

The Auditory Comprehension of Unaccusative Verbs in Aphasia

Some persons with aphasia, particularly those diagnosed with a Broca's aphasia, exhibit a delayed time course of lexical activation in canonically ordered S-V-O sentences (Ferrill et al., 2012) and delayed re-activation of displaced arguments in sentences that contain syntactic dependencies (Love et al., 2008). These patterns support the Delayed Lexical Activation (DLA) hypothesis: Lexical activation is delayed relative to the normal case, and thus lexical activation and syntactic operations are de-synchronized; that is, lexical access is too slow for normally fast-acting syntactic operations. This delay in lexical access leads to what appear to be syntactic comprehension deficits in aphasia. In the current study we further examined lexical activation during sentence comprehension in persons with aphasia by using unaccusative verbs. Unaccusative verbs are a type of intransitive verb with a single argument that is base generated in object position and displaced to the surface subject position, leaving behind a copy or trace ('gap') of the movement (see, for example, Burzio, 1986), as in:

1. The girl vanished <~~the girl~~>

Thus there is a syntactic dependency between the two positions. When encountering sentences that contain syntactic dependencies (e.g., object relatives, Wh-questions) neurologically unimpaired individuals immediately reactivate the displaced argument at the gap (Shapiro et al., 1999; Love et al., 2008). In contrast to this immediate reactivation, prior findings indicate that neurologically unimpaired individuals do not reactivate the displaced argument in similar sentences with unaccusative verbs until 750ms downstream from the gap (Friedmann et al., 2008). This built-in delay observed with unaccusative verbs in neurologically healthy participants provides a unique opportunity to further examine lexical delays in individuals with Broca's aphasia. Importantly, individuals with Broca's aphasia may have unaccusative verb deficits. Previous research has found that persons with aphasia have difficulty producing unaccusative verbs. Offline truth-value judgment tasks with intransitive sentences containing unaccusative verbs do not reveal comprehension deficits (Lee & Thompson, 2004). However, in a sentence-picture matching task, McAllister et al. (2009) found lower accuracy for intransitive sentences that contained unaccusative verbs than transitive sentences. We entertain the following hypothesis: The delayed lexical access routines better synchronize with the delay of reactivating the argument of unaccusatives, suggesting that individuals with Broca's aphasia should evince a pattern like that of unimpaired individuals. Alternatively, participants with Broca's aphasia might show activation even further downstream from the gap, given that in other sentence constructions containing syntactic dependencies they exhibit a delayed pattern of reactivation compared to neurologically unimpaired individuals.

METHOD

Participants (Table 1). Twelve adults who experienced a single, unilateral left hemisphere stroke participated in the study. Seven of the individuals were diagnosed with agrammatic Broca's aphasia. Diagnosis of agrammatism was based on the BDAE (version 3; Goodglass, Kaplan, & Barresi, 2000). Comprehension deficits were defined as chance or below chance performance on comprehension of non-canonically ordered sentences (object relatives and passives) from the SOAP Test (Love & Oster, 2002).

To determine the time course of reactivation in sentences with unaccusative verbs we used an on-line cross-modal picture priming task in a within-subjects design (e.g. Love, 2007; Swinney

& Prather, 1989). The test items consisted of 32 experimental sentences that contained an unaccusative verb as in (2), presented over headphones at a normal rate of speech.

2. The queen with the bad temper vanished ^{*1} during ^{*2} the ^{*3} spectacul^{*4} ar fireworks show. Two visual probe pictures were chosen for each sentence: a related visual probe depicting the single argument (queen) and a control probe (surgeon) that was unrelated to any lexical item in the test sentence, but was the related probe in another experimental sentence. Thus over all sentences, the set of related probes was identical to the set of control probes, minimizing the possibility that any observed priming effects would be due to anything other than the factors of interest. Priming was measured by comparing response times to the related and control probes – faster response times to the related probes indicate a priming effect, thus activation of the lexical item. Participants were instructed to listen to the sentences for meaning while also making a binary (animate/inanimate; note that the experimental items all required an ‘animate’ response; filler items were included to balance the responses) decision to the visually presented probes.

RESULTS

Incorrect responses, reaction times below 300ms, above 2000ms and reaction times 2 standard deviations above and below the mean by subject and condition were excluded prior to analysis (4.8% of the data). The results for all participants (see Figure 1) indicated priming at position 2 only ($t(11)=2.20$, $p=.01$). Likewise, individuals with agrammatic Broca’s aphasia demonstrated the same pattern, with priming at position 2 only ($t(11)=2.20$, $p=.003$).

