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A comparison of word versus sentence cues as therapy for verb naming in aphasia

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Background: Improving verb naming in people with aphasia should enable expression of a wider range of sentence types and meanings, and may have wider benefits for connected speech. Establishing the optimal therapy methods for improving verb naming is, therefore, of substantial clinical importance.

Aims: This study investigated whether cueing sentence production would improve verb-naming accuracy to a greater extent than the more typical, single-word verb-cueing therapies. A second aim was to examine the extent to which verb picture naming improvements would generalise to naming of the *same* items in dynamic videos.

Methods & Procedures: Seven participants with chronic aphasia including word retrieval impairment took part in a case-series study. Decreasing cues were used to devise two therapies to improve verb naming: word cue therapy and sentence cue therapy. A total of 60 verbs that had not been named accurately in baseline testing on three presentations were collated for each participant. These were split into three sets of 20 verbs: set A was used in word cue therapy, set B in sentence cue therapy, and set C served as control items undergoing no therapy. The sets were matched for significant psycholinguistic variables such as word frequency, imageability, length, and number of noun arguments. Therapy consisted of 10 sessions over 5 weeks. Post-therapy assessments consisted of an immediate naming assessment (1 week following therapy) and a follow-up assessment 5 weeks later. Naming of the target verbs in set A for each participant was also assessed using a dynamic video presentation.

Outcomes & Results: Both therapies resulted in highly significant gains in naming accuracy for treated verbs with little, if any, carry-over to untreated verbs. There were no significant differences between the therapies for individual participants. At the group level there was a significantly greater benefit for word cue over sentence cue therapy at the follow-up naming assessment. The gains in verb naming post therapy generalised from the static depictions used in therapy to naming of the same items in the dynamic video presentation format.

Conclusions: Both word and sentence cue therapy for verb naming were effective in improving naming accuracy. Gains from word cue therapy can generalise to naming of very different exemplars of the same verb targets. Word cue therapy resulted in significantly greater gains than sentence cues at the level of the group, but the difference was not substantial enough to be significant at the individual participant level. Generalisation, as an effect following intervention, can be examined in terms of naming different exemplars of a word, as well as its more typical meaning of generalisation from treated to untreated items in therapy.

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Keywords: Verbs; Naming; Aphasia; Word cues; Sentence cues; Generalisation.

Verb-naming therapies have tended to have the circumscribed aim of increasing verb-naming accuracy. In contrast, sentence production therapies have targeted verb naming as well as retrieval of the verb's noun arguments in grammatically correct syntactic frames with the greater aim of improving connected speech. Despite studies of each type in the literature, the two types of intervention have never been directly compared before. Improved verb access is crucial for connected speech, and increasing verb naming in people with aphasia should enable expression of a wider range of sentence types and meanings. Establishing the optimal therapy methods for improving verb naming is, therefore, of substantial clinical importance and was the subject of this study.

Verb therapies have typically been based on attempts to compare verb- against noun-naming therapies (Pashek, 1998; Wambaugh, Doyle, Martinez, & Kalinyak-Fliszar, 2002; Wambaugh et al., 2001). Often, cueing strategies devised for noun therapies have been applied to verb therapies. These methods may well have under-recognised the psycholinguistic differences between nouns and verbs: verbs tend to be more complex and demanding along a number of different continua including semantic, syntactic, morphological, and phonological dimensions. As a consequence, additional support or approaches to verb therapy might be required.

Previous comparisons between noun- and verb-naming studies have provided different accounts as to whether nouns and verbs, despite their psycholinguistic differences, respond in similar ways to single-word cueing therapies. Raymer et al. (2007) found comparable gains in noun and verb naming in eight participants with aphasia. In similar studies that directly compared noun and verb naming after therapy, Conroy et al. (Conroy, Sage, & Lambon Ralph, in press-a, in press-b) found poorer verb naming post-therapy in participants with more severe naming impairments. These results suggested that improving verb relative to noun naming may be intrinsically harder to achieve in therapy for some participants. These points underline the need to find methods to optimise accuracy and lasting gains in verb naming and such methods may differ from those that have been effective for nouns.

