewed above, no clear picture arises for the frequency and diversity of verb production in aphasia.

Finally, verb production can also be evaluated using Halliday's semantic categories of verb types (1985) of which there are five: material, mental, relational, verbal and behavioural. Limited evidence only is available from two studies employing this method of analysis. In a study using personal narratives, Armstrong (2001) found that two aphasic speakers produced

proportionally fewer mental and relational verbs compared to controls, whilst the other two aphasic speakers were comparable to controls. Furthermore, whilst controls produced more topic-specific verbs, no difference was found in type-token ratios for aphasic speakers and controls. Armstrong (2005) continued this study of verb semantic category using personal evaluative narrative with aphasic speakers (n=5 fluent) and controls (n=5), and found that: (1) overall, aphasic speakers and controls produced similar percentages of mental verbs and relational verbs; however (2) aphasic speakers used these mental and relational verbs *less often* to convey feelings, attitudes and evaluation. Armstrong also noted that aphasic speakers tended to produce mental verbs that were more general and high word frequency, such as *think, see*, whereas controls produced more specific and low word frequency verbs, such as *appreciate, expect*. Interestingly, Bird and Franklin (1996) noted that one aphasic speaker (IB) favoured low frequency verbs, and that IB's spontaneous speech was characterized by physical action verbs (i.e. Halliday behavioural verbs such as *sweep, wave*), with limited production of mental verbs (such as *think, realise*), and no relational verbs (such as *do, have, be*) produced. Further exploration of verb semantic category with larger numbers of aphasic speakers and controls is warranted.

1.4 Research Aims

This paper reports on a multi-faceted linguistic analysis of personal narrative (factual and evaluative language) based on participants' responses to questions regarding their quality of life elicited in structured interviews, the purpose of which is to identify the impact of aphasia on individuals' abilities to express their views on quality of life. The interviews generated sufficient language on which to undertake analysis, and provided a narrative genre that has not previously been analysed linguistically. The discourse analysed in this paper was collected as a part of a broader study exploring communication and quality of life (by author MC). There was evident diversity in the aphasic participant sample, in terms of severity and type, which resulted from non-purposive sampling in the original study. This unevenness was not considered to be an issue for the present study given that the focus here is on verb use in personal narratives from speakers with aphasia as compared to controls (rather than within aphasia sub-groups). Furthermore, whilst the sample underrepresents aphasic subtypes with clear verb deficits (Broca's agrammatic type), there is evidence from the previously reviewed literature, that fluent aphasic speakers will also experience verb difficulties, and have warranted further study in their own right (Bastiaanse, 2011). Thus, based on the findings of previous studies, it was hypothesised that in general:

- Aphasic speakers would use less complex predicate argument structures than non-aphasic speakers
- Aphasic speakers may use fewer mental and relational verbs than non-aphasic speakers

Two additional hypotheses were not based on previous findings, due to the novel nature of the stimulus, participant sample and study design. It was hypothesised that:

- Aphasic speakers would use heavy and light verbs differently to non-aphasic speakers.
- All speakers would use a diverse range of verbs, due to the individual and personal nature of the stimulus

2. Materials and Methods

2.1 Participants

Data was collected from 29 participants with aphasia from a single left hemisphere stroke and 29 non-aphasic participants by one author (MC). Participant samples were matched for gender, age, and education (Table 1). Participants were statistically similar, and were on average 71-72 years old, with an average 11-12 years of education (schooling and training). Language assessment scores indicated that the aphasic participant group was composed of varying aphasia subtypes (including 15 anomic; 9 conduction, 4 Wernicke's, and 1 Broca's) and abilities (Aphasia Quotient 90+ n=7; 80-89 n=7; 70-79 n=5; 60-69 n=7; and <59 n=3). The mean WAB Aphasia Quotient for the aphasic participant sample was 76.14 (SD =15.97, range 30 – 95.8) and mean Spontaneous Speech subtest score was 15.41 (SD = 3.67, range 4 - 20). Four PWA scored higher than the Western Aphasia Battery (WAB: Kertesz, 1982) cut-off of 93.8. Despite scoring within the normal range, these participants reported aphasia impacted their language and everyday lives, and this impact was noticeable to the researcher during data collection.

Insert Table 1 about here

2.2 Data

Verbatim transcripts of participants' responses to six unprompted QoL questions were analysed (see Cruice, 2002; Cruice, Hill, Worrall, & Hickson, 2010 for further information). The questions were as follows:

1) How would you describe the quality of your life, and why do you say that?
2) What things give your life quality?
3) What things take quality away from your life?
4) What would make the quality of your life better?
5) What would make the quality of your life worse?
6) Does communication have an impact on the quality of your life? If yes, then how?

Example transcripts from one non-aphasic neurologically healthy participant (NHP) and one aphasic speaker (person with aphasia: PWA) are included in Appendix 1. Data was transcribed from taped audio recordings for 23/29 NHP and 21/29 PWA[1]. PWA produced a total of 11 phonemic paraphasias, which were close approximations of the target verb. This represented 1.17% of total verbs produced by PWA. These were analysed as the target, for example 'swalk' was analysed as 'walk'. Original transcription notes clarifying context, e.g. *(these are the names of 2 TV channels)*, were removed from analysis. Other data removed from analysis included metalinguistic utterances e.g. *I don't understand* and *that's question three*, and [NPVP] structures functioning as discourse connectives, e.g. *you know* and *you see*. Total word count for all PWA responses was 6,207 words (N = 29; X = 214; SD = 199.95; SEM = 37.13; range 20-831); total word count for all NHP responses was 7,863 words (N = 29; X = 271; SD = 258.16; SEM = 47.94; range 69-936). Transcript length was statistically similar between groups ($t(56) = -.94$, $p = .35$).