DISCUSSION

Persons with aphasia are able to take advantage of the inherent delay in reactivating the argument of unaccusatives, allowing for improved synchronization of lexical access and syntax. This improved synchronization results in similar patterns of lexical reactivation as neurologically healthy participants. These findings suggest that even in individuals with agrammatic aphasia with deficient comprehension of syntactic dependencies, they reactivate the displaced argument in sentences with unaccusative verbs. These findings are consistent with the Delayed Lexical Activation hypothesis, and suggest that the syntactic comprehension deficits that are a hallmark of Broca’s aphasia may reflect a de-synchronization of lexical and syntactic processes.

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Table 1

Participant	Group	Gender	BDAE Severity Level	Years Post Stroke	Age	Education	SOAP Canonical	SOAP Non-canonical
LHD009	Broca's	M	3	12	52	1 year of grad school	75%	55%
LHD101	Broca's	M	2	6	64	Ph.D.	95%	35%
LHD130	Broca's	M	4	5	60	4 years of college	75%	55%
LHD132	Broca's	M	4	8	50	4 years of college	85%	55%
LHD140	Broca's	F	2	13	38	4 years of college	80%	30%
LHD142	Broca's	M	3	3	75	8th grade	100%	65%
LHD159	Broca's	F	3	3	61	2 years of college	100%	70%
LHD017	Left CVA Control	M	4	15	63	4 years of college	100%	90%
LHD137	Left CVA Control	M	3	4	80	M.D.	90%	95%
LHD139	Left CVA Control	M	3	14	39	2 years of college	55%	70%
LHD145	Left CVA Control	M	1	10	57	4 years of college	50%	40%
LHD151	Left CVA Control	F	3	4	62	4 years of college	100%	85%

The queen with the bad temper vanished *1 during *2 the *3 spectacu*4 lar fireworks show.

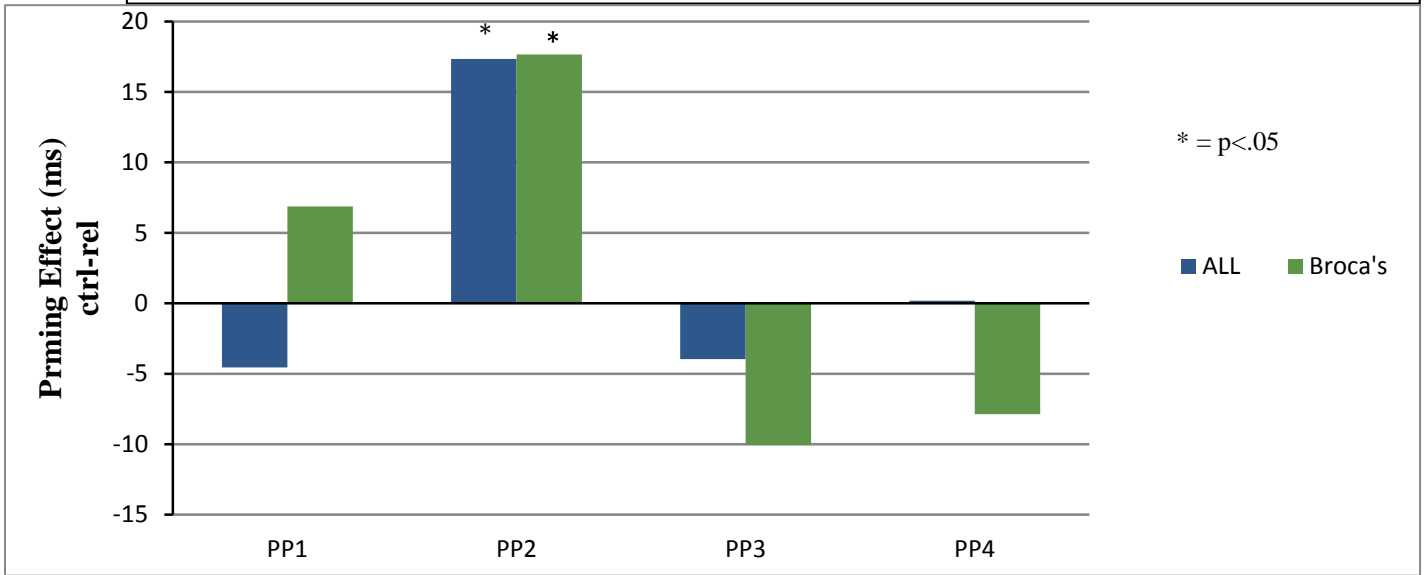


Figure 1. Priming effects (control-related difference; a positive difference indicates priming) for all participants and participants with Broca's aphasia.