Single-word cueing therapies for nouns may have arisen in part because nouns, at least in Romance and Germanic languages, are relatively free of influence from grammatical analysis such as morphology and syntax (Bak & Hodges, 2003). In contrast, verbs are enmeshed in these levels of language even when attempting to treat verbs as single words only. For example, single-word naming of verbs in English is often marked for aspect, as in the present continuous “-ing” form. Similarly, it can be difficult to separate verb naming from syntactic levels of linguistic processing. In order to elicit the required verb when depicting actions in assessment or therapy stimuli, noun arguments have to be included (the “ball” needs to be present if “bouncing” is the verb to be named). By showing all the aspects involved in an event, state, or action (all of which are conveyed by verbs) comprehension of the verb itself is aided. For example, the agent/initiator of an action (e.g., a boy kicking) or the patient/the entity that has undergone the action (e.g., the ball being kicked by the boy) are required parts of the visual presentation of the action in order to elicit the verb “kicking” reliably. This contrasts with object pictures where, typically, the object is depicted alone or alongside another object in order to convey scale. Recently, more assessments examining verb or action naming

have been published such as the Object Action Naming Battery (Druks & Masterson, 2000) and the Verb and Sentence Test (Bastiaanse, Edwards, Maas, & Rispens, 2003) to enable comparisons of noun and verb naming in aphasia. However, it can be difficult to elicit single-word responses to action pictures. It is often necessary to instruct participants that only one word is required and there can be a sense in which this is artificial. Even then, participants will often attempt sentence production.

Models of sentence production ascribe a pivotal role to the verb—see Thompson and Faroqi-Shah (2002) for a review. Garrett's model (1980), for instance, proposes a functional level of sentence production in which lexical selection specifies the verb and its thematic roles (agent, patient, goal). This is at an earlier stage in the sentence production process than assignment of syntactic frames and phonological encoding; the verb and its thematic roles constitute a semantic relationship between the elements involved in the event or state being conveyed by the verb.

This relationship has been utilised in a number of therapy studies. A distinct group of studies has targeted improved sentence production through focus on verbs and their argument structures (Fink, Martin, Schwartz, Saffran, & Myers, 1992; Murray & Karcher, 2000; Schneider & Thompson, 2003; Webster, Morris, & Franklin, 2005). These differed from simple verb naming in that they trained production of verbs and key nouns in sentences. More recently, Webster and Gordon (2007) improved verb naming and sentence production via a nonverbal noun–verb association task, in which the participant with aphasia chose pictures of the nouns associated in meaning with the target verb.

Aside from the semantic relationships between a verb and its arguments, use of sentence cues to target verb naming might also have the benefit of harnessing morphological and syntactic levels of linguistic processing. In reviewing the aphasia literature Conroy, Sage, and Lambon Ralph (2006) noted that there was some evidence to suggest that using more intact levels of linguistic processing can facilitate specific therapy targets such as verb naming. Weinrich, Shelton, Cox, and McCall (1997), for example, found that therapy requiring practice of tense markers in computer-based therapy resulted in gains in both production of tense morphology and verb retrieval. This principle has been used in therapy studies; for example, Marshall, Chiat, and Pring (1997) and arguably all “mapping therapies” (Marshall, 1995) utilise their participants' intact syntactic skills to home in on more impaired thematic role knowledge.

One possible drawback of attempting to improve verb naming through picture naming using single-word cueing could be that the relationship between the verb and its noun arguments is not well elaborated for participants with aphasia during therapy, and this may reduce the semantic processing that is prompted by the therapy task. So, for example, explaining to a participant with aphasia that a certain picture represents the target verb “bouncing” as opposed to “a boy is bouncing a ball” may require a level of abstract processing of lexical information that may be difficult for some individuals with aphasia. This difficulty is reflected in the use of arrows in some static picture assessments of verb naming in order to highlight the relationship between the participants in an action. For example, in the Object Action Naming Battery (OANB; Druks & Masterson, 2000), an arrow points to the person “begging” in order to highlight that this person is central to the action, as opposed to the person passing by who is not centrally involved in the action. In contrast, in the VAN test (Webster & Bird, 2000) the depiction of the action “begging” in a dynamic video format is more transparent. This dynamic depiction is also thought to demand