2.3 Analysis

The transcripts were analysed using three different methods (one syntactic, two semantic) focusing on verbs. The analyses examined argument structures, the semantic weight (heavy/light), and semantic category (using Halliday verb types) of the verbs. A detailed explanation of each of these methods is given below. As well as analysing whole transcripts,

[1] Responses transcribed live at interview and responses transcribed from audiotape were comparable – statistical analysis of argument structure revealed no significant difference.

data were analysed according to question. For each linguistic method, aphasic data was also analysed according to WAB subtype and WAB AQ. However, similar to the only other large group study of language used by speakers with aphasia (Webster et al., 2007), this latter analysis yielded unremarkable and non-significant findings, and these findings have consequently not been reported in this paper. Frequency counts were computed for each analysis, however percentages were used to compare the data as this was a more meaningful measure. An overview of the data analysis, including frequency counts and percentages for both data sets, is reported in Appendix 2.

2.3.1 Argument Structure

The argument structures within participants' responses were analysed by identifying the main verbs and verb groups within transcripts, and then identifying the internal arguments of these verbs. This excluded the subject noun phrase or external argument from the analysis – for example, in the sentence "*that's my big things*", the subject noun phrase [that] was not part of the analysis but the verb and the noun phrase that follows [my big things] were. Verbs were categorised as having 0, 1, and 2 internal arguments (matching the 1, 2 and 3 arguments identified in Byng & Black, 1989 and Webster et al., 2007 both of whom counted the VP-external subject NP as well as VP-internal phrases). Complex arguments were coded as a single argument e.g. *[I]* <u>*know*</u> *[I need the rest]* but the embedded clause was noted and embedded clauses were also separately categorised and counted. Example arguments from the data included: *changed* (0 argument); <u>is [</u>a wonderful thing] (1 argument); <u>do [</u>everything I want to do] (1 argument, clausal embedding); and <u>takes</u> [it][away] (2 arguments). Adjuncts were removed from data analysis and not counted. Using this data, the average predicate argument structure (PAS) score was calculated for each participant, using the formula (total number of arguments produced/ total number of predicates produced). Scores from this calculation describe the average complexity of utterances produced, termed mean PAS complexity by Webster et al. (2007).

Verb arguments produced in isolation were coded as 'fragments' and not analysed. Fragments ranged in complexity, from single words, e.g. *movies* and *doctor*, to longer and more complex utterances, e.g. *this my priority my speech priority* and *the ah..the ah son in Brisbane*. There was no group difference between the number of fragments produced by NHP and PWA ($t(56) = -0.61$, $p = 0.54$).

2.3.2 Semantic Weight

The main verb carrying the weight of meaning within each verb group was identified, e.g. *talk* within the verb phrase *not being able to talk.* This removed auxiliary verbs from the analysis. These main verbs were then classified into 'light' and 'heavy' categories as defined by Berndt, Haendiges et al. (1997). As outlined in the previous section, light verbs do not carry semantic weight, and rely heavily on the arguments for meaning, e.g. *go, do, be, have*; whereas heavy verbs carry a greater degree of semantic weight, e.g. *swim, think, talk.*

2.3.3 Semantic Category

Main verbs were classified using Halliday's classification system (1985) as described and used by Armstrong (2001). In the case of phrasal verbs, e.g. *get used to*, the whole phrasal verb meaning was considered. This classified main verbs according to five categories outlined below, with examples taken from participants' transcripts:

- Material: describe the process of doing, e.g. *start, bought, drive, sew, play, phone*
- Mental: describe thoughts, feelings and psychological states, e.g. *suppose, love, like, think, hate*
- Relational: describe being and having, e.g. *be, have, live, own,*
- Verbal: report speech and conversations, e.g. *talk, said, invite, thank*
- Behavioural: describe physical/ physiological actions, e.g. *wave, watch, woke*

2.4 Reliability

All transcripts were initially analysed by one author (MP). Following a break of two months, 10.3% of the transcripts (three transcripts from each group) were re-analysed by this rater. Intra-rater reliability was 98.7%, representing only seven differences across the three main analyses. Inter-rater reliability was conducted by a second author (LD) on 27.5% of the transcripts (eight transcripts from each group). Inter-rater reliability was 89% on PWA argument structure[2] and 97% on NHP argument structure; 100% for PWA and NHP on heavy/light classification; and 98.6% for PWA and NHP on Halliday verb type classification.

3. Results

3.1 Overview

Overall, NHP and PWA produced similar total numbers of verbs in their responses to the six questions (NHP total = 1056, PWA total = 938; Appendix 2). Participant groups were not significantly different $t(56) = 0.54$, $p = 0.6$, with NHP producing an average 37 verbs per participant (SD = 30.2, range 9-108) and PWA producing an average 32 verbs per participant (SD = 26.11, range 2-101). The following results are largely reported as percentages, with corresponding numerical data available in Appendix 2, and additional qualitative information regarding verbs in Appendix 3.

