Research proposal

Rationale

Model based intervention studies show a lack of generalisation from training verbs in isolation to sentence production (e.g., Mitchum & Berndt, 1994; Jain, Horner & Maclagan, 2003). In contrast, other studies found increased grammatical sentence production for all participants with improved verb retrieval (Raymer & Ellsworth, 2002; Schneider & Thompson, 2003).

The Grammatical encoding model (GEM) is a consolidated summary of models of sentence production (Garrett, 1984; Bock & Levelt, 1994 and Levelt, Roelefs & Meyer,1999) (see Fig. 1). To test GEM, Jain et al. (2003) trained verbs and nouns at three different levels in six individuals with aphasia. The targeted levels were the functional level, positional level and the final representation of the positional level of GEM. The three modules of intervention that corresponded to these levels were the word module, affix module and the sentence module. According to GEM, verbs in isolation activate the argument structure of the verb that should improve sentence production. However, none of the participants showed generalisation from intervention at the word module to retrieval of argument structure at the sentence level (Jain et al., 2003). The lack of generalisation from verb retrieval to sentence production was inconsistent with the predictions of GEM.

Mitchum & Berndt (1994) found that facilitation of verb production (repeated naming) did not generalise to sentence production. Three possible explanations are available for this lack of generalisation from verb retrieval to sentence production. Firstly, differences in the processes used to produce a verb in isolation and those used to produce a sentence may account for the lack of generalisation (Mitchum and Berndt, 1994). Secondly, according to GEM, activation of the verb lemma might not activate the argument structure (i.e. the grammatical structure of a verb in terms of the clause elements required) for that particular verb in individuals with aphasia. This suggestion receives support from Thompson, Lange, Schneider & Shapiro (1997a), who found that it was easier for patients with agrammatism to produce verbs that had obligatory arguments than verbs with optional arguments. In addition, Kim and Thompson (2000) found that in patients with agrammatism, difficulty retrieving the verb and arguments increased with an increase in the number of arguments. Finally, the lemma of a verb might activate the argument structure. However, individuals with aphasia might be unable to retrieve the word forms of those verb arguments. This possibility does not hold true for individuals with good verb and noun retrieval abilities.

The aim of the study was to determine if the availability of verb arguments would facilitate sentence production. The rationale for targeting verb arguments was the lack of clarity of the process of activation of a verb lemma. To do this, changes in sentence production in response to the presence of the verb and the verb arguments were analysed in participants with aphasia.

Research question

If a participant is presented with the verb and its arguments, will the participant be able to produce a subject-verb-object (SVO) or subject-verb-direct object-indirect object (SVOO) sentence structure depending upon whether the verb is a two-place (e.g. *the woman grated the carrot*) or a three-place verb (e.g. *the man gave a bottle of wine to the woman*)?

Purpose

The purpose of the study was to evaluate the effectiveness of an experimental intervention focusing on verbs and arguments of those verbs on sentence production in individuals with aphasia.

Based on GEM, we predicted that providing the arguments of a particular verb should result in an improved structure for the sentence. This improvement in sentence structure will be evident as an increase in the number of sentences produced using verbs with the appropriate arguments.

Method

Participants

Four participants with chronic aphasia with good comprehension but difficulty producing SVO sentences were included in this study. The time post onset stroke ranged from 17 months to 24 months for these participants. Table 1 describes the personal characteristics of the participants.

Procedures

A pre-intervention battery was administered to the participants to determine their language characteristics prior to intervention. The pre-intervention test battery consisted of the Short form of the Boston Diagnostic Aphasia Examination (Goodglass, Kaplan and Barresi, 2001), the North Western University Verb Production Battery (Thompson, Lange, Schneider and Shapiro, 1997b), the North Western University Sentence Comprehension Test for Aphasia (Thompson, Ballard and Tait, 1995), and subtests from the Psycholinguistic Assessments of Language Processing in Aphasia (PALPA) (Kay, Lesser and Coltheart, 1992). The participants' responses to the pre-intervention battery are shown in Table 2.