less executive-attentional resources in naming (D'Honincthun & Pillon, 2005). For some people with aphasia, there may be specific difficulties in decoding static action pictures because of this extra processing load. This may particularly be the case where participants have co-occurring deficits in cognitive domains such as executive dysfunction, which have been proposed in recent studies as being central to "semantic control", in other words, having stable mechanisms that shape or control online activation of semantic information such that the most task-relevant aspects are brought to the fore and irrelevant features are inhibited (Jefferies & Lambon Ralph, 2006; Jefferies et al., 2007). According to this view, some aphasic participants with multi-modal semantic processing deficits may have intact semantic representations but score poorly on semantic tasks because of a difficulty shaping their semantic activation to fit the requirements of the task or activity at hand. In support of this hypothesis, Jefferies et al. were able to show that these participants were able to carry out semantic tasks when the task requirements were less complex or when external constraint/focus was provided by the examiner. This group of participants with aphasia also showed difficulties with tests of divided and sustained attention (e.g., Test of Everyday Attention) and those demanding high executive control (Wisconsin Card Sorting Test)—suggesting more generalised, weakened "cognitive control" as a part of their clinical presentation.

The present study also licensed an investigation of a second issue—the ability of participants with aphasia to generalise improvements in naming from the therapy materials to other examples of the same target items. Generalisation, as a concept in the therapy literature, has typically been used in reference to improved naming of treated items leading to some improvement in naming of untreated items (Nickels, 2002). However, generalisation can also refer to the ability to use treated items in speech contexts other than that in which items were trained, e.g., improving in picture-naming therapy and then using trained items in conversation or in a narrative sample (Conroy, Sage, & Lambon Ralph, in press-c). Clearly, this latter form of generalisation, i.e., the ability to generalise the *use* of a specific verb, is a crucial requirement for effective therapy. One test of naming generalisation would be to examine verb naming across different forms of stimulus presentation such as static picture depiction versus dynamic video depiction, e.g., the Verb and Noun Test (Webster & Bird, 2000).

These points from the aphasiology literature led us to specify the following aims in the present study. First, we directly compared therapy cues consisting of either single words (verbs) or sentence cues containing the target verb. By definition these sentence cues contained not only the surface form of the target verb but also displayed their noun arguments within a grammatically correct syntactic frame. Although both word and sentence cues have been used before in the aphasia therapy literature, no study has compared them directly against each other. Considering the factors reviewed above on the potential benefit or need for elaborated therapy for verbs, we predicted that sentence cues would result in greater improvements in naming accuracy. Second, we sought to establish whether improvements in naming obtained specifically through single-word cues would generalise to the same items in markedly different depictions. Clearly, establishing the extent to which sentence cueing therapy generalises to different exemplars or presentation formats would also be a clinically interesting question. However, given the limited availability of standardised materials in dynamic video format, we were limited to examining generalisation from the single-word verb cueing therapy in the present study.

METHOD

Participants

Seven participants with chronic aphasia including word retrieval impairment took part in a case-series study. These participants had previously taken part in a case-series study comparing pure errorless naming therapy against errorful therapy for verb and noun naming in aphasia (Conroy et al., in press-b). Participants varied in their aphasia symptoms, severity, and time since CVA. All were monolingual English speakers. Participants were recruited from NHS Speech and Language Therapy services within Shropshire, England. Inclusion criteria were devised to ensure the word and sentence cue therapies would be viable and also to eliminate the likelihood of spontaneous recovery. Participants had to be at least 6 months post CVA, with no other history of significant neurological illness such as dementia or multiple sclerosis. Normal or corrected hearing and vision were required. With regard to language skills, two factors were considered: degree of (noun and verb) naming impairment, and word and sentence repetition skills. For the former, noun and verb picture items were taken from the Object and Action Naming Battery (Druks & Masterson, 2000). These were 20 nouns and 20 verbs, with each set matched for significant variables including frequency, imageability, and visual complexity. Participants were required to achieve a score between a minimum of 10% (4/40) and a maximum of 90% (36/40). On the word repetition task, which consisted of the first 20 items in PALPA 9 (Kay, Lesser, & Coltheart, 1992), participants were required to score at least 75% correct. This was in order to ensure that the word cue therapy, which required reliable word repetition skills, would be viable for all participants. Similarly, participants were required to achieve 75% accurate repetition of 20 sentences based on actions in the Object Action Naming Battery. This was in order to ensure that the sentence cue therapy, which required reliable sentence repetition skills, would be viable for all participants.