3.2 Argument Structure

NHP and PWA both produced 0, 1, and 2 argument structures (see Appendix 2). NHP had significantly higher mean PAS complexity scores than PWA (NHP mean = 0.99, SD = 0.18; PWA mean = 0.78, SD = 0.19, $t(56) = 4.1$, $p = <0.05$) indicating that PWA used verbs with fewer arguments to describe their QoL.

Figure 1 depicts average percentages of 0, 1, and 2 internal arguments used by both groups. NHP and PWA showed similar overall patterns. The distribution is not surprising as there are more verbs that take 1 internal argument than verbs that take 0 or 2 internal arguments. A one way mixed ANOVA, with group as the between subjects variable and arguments used as a within subject variables indicated a significant interaction between group and arguments used $F(2, 112)= 11.33$, $p< 0.05$. Partial Eta squared was 0.168, indicating a medium effect accounting for 16.8% of the observed variance. Bonferroni post- hoc comparisons with significance set at $p< 0.007$ indicated that PWA used more 0 argument verbs than NHP, $t(56)= 4.63$, $p= 0.0001$; and fewer 1 argument structures $t(56)= -3.08$, $p= 0.003$; but not 2 argument structures $t(56)= 1.0$, $p= 0.051$. A qualitative difference was noted between the 1 argument structures produced by PWA and NHP, with further analysis revealing that NHP

[2] Of these 11% disagreements, 8% were due to the internal AP argument in a copular verb phrase being overlooked (e.g. [I] want speak [better]$_{AP}$), and the remaining 3% were due to two arguments being mis-analysed as one ([I]'m not going to get [that] [back], analysed as [I]'m not going to get [that back]).

produced a higher percentage of 1 argument structures containing clausal embedding $t(56) = 6.4$, $p < 0.05$.

Insert Figure 1 about here

There was a trend for argument structures to be produced differently in response to the different questions, wherein both NHP and PWA produced the most 1 internal argument structures when responding to Q1, including argument phrases, e.g. *had [your own place], is [a wonderful thing]* and also arguments containing embedded clauses, e.g. and *[I] do [everything I want to do]*; and the most 2 argument structures when responding to Q2, e.g. *use [that][as an interest];* and *hold [us][up]*.

3.3 Semantic Weight

NHP and PWA produced both light verbs (NHP and PWA mean = 48%; see Appendix 2) and heavy verbs (NHP mean = 51%, PWA mean = 50%) in statistically equal proportions $F(1, 56) = 0.58$, $p = 0.58$. This analysis did not demonstrate the use of auxiliary verbs with no main verb, coded as [Aux+0], which was used more by PWA than NHP (PWA = 23, NHP = 7). A trend was noted in heavy verb use according to question (see Figures 2 & 3), wherein PWA produced more heavy verbs responding to Q3 than NHP (e.g. *think, talk, sew, cook, manage, remember* and these were typically prefaced by *I can't*); whilst NHP produced more heavy verbs responding to Q4 (e.g. *share, communicate, know*) and Q5 (e.g. *happen, deteriorate, lose*) than PWA.

Insert Figures 2 and 3 about here

3.4 Semantic Category

Both groups used each of the Halliday verb types when describing QoL (see Appendix 2). NHP and PWA showed very similar patterns in their distribution of types, with both groups producing mostly relational verbs (35-38%) and then material verbs (32%), followed by mental (17-22%), verbal (7-8%) and behavioural verbs (2-4%). One way repeated measures ANOVA with group as the independent between subjects variable and verb type as the dependent within subjects variable indicated no interaction between group and percentages of verbs used $F(4, 224) = 0.58$, $p = 0.68$. In terms of lexical diversity, there was no difference in type token ratio between the groups (NHP Mean = 61.06, SD = 17.39; PWA Mean = 60.98, SD =20.18), $t(56) = 0.02$, $p>0.05$). Furthermore, there were no differences in type token ratios within the verb categories.

Analysis of verb type according to interview question yielded similarities (see Figures 4 & 5): relational verbs were prominent across all questions; material verbs featured most strongly in Q2; and behavioural verbs featured most strongly in Q6. Differences were also evident: PWA produced more mental verbs in Q5 than NHP (PWA = 19.4%; NHP = 7.6%), and also produced more material verbs in Q6 than NHP (PWA = 41%; NHP = 12.5%).

Insert Figures 4 and 5 about here

3.5 Qualitative observations

Thus far, the quantitative statistics have conveyed none of the richness of verb data uncovered in this study. Therefore, an inventory of verbs was created, according to Halliday verb type.

The inventory revealed a substantial overlap in verbs (many are shared by NHP and PWA) and substantial diversity regardless of participant group, specifically in material verbs e.g. *come, cook, driving, happen, hold, impact, lost, married, play, start, walk, wipe,* and mental verbs e.g. *annoy, depend, enjoy, feel, guess, hate, know, learn, realise, remember, seem, suppose, think, want, worry*. Much less diversity was noted for relational verbs, wherein nine verbs (*be, become, die, do, got, have, live, own, depends*) accounted for the entire inventory of relational verb tokens. These verbs however were used frequently by both groups, accounting for approximately one third of all verbs produced (NHP = 389; PWA = 308). Appendix 3 illustrates the range of verbs produced by speakers; these verbs appear in the tense in which they were spoken, and are presented according to whether they were shared (i.e. appeared in both NHP and PWA data) or featured in only one participant sample.