A single subject experimental design (Kazdin, 1982) was used. The intervention involved providing participants with the verbs and their arguments (i.e., facilitation) to activate the functional level of GEM. Provision of the target sentence followed provision of the verb arguments. Each participant repeated the sentence twice, thus activating the positional level. The responses of the participants were noted at two different points: after the presentation of the verb arguments and after the presentation of the entire intervention (arguments + sentence). The responses of the participants were analysed in terms of the number of sentences produced and the number and type of clause elements produced. A set of untrained stimuli was probed every session. A spontaneous speech sample was obtained before and after the intervention. The participants were probed for maintenance of intervention gains one week after termination of the intervention. At this time, the pre-intervention battery was re-administered.

Results and analysis

Data were analysed both visually and statistically. Statistical analysis consisted of a celeration line and binomial test (Portney & Watkins, 2000).

Results of the intervention for all participants are displayed in Figures 2, 3, 4 and 5. Figures 2, 4 and 5 show an increase in sentence production for P1, P3 and P4. P2 did not show any change (see Fig. 3). In terms of clause elements, P3 showed an increase in the

production of verbs and direct objects. P4 showed an increase in the production of subjects, verbs and direct objects. The improvement for P3 and P4 was statistically significant ($p<.05$).

Conclusions

The present study shows that information about verbs and verb arguments is crucial for sentence production but may not be sufficient for patients with aphasia to produce sentences. The present study shows that provision of verb arguments benefits individuals with impaired lexeme retrieval.

Clinical implications

The present study indicated that information about verbs and verb arguments is important for sentence production but the mere presentation of this information (e.g., without explanation of roles) may not be enough to result in a permanent improvement in sentence production. This study suggests additional research focusing on specification of roles of verb arguments in a particular sentence is necessary.

Tables and figures

Table 1. Personal characteristics of the four participants of Study 1A.

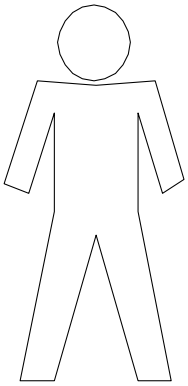
Participant number	Age	Sex	Education	Etiology	Months post onset
P1	77	F	Registered nurse	Left MCA infarct	24 months
P2	71	F	Primary school	Left parietal lobe infarct	24 months
P3	77	F	High school	Left CVA	17 months
P4	75	M	Primary school	Left CVA	22 months

Table 2. Language test data for the four participants. Scores for BDAE are in percentiles. For Verb Production Battery, sentence comprehension test and PALPA subtests, the scores presented are raw scores.

Test	P 1	P2	P 3	P4
Short form of the Boston Diagnostic Aphasia Examination (BDAE)				
Fluency	20	20	30	50
Conversational Speech	50	50	100	60
Auditory Comprehension	50	35	50	60
Repetition	60	35	30	20
Naming	70	15	50	40
Verb Production Battery				
Verb production (27)	17	7	23	4
Verb comprehension (27)	26	25	27	27
Sentence production				
X (33, subject)	6	24	7	15
Y (23, direct object)	7	7	16	6
Z (8, indirect object	2	0	1	0
V (33, verb)	27	19	33	23
PALPA (Subtest 47 and 53)				
Spoken word-picture matching (40)	33	34	40	39
Spoken picture naming (40)	37	12	19	21
Sentence comprehension				
A (20, active)	10	13	12	10
P (20, passive)	13	5	12	12
SR (20, subject relative)	15	7	14	10
OR (20, object relative)	10	11	11	10

Figure 1 The grammatical encoding model (GEM) of sentence production Garrett (1984), Bock & Levelt (1994), Levelt (1999)

Person looks at the picture



Person

MESSAGE LEVEL

Intention

The woman is grating a carrot .