Table 1 shows participants' age, gender, handedness, number of years' education, occupation, and months since CVA. Table 1 also contains baseline naming scores, first in the Boston Naming Test, used here as a broad indicator of degree of anomia, and also in the set of matched nouns and verbs. There were no significant differences for any one participant on their relative noun/verb naming on these matched sets. Table 1 also contains a description of the participants' aphasic symptoms, which were derived by using a combination of clinical analysis of their connected speech, their comprehension of spoken speech, and their ability to repeat words. Baseline noun-naming scores obtained in the BNT showed a range of naming ability on a continuum from severe impairment to moderate and mild impairment.

Background assessment

In order to have a full picture of the cognitive and language skills of each participant within the case-series, we asked the participants to complete a comprehensive set of linguistic and cognitive assessments. Such detailed investigations can be helpful when exploring differences in performance between participants. An explanation for such differences is impossible where insufficient background testing has been completed (Shallice, 1988). The results of the assessments are shown in Tables 2 and 3, respectively.

TABLE 1
Participant profiles including naming scores and error types and description of aphasic symptoms

<i>Participant</i>		<i>KP</i>	<i>PM</i>	<i>BM</i>	<i>PO</i>	<i>JT</i>	<i>IH</i>	<i>WE</i>
Age		77	43	73	61	85	62	66
Gender		female	female	male	male	female	female	female
Handedness		right	right	right	right	right	right	right
Number of years education		10	13	13	13	16	12	16
Occupation		Administrator	Secretary	Farmer	Business Manager	Teacher	Housewife	Teacher
Months since CVA		59	55	26	16	19	20	65
Baseline naming of matched noun verb sets (20 N, 20 V)		V = 3 N = 1	V = 3 N = 2	V = 8 N = 9	V = 10 N = 8	V = 12 N = 8	V = 14 N = 14	V = 16 N = 12
Baseline naming score (BNT: max = 60)		0	3	23	24	28	29	40
Error type on BNT	Semantic	0	4	13	2	12	4	8
	Phonological	0	6	0	2	4	0	0
	No response	60	43	24	31	13	27	10
	Unrelated	0	0	0	0	0	0	2
Description of aphasia		Fluent anomic	Non fluent	Fluent anomic	Fluent jargon	Non fluent	Non fluent	Agrammatic

BNT = Boston Naming Test (Goodglass, Kaplan, & Barresi, 2001). Error codes: Semantic = semantic relationship to target; Phonological = more than 50% shared phonology with target; No response; Unrelated = no relationship to target.

TABLE 2
Results of language assessments across participants

Assessments	Max	Participants							Normal range
		KP	PM	BM	PO	JT	IH	WE	
<i>Naming</i>									
Objects (OANB)	162	15	25	103	96	96	125	125	n/a
% correct		9%	15%	64%	59%	59%	77%	77%	
Actions (OANB)	100	6	7	60	29	36	36	59	n/a
<i>Phonology</i>									
Word Reading	80	28	9	<u>79</u>	63	46	71	77	79–80
Nonword Reading	24	1	0	<u>12</u>	3	0	13	22	n/a
Word Repetition	80	55	<u>79</u>	<u>80</u>	<u>78</u>	74	76	<u>80</u>	78–80
Nonword Repetition	80	34	69	70	<u>58</u>	48	56	72	n/a
<i>Semantics</i>									
P & P	52	42	39	42	47	40	<u>52</u>	46	49–52
K & D	52	44	47	39	47	37	<u>51</u>	41	48–52
Syn Judgement	96	73	11	66	67	65	90	73	91–96
N V Comp	100	90	72	88	90	77	100	95	100
SWPM	40	<u>39</u>	26	<u>36</u>	<u>40</u>	<u>37</u>	<u>40</u>	<u>38</u>	35–40
WWPM	40	<u>37</u>	23	<u>37</u>	<u>40</u>	26	<u>40</u>	<u>40</u>	35–40

OANB = Object Action Naming Battery; all phonology subtests taken from PALPA; P & P = Pyramids and Palm Trees Test; K & D = Kissing & Dancing Test; Syn Judgement = Synonym Judgement Test; N V Comp = Noun Verb Comprehension Test; SWPM = Spoken Word to Picture Matching; WWPM = Written Word to Picture Matching; n/a = not available; underlined and emboldened scores were within the normal range.