3.6 Results summary

In summary, the main findings were (1) similar numbers of verbs produced by PWA and NHP, as well as (2) similar numbers of heavy and light verbs (weight), (3) similar general distribution of verb argument structures and (4) Halliday verb types (category), and (5) commonality in verbs used by PWA and NHP, as well as (6) diversity in material and mental verbs. PWA had significantly lower mean PAS complexity scores, used significantly more 0 internal argument structures and significantly fewer 1 internal argument structures, used more [Aux+0] constructions, and used significantly fewer 1 internal argument structures with clausal embedding, compared to NHP. The data provides evidence of high use of relational, material and mental verbs in both groups. Data analysis according to interview question was especially informative, revealing similarities and differences between PWA and NHP; however these were not consistent for interview question or participant group.

4. Discussion

4.1 Linguistic analyses

Our collective knowledge base in aphasia has been biased towards an expectation of deficit or impairment. The review of literature in section 1 indicates significant and non-significant differences between aphasic and non-aphasic speakers in verb production, and indeed incredible ability in verb production in some studies. The current study provides evidence for (1) impaired ability in the PWA group in terms of verb argument structure and embedding, and (2) heterogeneity in the range of verb tokens used across groups, both as we had hypothesised. However, we also found (3) intact ability for lexical verb production in terms of semantic weight and type, contrary to our hypotheses, as well as (4) substantial impact of stimulus question on verb production. This is in the context of a diverse group of aphasic speakers (anomic, conduction, Wernicke's, Broca's) and notable variation in normal speakers.

In this study, syntactic analysis of verb argument structure is the method of linguistic analysis that differentiated aphasic from normal speakers' discourse, whereas semantic analyses did not. Armstrong et al. (2011) similarly found differences depending on analysis type (albeit with different elicitation tasks and analyses), in their study of four aphasic and non-aphasic speakers. In the present study, aphasic speakers had lower mean PAS complexity scores, used verbs with fewer arguments and employed less complex argument structures, which concur with previous research (Webster et al., 2007). Use of semantically similar verbs whilst producing structurally less complex language may indicate that the PWA in our study were missing compulsory arguments, although this was not something we identified in our analysis. This would be consistent with the findings of Webster et al. (2007) who noted that aphasic

speakers omitted obligatory arguments, and normal speakers rarely did this. Furthermore, Edwards and Bastiaanse (1998) and Webster et al. (2007) also reported that aphasic speakers produced fewer utterances with clausal embedding. However, similarly to the current study, Webster and colleagues also found that there was considerable variation in the way healthy speakers used clausal embedding, with some speakers not using it at all.

In terms of semantic analysis, the heavy/light and Halliday analyses revealed no significant differences between normal and aphasic speakers in this discourse context. Whilst it might have been expected that the aphasic speakers in the present study would have demonstrated heavy verb production deficits (see section 1.3), we did not hypothesise this because the normal/aphasic comparison we make here is novel. Three possible explanations for this are proposed. Firstly, previous findings indicate heavy verb deficit in fluent speakers relative to non-fluent speakers rather than in comparison to controls. Similarly, the evidence base comparing aphasic speakers with normal speakers in terms of the Halliday analysis is not yet extensive enough to draw firm conclusions. Secondly, substantial variation in both samples will have impacted on statistical analyses, contributing to non-significance. Such variability in both aphasic and normal speakers has been previously documented (Edwards & Bastiaanse, 1998; Webster et al., 2007). Thirdly, genre is known to exert a significant influence on outcome (Armstrong, 2000), and the QoL narrative genre provides broader linguistic opportunities than typical elicitation methods of verb naming, repetition, picture description, and story retell. In other words, given the opportunity afforded by the spontaneous and open-ended nature of the QoL questions to respond with verbs with a range of semantic properties, the aphasic speakers in the present study did so in equal measure.

Our findings indicate that people with aphasia have more linguistic resources and abilities than previously thought and they concur with smaller studies' main findings or incidental findings (Berndt, Mitchum et al., 1997; Breedin et al., 1998; Edwards & Bastiaanse, 1998). However, inspection of the verb inventory reveals clear qualitative differences between the verbs produced by aphasic and non-aphasic speakers. One way to characterize this difference is to look at the interplay between lexical semantics and verb syntactic form, because of a possible trade-off. Agrammatic aphasic speakers have been found to produce complex verbs similar to non-aphasic speakers; however they used them in the simplest syntactic form (Thompson, Shapiro, Li, & Schendel, 1995). Recent research shows that fluent aphasic speakers show an impact of grammaticality on verb lexical diversity in spontaneous speech (Bastiaanse, 2011).

4.2 Variability

The most outstanding finding of this research is the variability that exists amongst normal and aphasic speakers. For example, one normal speaker used only nine verbs when responding to the questions, whereas another normal speaker used 118 verbs. This extensive range is mirrored in aphasic speakers (range 2-101 for total verbs). These findings are important for two reasons: firstly, the variability had a substantial impact on statistical analysis, resulting in similar means with vast standard deviations which are likely to have influenced the data in the direction of non-significance; secondly, it indicates heterogeneity rather than homogeneity for aphasic *and* normal speakers, and in doing so, challenges assumptions of normality and typicality in both speaker groups. Previous research similarly attests to individual and extensive variability in both small-scale (N = 4: Armstrong et al., 2011) and large-scale studies (N = 42: Webster et al., 2007), with the latter uniquely discussing specific aphasic individuals as 'falling within the normal range'. Variability *within* aphasic speakers, identified using repeated sampling on the same stimuli, has also been documented (Cameron et al.,

2010), challenging us further to consider what constitutes stable and representative baseline assessment (with treatment outcome measurement implications).