FUNCTIONAL LEVEL

Lexical Selection(Lemma)
Function Assignment

woman grate carrot

Grate – Verb (action)
Woman – Subject (agent)
Carrot – Object (theme)

POSITIONAL LEVEL

Lexical Retrieval(Lexeme)
Affix Retrieval
Word Order

woman grate carrot

the ___ is __ing a __ .

the woman is grating a carrot

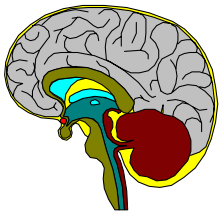
PHONETIC LEVEL

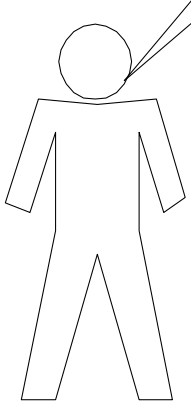
Phonetic Encoding

the woman is grating a carrot

ARTICULATORY LEVEL

Motor Encoding





Person

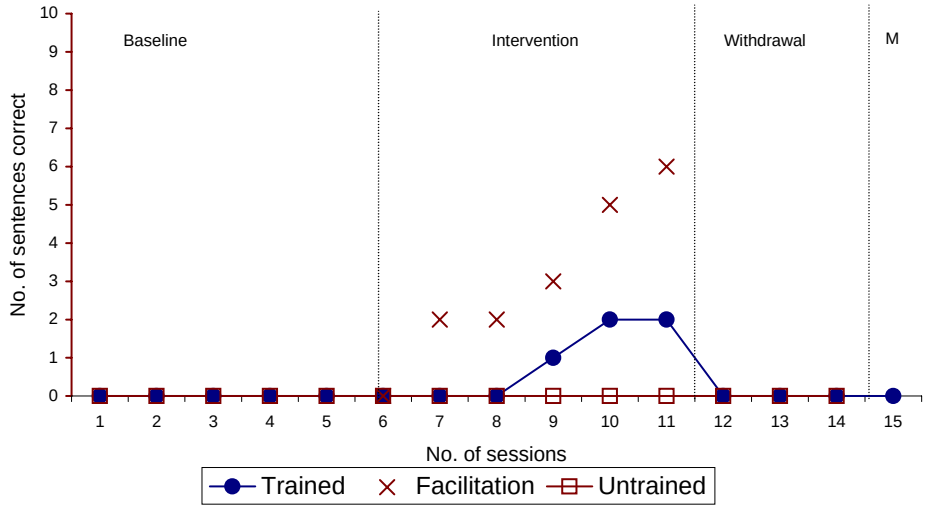


Figure 2. P1: Session-by-session data record for trained and untrained verb sentences. This figure shows a change in the production of trained sentences as a result of facilitation and as a result of the complete intervention.

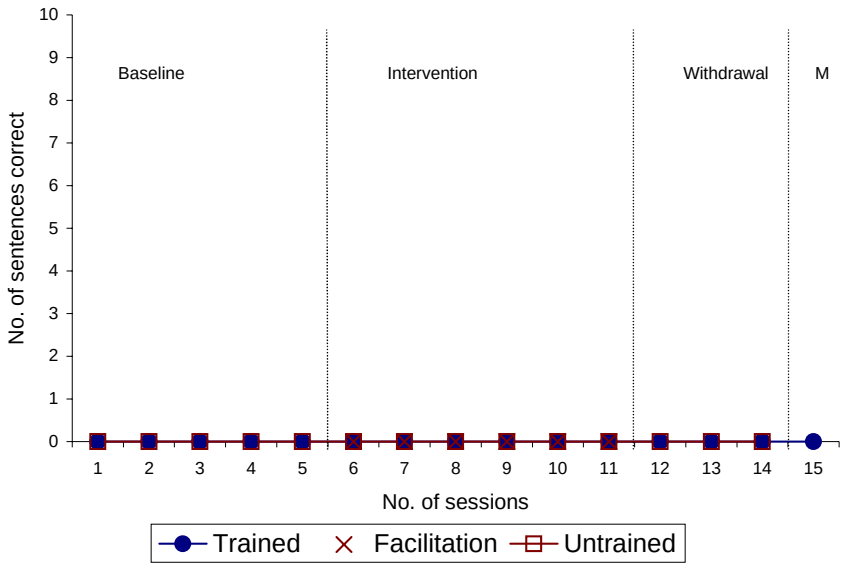


Figure 3. P2: Session-by-session data record for trained and untrained verb sentences. This figure shows no change in the production of trained sentences as a result of facilitation and as a result of the complete intervention.