Assessment of participants' language skills focused on single-word processing skills in the domains of naming, phonology, and semantics.

Naming: the Object Action Naming Battery (Druks & Masterson, 2000) was used as a measure of verb and noun retrieval.

Phonology: Word and non-word reading and repetition tasks from the PALPA test battery (Kay et al., 1992) were used to assess the integrity of participants' phonological representations:

- Imageability by frequency word reading (PALPA 31).
- Non-word reading (PALPA 36).
- Auditory word repetition: Imageability by frequency (PALPA 9).
- Auditory non-word repetition (PALPA 9).

Semantic memory and comprehension of nouns and verbs.

- The three-picture version of the Pyramids and Palm Trees Test (Howard & Patterson, 1992). This test required participants to match pictures on the basis of semantic relatedness; e.g., for a *pyramid*, the participant should select a *palm tree* and not a *fir tree*.
- The three-picture version of The Kissing and Dancing Test (Bak & Hodges, 2003). This test resembles the Pyramids and Palm Trees Test in its format but uses action instead of object pictures. The participant is required to match actions on the basis of semantic similarity; e.g., for *kissing*, the participant should select *dancing* and not *running*.

TABLE 3
Results of cognitive assessments across participants

Assessments		Max	Participants						
			KP	PM	BM	PO	JT	IH	WE
CMT (pictures)	Score	30	25	28	26	30	26	28	29
	%tile		4.7	13	7.1	100	7.1	15.7	37.8
CMT (words)	Score	25	13	21	17	19	17	<u>25</u>	20
	%tile		<2.8	1.9	2.8–11.1	3.1–6.3	2.8–11.1	100	6.3
Rey Copy	Score	36	23	26	30	34	18	<u>35</u>	28
	%tile		<1	<1	>16	>16	<1	>16	2–5
Rey Imm Recall	Score	36	3	5	8	11	6	<u>22</u>	7
	%tile		1	<1	12	12	24	86	4
Rey Delayed Recall	Score	36	6	7	5	11	4	<u>22</u>	7
	%tile		4	<1	2	10	8	88	3
WCST: no of categories	Score	6	2	1	1	5	0	<u>2</u>	3
	%tile		>16	2–5	6–10	>16	11–16	6–10	>16
WCST: items to 1st cat	Score	0	<u>21</u>	27	28	14	94	28	<u>20</u>
	%tile		>16	2–5	1	11–16	>16	6–10	6–10
TEA: elevator counting	Score	7	<u>7</u>	4	4	5	<u>4</u>	5	7
TEA: elevator counting distractions	Score	10	2	0	3	7	3	1	2
	%tile		5	1	5–10	10–25	5–10	1	5
Self assessment of naming	%	100	100	90	82	66	80	100	100

CMT = Camden Memory Test; Rey Copy = Rey Complex Figure Test – Copy subtest; Rey Imm Recall = Rey Complex Figure Test – Immediate Recall subtest; Rey Delayed Recall = Rey Complex Figure Test – Delayed Recall subtest; WCST = Wisconsin Card Sorting Test; TEA = Test of Everyday Attention. Underlined and emboldened scores were within the normal range.

- (c) A synonym judgement test (Jefferies et al., 2007) was used to detect milder forms of semantic impairment. This test required participants to match words (presented in written and spoken form) on the basis of semantic relatedness; e.g., for *rogue*, the participant should select *scoundrel*, and not *polka* or *gasket*. Probe, target, and foils within each trial are matched for frequency and imageability, and these factors are varied across trials to produce an orthogonal manipulation of the two variables (high vs low frequency; low, medium, and high imageability).
- (d) The Noun Verb Comprehension Test is an adapted version of a comprehension test supplementary to the Object Action Naming Battery (Druks & Masterson, 2000). This spoken word-to-picture matching test contains 50 noun and 50 verb targets. Target items are presented alongside four semantic-related and one unrelated pictures (e.g., UMBRELLA: *raining, roof, hat, bucket, or plug*; POURING: *kettle, dripping, stirring, dropping, or yawning*.)
- (e) Spoken word to picture matching (PALPA 47) (Kay et al., 1992). This test consists of five items in an array: one target, one close semantic distractor, one distant semantic distractor, a visually related distractor, and an unrelated distractor. For example, for the target *stamp*, the distractors in the same order are *envelope, pen, picture, and paint*.
- (f) Written word to picture matching (PALPA 48) (Kay et al., 1992). This test consists of the target as a written word and five surrounding pictures.