Variation in verb argument structure, weight and category was noted according to interview question. Aphasic speakers used more complex structures (*2 argument*) when discussing present life quality and the specific impact of communication, and simpler structures (*1 argument*) when responding to questions about holistic life evaluation and future life quality. Aphasic speakers used more *heavy* verbs than their counterparts when responding to the question relating to negative aspects of their current life, whereas normal speakers used more *heavy* verbs when responding to the questions regarding future life quality (both positive and negative aspects). *Material* verbs featured highly in responses about what gives life quality, and this is not surprising given that individuals generally discussed various activities they did or participated in when answering this question (Cruice et al., 2010). *Behavioural* verbs featured mostly when participants were asked about specific impact of communication on life quality. Interestingly, aphasic speakers used more *mental* verbs than their counterparts when describing negative future life quality, and more *material* verbs when describing the specific impact of communication. Ultimately, these findings illustrate that the outcomes of syntactic and semantic analyses are strongly influenced by question type, suggesting two implications: (1) that analyzing speakers' discourse as a whole is inadequate in appreciating the true picture for aphasic *and* normal speakers; and (2) that the impact of the syntactic structure and semantic content of the prompt question (or stimulus material) warrants substantially more investigation in the disciplines of clinical linguistics and aphasiology (see also Gordon & Dell, 2003). Indeed, there was evidence in the data that aphasic and non-aphasic speakers utilized the prompt question verbs (*describe, say, give, take, make, have*) in their responses.

Finally, no trends in the syntactic or semantic analyses were evident for severity or type of aphasia. It is likely that the small and uneven sub-groups within the aphasic sample adversely affected the findings, and that the linguistic analyses were not sufficiently sensitive to capture any differences that were present. However, it is also possible that aphasic speakers of different levels of linguistic functioning were equally able to describe their QoL.

4.3 Future Research Directions

Several suggestions for further research have been made in above Discussion; however a few more are proposed here. Non-fluent aphasic speakers were substantially under-represented in this participant sample, and replication of this study with these aphasic speakers would provide a comprehensive understanding of the impact of aphasia on capacity to discuss one's life quality. Future research could additionally seek to explore the evaluative resources that individuals with aphasia employ, especially in contexts where evaluation is core to the genre. Whilst the analyses employed in this study do not permit one to judge the effectiveness of communication (Armstrong, 2000), future research would ideally consider discourse in terms of whether it is correctly used and/or effectively understood by the listener. Omission or inappropriate use was not recorded in our study, and future recording of such items is advocated given their informativeness (Webster et al., 2007). More specific analysis for example, of semantic units understood by the listener, would complement the existing analysis, as would analysis of cohesion at micro- and macro-structure levels (see Sherratt, 2007). Combining two approaches where appropriate (Brady & Armstrong, 2007) or using multi-layered approaches on the same text (Armstrong et al., 2011; Sherratt, 2007) would provide a more holistic picture of discourse abilities.

Finally, more research investigating verb production alongside verb comprehension tasks would be valuable because investigation of verb production only yields as incomplete picture of the interplay between an individual's semantic and syntactic knowledge. There is evidence from normal speakers that comprehension of a verb activates not only lexical semantics but also argument structure knowledge (Thompson, Bonakdarpour, & Fix, 2010).

Finally, a limitation of this study is the short participant responses, which do not approximate the recommended 300-400 words sample size (Brookshire & Nicholas, 1994). This arose as participants were permitted to say as little or as much as they wished in response to the questions. Advising participants on the length of time one wishes them to speak clearly elicits longer samples (Armstrong et al., 2011). Thus we acknowledge that the text analysed in these transcripts may not be representative of the speakers' broader abilities in discourse, and also will not represent speakers' abilities in everyday conversation or other verbal tasks.

4.4 Clinical Implications

Although these individuals with aphasia relied on simpler grammatical structures, this did not appear to prevent them from discussing their QoL, and engaging at a level where meaning could be interpreted (Cruice et al., 2010). Our study's participants had mild to moderate aphasic linguistic impairment; however, WAB AQ did not have a clear effect, suggesting this in isolation is not an appropriate means for judging whether someone can discuss their QoL. The findings of this study suggest that in this context, the linguistic deficit is structural and complexity based, and therapy to enhance aphasic individuals' ability to discuss their QoL should address this deficit. Research suggests that various verb treatments improve verb retrieval, as well as argument structure and sentence production (Schneider & Thompson, 2003; Webster, Morris, & Franklin, 2005). Finally, the collective findings of this research indicate the importance of using multiple discourse samples, rather than drawing inferences and basing clinical decision-making on one sample of one genre in isolation. This current study, as well as existing research (Armstrong et al., 2011), indicates sampling in only one context could under- or over-estimate an individual's abilities.