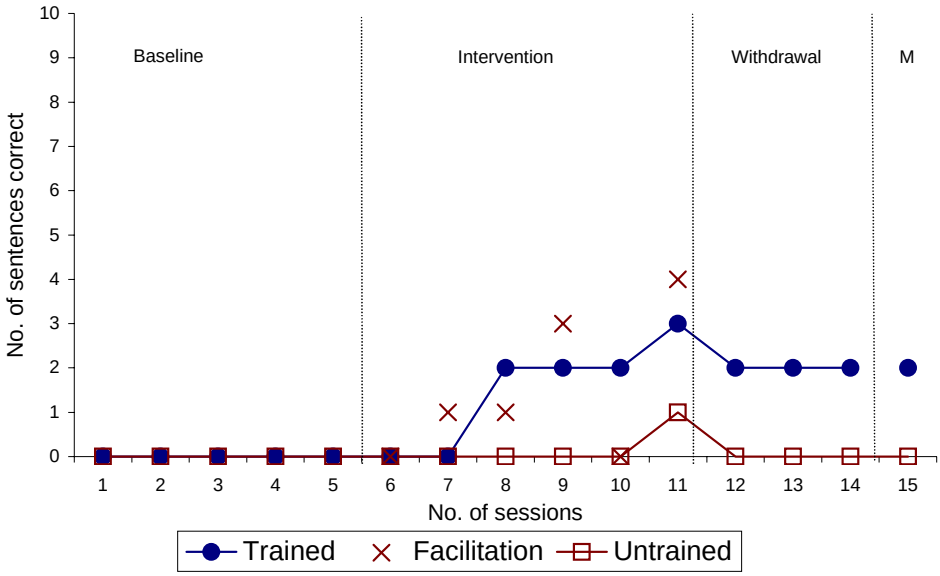


Figure 4. P3: Session-by-session data record for trained and untrained verb sentences. This figure shows a change in the production of trained sentences as a result of facilitation and as a result of the complete intervention.

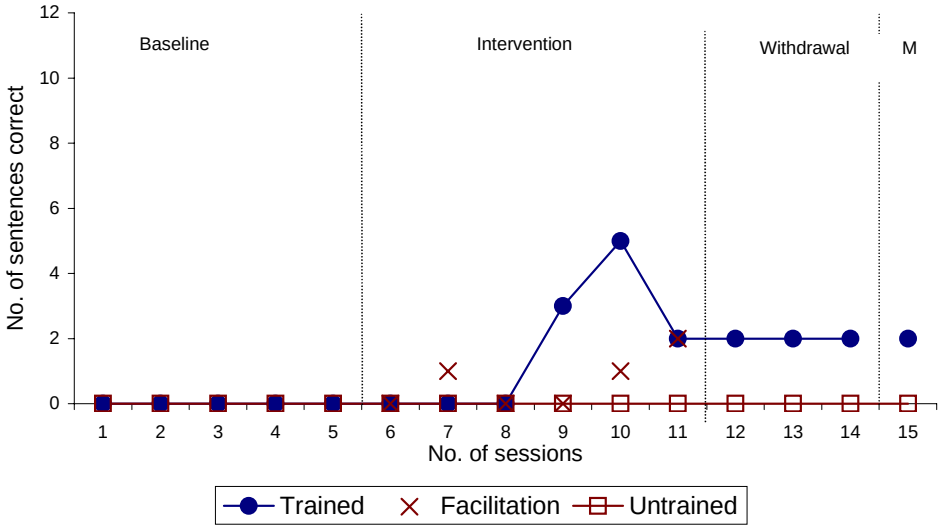


Figure 5. P4: Session-by-session data record for trained and untrained verb sentences. This figure shows a change in the production of trained sentences as a result of facilitation and as a result of the complete intervention.

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