Syntactic Priming in Sentence Comprehension

Introduction

The study of alignment in communication and underlying processes like priming has become an important aspect of linguistic research (Hartsuiker et al., 2008; Pickering & Garrod, 2004; Branigan, Pickering & Cleland, 2000). Many recent studies have focused on syntactic production priming in dialogue games (cf. Branigan et al., 2006). A large body of literature exists that demonstrates priming effects for different syntactic structures, i.e. one person is more likely to use a passive structure in a picture description following a passive phrase than following an active phrase produced by the conversation partner (Branigan et al., 2007).

These results are most relevant to research in aphasic language therapy. Hartsuiker and Kolk (1998) were able to show that agrammatic speakers who produced little syntactic structures (e.g. passive structures) produce more of these structures within the context of priming (cf. Kolk, 2001; Saffran & Martin, 1997). An interesting issue is the reaction of paragrammatic and healthy speakers. In fact, further studies were able to show that patients with different types of aphasia reacted differently to external primes (e.g. Hartsuiker et al., 2008; Blumstein et al., 1991). Although considerable research has been devoted to syntactic priming and alignment processes in language production, rather less attention has been paid to comprehension priming, especially in the population with aphasia. This study aims to examine if syntactic priming does enhance the accuracy and speed of language comprehension of passive sentences in non-brain-injured people (NBI) and patients with aphasia (APH).

Participants

Fourteen non-brain-injured subjects (NBI) and eight patients with aphasia (APH) participated in the study. All study participants are monolingual native speakers of German. Exclusions were based on medically documented evidence of bilateral, cerebellar, or brainstem lesions; chronic depression; deteriorating conditions such as Alzheimer's or Parkinson's disease; or substance abuse. Participants did not exhibit any serious cognitive or motor-speech problem. Severity of aphasia ranged from residual to moderate. The groups did not differ in age or level of education (Mann-Whitney-U = 49.5; Z = -.444; p = .664; see Table 1).

Stimuli

Twenty experimental items were constructed, each consisting of a target sentence and two line drawings. Every item is complemented by a prime also including a sentence with two pictures. Each picture, showing several human or animal agents, interacting in different situations, can be described with an active or a passive sentence. The experimental priming paradigm contrasts ten items with a syntactic prime and ten items with no prime, i.e. a baseline.

Priming condition:
Stimulus sentence: Das Kind wird von der Mutter geweckt. (The child is wakened up by the mother).
1. Picture (correct): mother_wakes up_child
2. Picture (distractor): mother_bandages_child
(See Figure 1)

Thus, the participants are directed to the (correct) passive interpretation of the sentence. In consequence, the comprehension functions as a prime for the next stimulus. The syntactic prime is, in fact, the understanding of the passive sentence structure enhanced by the different nominal agents. In the baseline condition the stimulus is an active sentence with two pictures.

Target:

Target sentence: Die Frau wird von dem Jungen gemalt. (The woman is painted by the boy).
1. Picture (correct): boy_paints_woman
2. Picture (distractor): woman_paints_boy
(See Figure 2)

The participants are asked to listen and read the stimulus sentence and to choose the corresponding picture as fast as possible. Accuracy and response time are analyzed with non-parametric statistics (Mann & Whitney U-test, Wilcoxon Test).

Results
Table 2 shows the empirical means, range and standard deviation for the two participant groups. Overall, NBI performed considerably better than APH. With a mean reaction time (RT) of 3065.92 ms, NBI are significantly faster to choose the correct picture than APH ($U = 5.00$; $Z = -3.481$; $p \leq .000$). Yet, they do not show a higher percentage of correct responses (NBI: 86,43% vs. APH: 85,0%; $U = 48.5$; $Z = -.535$; $p = .616$).

By comparing the two experimental conditions, we detect that participants of both groups tend to react faster to the stimuli in the baseline condition than in the priming condition (APH: baseline condition = 5932.84 ms vs. priming condition = 6912.81 ms; $Z = -1.680$; $p = .093$; NBI: baseline condition = 2990.06 ms vs. priming condition = 3141.79 ms; $Z = -1.789$; $p = .074$). For both groups, we do not find any effect of conditions on the accuracy of responses (APH: $Z = -.604$; $p = .546$; NBI: $Z = -1.027$; $p = .305$).

Discussion
The main purpose of this study is to examine the process of syntactic priming in aphasic language comprehension. Not surprisingly, we found significant group differences between NBI and APH in reaction time. With a high mean accuracy score of 85% for the patient group, we assume that the task is adequately chosen for NBI and people with mild to moderate aphasia.

More interesting is the fact that in both groups the baseline condition seems to be easier to respond. While there is no significant difference between conditions in the percentage of correct responses, the participants take more time to choose the correct picture when they are syntactically primed. Therefore, we assume some kind of *negative syntactic priming* that inhibits the cognitive capacity of syntactic information processing for some time after the prime.

Small sample size is the major limitation of this study. Therefore, we are going to test more participants in the next months with a second set of items. Another item list is necessary to control for item effects, i.e. items that are now tested in the priming condition, will then be assessed in the baseline condition. Further studies with large patient groups are essential to evaluate the interesting tendency of negative priming and related timing questions.

The long-term goal of subsequent research is the development and validation of linguistic material for speech-language therapy in the context of aphasic language impairments concerning syntax. Based on the assumption that syntactic utterances enable not only the priming of identical structures but also the priming of similar structures (Bock et al., 2007; Branigan et al., 2006), the further studies' results could lead to a promising therapeutic approach with a specific focus on the distinct patterns of impairments of different aphasic syndromes.

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TABLE 1: Basic demographic data

	APH	NBI
N	8	14
Gender		
Male	3 (37.5%)	6 (42.8%)
Female	5 (62.5%)	8 (57.2%)
Age (years)		
Median / Average	47.28	51
SD	14.8	14.5
Range	24-65	24-74
Education level (years)		
Median / Average	15.81	15.75
SD	3.79	2.5
Range	12-21.5	12-20
Time post-onset (months)		
Median / Average	52.18	--
SD	69.7	--
Range	2.5- 192	--

FIGURE 1: Prime stimulus

FIGURE 2: Target stimulus

TABLE 2: Descriptive statistics

	APH	NBI
N	8	14
Reaction time (ms)		
Mean	6422.82	3065.92
SD	3219.85	378.97
Min	3240.05	2415.85
Max	13391.40	3647.90
% Accuracy		
Mean	85.00	86.42
SD	10.69	8.64
Min	60.00	70.00
Max	95.00	95.00
Baseline condition RT (ms)		
Mean	5932.84	2990.06
SD	2651.81	347.10
Min	3139.00	2377.00
Max	11480.00	3623.00
Prime condition RT (ms)		
Mean	6912.81	3141.79
SD	3826.46	445.70
Min	3341.00	2399.00
Max	15303.00	3941.00
Baseline condition % ACC		
Mean	82.50	87.85
SD	19.08	11.21
Min	40.00	60.00
Max	100.00	100.00
Priming condition % ACC		
Mean	87.50	85.00
SD	7.07	8.54
Min	80.00	70.00
Max	100.00	100.00