5. Conclusions

Syntactic analysis of verb argument structure differentiates individuals with predominantly fluent aphasia from those without in the discourse of describing their QoL in an interview context. However, individuals with aphasia used a wide range of verbs when expressing their thoughts about their QoL, and were not dissimilar to their non-aphasic counterparts in terms of weight or category of verbs. This study highlights the impact of discourse genre on aphasic verb production, and substantially strengthens the existing evidence base from normal speakers. However its most salient finding is one of heterogeneity or diversity in verb usage for all individuals, challenging notions of normal.

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Appendix 1: Example transcripts

Neurologically Healthy Participant

1. How would you describe the quality of your life, and why do you say that?
Good, seem to have the freedom, and finance and health to do most of the things we want…most of the things…if we had more of each we'd do more of each

2. What things give your life quality?
Ah, living conditions, no not so much living conditions, um quality of friends and people that support us we've built up a support group..finance advisor, doctor, old workmates and that sort of thing…and activities to do and take up hobbies and things

3. What things take quality away from your life?
Frustration of unpredictable people that sort of thing…hoons[3] around the place..people who don't appreciate society…I get frustrated probably because I grew up in a generation that copped it hard during the war and did a lot of civic all over the place…handing it over its been the trouble and those that have got it are tearing it apart…political groups ..I think like the GST[4] I paid taxes up to 65 …I reckon that's the way it goes and now I'm going to be hit for more. The generation before is not likely to take it up.

4. What would make the quality of your life better?
I'm on a high …high for the last few years…no but ah we've had a very successful retirement you know after the frustrations of long service and limitations and you can't criticise that because it might come back at you…… we've got a good relationship we've got time for the other we do most things together.

5. What would make the quality of your life worse?
Yeah losing a partner that would be devastating

6. Does communication have an impact on the quality of your life? If yes, then how?
Oh, it's the main thing..cause I oh I got an old workmate that rings up every Monday morning…the internet email and catching up with the family tree….that's all communication.

Participant with Aphasia

1. How would you describe the quality of your life, and why do you say that?
To me, it it's very good cause older person I've had a long time, the small things is here you get to now…I can have good things. This stopped me but it's not too bad

2. What things give your life quality?
My kids and all the [daughter-in-law's name] and [son's name] that's my big things

3. What things take quality away from your life?
I don't know the only thing would be that I can't do these sort of things (Online research notes: speaker moves hand to mouth appearing to indicate talking)

[3] Refers to individual who drives car or boat in an anti-social manner (too fast or noisily)
[4] Goods and Services Tax

4. What would make the quality of your life better?
I don't really don't know. I have everything I want. I've got what I need to have.

5. What would make the quality of your life worse?
I don't know if I couldn't even do the little bit now

6. Does communication have an impact on the quality of your life? If yes, then how?
Yes it does because I…it stops me to getting people hear what they, I can hear what they say but I like to have them talk to me back that's a bit hard-helps me.

Appendix 2: Overview of Data Analysis

Neurologically Healthy Participants (N = 29)

		Total	Mean	Standard deviation	Range
Overall verb production		1056	37.1	30.23	9-108
Mean PAS complexity*		28.81	0.99	0.18	0.27-1.2
Argument analysis numerical totals	0 argument structures	140	4.83	5.68	0-20
	1 argument structures	835	28.79	23.29	7-86
	2 argument structures	81	2.79	2.84	0-14
Argument analysis % totals	% 0 argument structures	-	10.82	6.73	0-28.4
	%1 argument structures	-	80.93	7.89	64.28-100
	% 2 argument structures	-	7.9	6.39	0-23.07
Heavy and light numerical	Heavy verbs	548	18.9	16.82	3-59
	Light verbs	508	17.51	14.71	1-53
	Light: Aux+ [0]	7	0.24	0.58	0-2
Heavy and light %	% Heavy verbs	-	51.1	14.67	23.1- 88.9
	% Light verbs	-	48.05	14.14	11.11- 70.58
	% Light: Aux+[0]	-	0.85	2.95	0-15.38
Halliday numerical	Mat	325	11.26	9.24	1-34
	Ment	215	7.41	7.97	0-31
	Rel	389	13.41	12.74	3-47
	Ver	88	3.03	3.21	0-8
	Beh	39	1.34	1.76	0-13
Halliday %	% Mat	-	32.46	13.83	11.11- 57.14
	% Ment	-	17.41	9.27	0-34.1
	% Rel	-	37.62	13.88	14.29- 66.67
	% Ver	-	7.37	7.92	0-19.05
	% Beh	-	4.33	5.51	0-22.22

* PAS = Predicate Argument Structure

Participants with Aphasia (N = 29)

		Total	Mean	Standard deviation	Range
Overall verb production		938	32.41	26.11	2-101
Mean PAS complexity		23.11	0.78	0.19	0.36-1.33
Argument analysis numerical totals	0 argument structures	223	7.79	6.36	0-23
	1 argument structures	644	22.9	20.23	2-76
	2 argument structures	48	1.65	3.31	0-18
Argument analysis % totals	% 0 argument structures	-	24.07	13.86	0- 63.64
	%1 argument structures	-	71.22	15.04	36.36-87.209
	% 2 argument structures	-	4.25	7.51	0-17.35
Heavy and light numerical	Heavy verbs	461	15.89	12.45	1-49
	Light verbs	454	15.65	13.71	1-52
	Light: Aux+ [0]	23	0.79	1.82	0-7
Heavy and light %	% Heavy verbs	-	49.86	14.73	0-66.67
	% Light verbs	-	48.33	15.04	29.41-57.14
	% Light: Aux+[0]	-	1.8	4.13	0-16.22
Halliday numerical	Mat	312	10.76	9.67	0-29
	Ment	188	6.48	5.66	0-57.14
	Rel	308	10.62	10.55	1-43
	Ver	85	2.93	3.52	0-14
	Beh	22	0.76	1.64	0-8
Halliday %	% Mat	-	31.78	17.99	15.39- 81.81
	% Ment	-	21.99	14.04	0-57.14
	% Rel	-	34.73	19.67	9.09-57.14
	% Ver	-	8.27	7.7	0-18.67
	% Beh	-	1.54	3.07	0-7.8

Appendix 3: Illustrative inventory of verbs

Verbs are organised below according to Halliday's verb type, and appear in the tense that they were spoken in by NHP and PWA.

Material verbs

Used by both NHP and PWA	come, cook, do, driving, get, get out, get rid, give, go, got, happen, hold, impact, lost, make, married, moving, play, put, read, ring up, start, stay, stop, take, use, walk, wipe, work, writing
Used by NHP only	achieve, adds, affected, allow, alter, assert, become, bring, broke, built, copped, covers, crop up, cure, depending, destroy, divorced, entertain, exercise, fell, going on, grown, handing, hit, included, increase, investigate, invite, keep up, lead, let, manage, meeting, narrows, overcome, paid, proved, record, retire, send, serves, set, share, shut in, sit, spoil, struck, surrounding, take up, tape, tearing, took up, travel, turn, twiddle, wait, waste
Used by PWA only	choose, bar, bought, breathe, call in, catered, changed, clean, come on, comes up, confined, fall, fishing, garden, get about, get away, get by, going out, got to, got used to, handing out, hang on, help, hide, hold up, involved, kill, leave, left, lose, owe, phone, prepare, restrain, ride, run, scrabble, see, sew, shake off, show, sign, smoke, stand, swim, tour, voom[5], wash up, win

Mental verbs

Used by both NHP and PWA	annoy, depend, enjoy, feel, guess, hate, know, learn, like, love, need, realise, reckon, remember, seem, suppose, think, thought, understand, want, worry
Used by NHP only	appreciate, believe, bothering, brood, concerned, convinced, decide, distinguish, disturb, forget, get on, mind, noticing, overcome, put off, relaxing, rely, settled, support, take care, tied
Used by PWA only	accept, care for, cope, delight, frustrate, handle, impose, madding[6], manage, meant, miss, play, subjected to, succeed, used, watch, wonder

Relational verbs

Used by both NHP and PWA	be, become, die, do, got, have, live
Used by NHP only	Own
Used by PWA only	Depends

Verbal verbs

Used by both NHP and PWA	complain, describe, mean, say, speak, talk, tell

[5] Used by participant to mean zooming about

[6] Used by participant in following context: "shouldn't be greedy madding better I really wish to read well"

Used by NHP only	ask, catch up, communicate, criticise, decline, discuss, enlarging, mention, patronise, whinge
Used by PWA only	advise, invite, socialise, thank

Behavioural verbs

Used by both NHP and PWA	hear, listen, look, see, watch
Used by NHP only	deteriorating, hear, shining, sounds, woke
Used by PWA only	interfere, tired, wave

Table 1: Demographic information for participant samples

	PWA (n = 29)	**NHP (n = 29)**	**Significance**
Gender	16 females; 13 males	16 females; 13 males	N/A
Age	Mean = 71yrs SD = 8.44 Range = 57-88yrs	Mean = 72.1yrs SD = 6.82 Range = 62-88yrs	n.s. t = -.55, p = .59
Education (years of schooling and further training/ education)	Mean = 10.66yrs SD = 4.03 Range = 6-20yrs	Mean = 12.07yrs SD = 2.78 Range = 7-18yrs	n.s. t = -1.55, p = .13

Figure 1: Average percentage of 0, 1, and 2 argument structures used by PWA and NHP

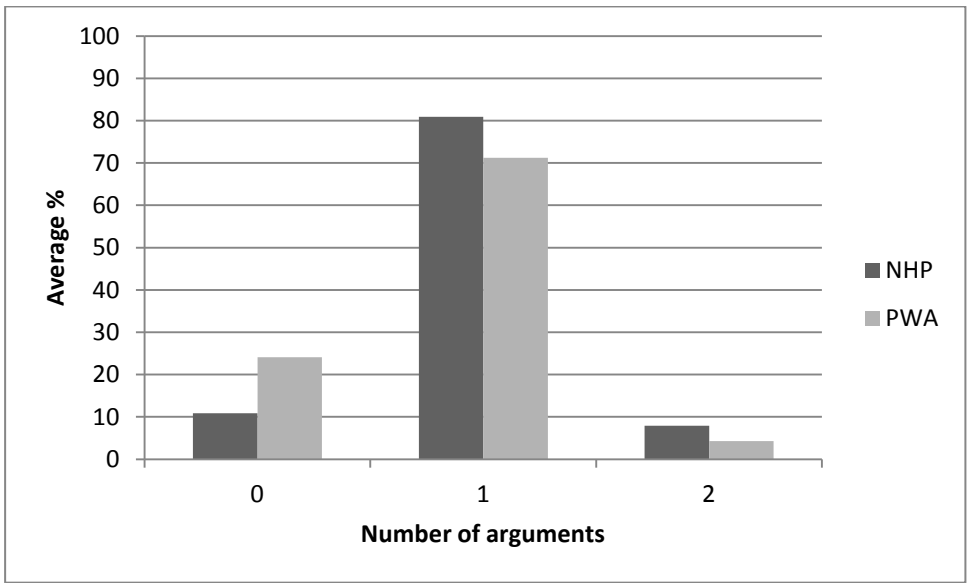

Figure 2: Average percentage of heavy and light verbs according to interview question in NHP

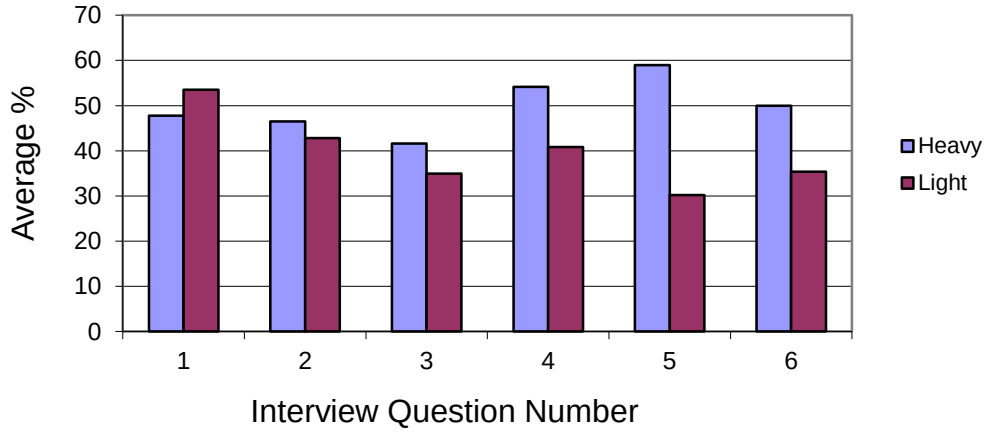

Figure 3: Average percentage of heavy and light verbs according to interview question in PWA

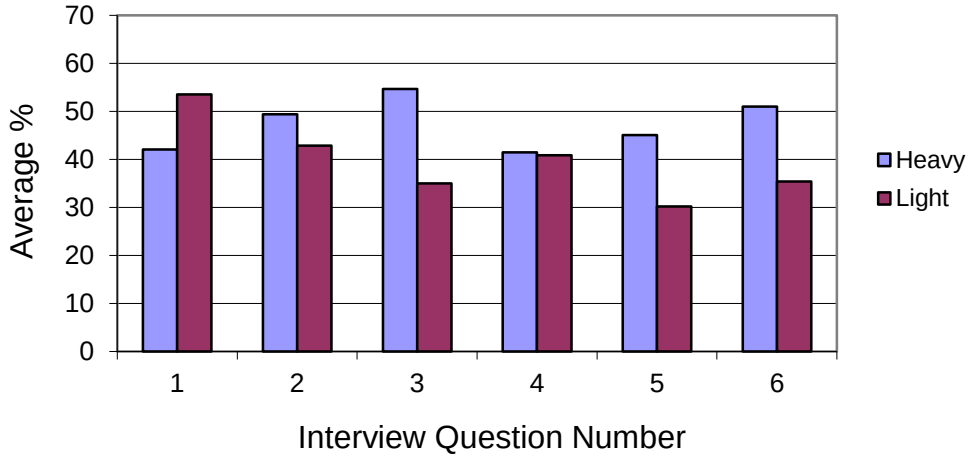

Figure 4: Average percentage of Halliday verb types according to interview question in NHP

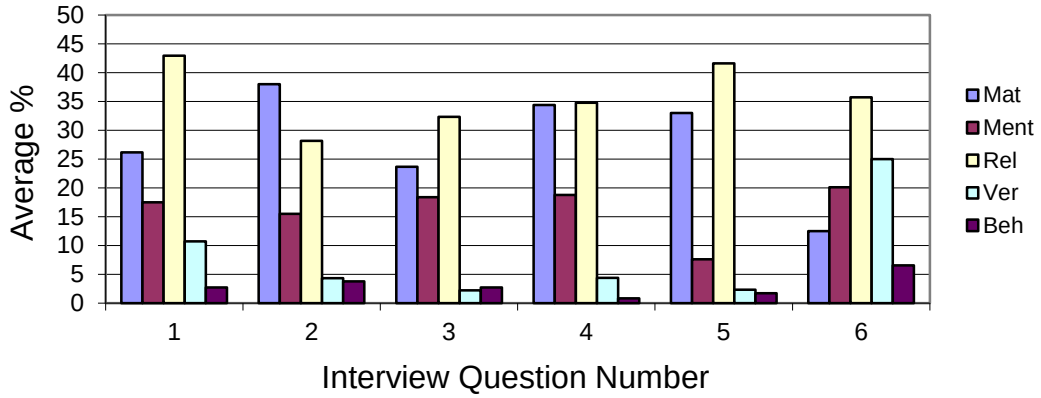

Figure 5: Average percentage of Halliday verb types according to interview question in PWA