The targets and distractors are the same as for the spoken version (PALPA 47).

Assessment of participants' cognitive skills included measures in the domains of memory, executive and attention skills, and self-monitoring.

Memory:

- (a) The picture and written word subtests from the Camden Memory Tests (Warrington, 1996). In the picture version, participants looked at a set of composite scenes and decided whether each one had been taken by an amateur or professional photographer. Participants then looked at a set of three photographs and decided which one they had previously seen. For the written word recognition task, participants read written words appearing on a set of cards, one word per card. Participants then pointed to words they had already seen from sets of multiple word lists.
- (b) Copy, immediate, and delayed recall parts of the Rey Complex Figure Test (Meyers & Meyers, 1995). This test required participants to copy a complex geometric figure, then to draw this figure from memory 5 minutes later and then again 30 minutes later. Although most of the participants used their dominant right hands for this task, which were, for some, affected by hemiparesis, all were able to copy the geometric figure, albeit slowly. Decrements in drawing accuracy between the copy and subsequent drawing therefore represented lapses in memory rather than impaired limb control.

Executive and attention skills:

- (a) the Wisconsin Card Sorting Test (Grant & Berg, 1993) was used to assess aspects of executive functioning such as cognitive flexibility and problem solving. This test examined participants' ability to formulate rules with which to match cards on the basis of shape, colour, or number, and then to shift to different rules as the test progressed. We looked at two measures: number of items to first category, which was the number of guesses a participant made before they had worked out the "rule" for matching cards; and the number of categories obtained, which was the number of times the participant both worked out and maintained the application of a matching rule. This latter measure can be particularly useful in detecting perseveration, where a participant has worked out one rule successfully but cannot shift from this as required.
- (b) Two subtests from the Test of Everyday Attention (TEA) (Robertson, Ward, Ridgeway, & Nimmo-Smith, 1994) were used: "elevator counting", which requires sustained attention, and "elevator counting with distraction", which requires divided attention. Elevator counting requires participants to listen to and count a set of tones at random time intervals from 1 to several seconds apart. Elevator counting with distraction requires participants to listen to sets of tones but to count only the low-pitch ones while ignoring the high-pitch ones. Written numbers were provided in both tasks to avoid problems in verbal number naming.

Self-monitoring skills: We assessed participants' reliability in judging the accuracy of their own naming by asking them to judge their own response as correct or incorrect. A subset of nouns and verbs from the Object Action Naming Battery (Druks & Masterson, 2000), was used for this task.

Participant profiles and summary of assessment findings

The assessment findings provided us with profiles of linguistic and cognitive functioning through which to describe our study participants. In the scores obtained from the Object Action Naming Battery (see Table 2), three participants (KP, PM, & BM) showed similar degrees of naming impairment across these sets. The other six participants, who were less severely naming-impaired, exhibited markedly lower accuracy scores for action as opposed to object naming (e.g., IH 125/162 objects vs 36/100 actions named) although, of course, these sets are not matched for various confounding psycholinguistic factors. Perhaps most importantly for this study, this assessment demonstrates that all the participants in this case-series had verb-naming impairments in addition to those for nouns—and thus both word types are legitimate targets for therapy.

On the phonology subtests, all participants scored over 50% on word repetition, which was unsurprising given that 75% accuracy was required for entry to the study on a 20-item screen. KP was the most markedly impaired in word repetition at 55/80, as well as on the nonword repetition task where she scored 34/80. All the other participants scored at least 50% on the nonword repetition task. On the word reading task, only participants IH, WE, and BM were near to or within the normal range. Similarly, with the exception of IH, WE, and BM, all other participants exhibited considerable impairment on the nonword reading task.

Within the domain of semantics, all participants scored more highly on these tasks reflecting better processing in this domain. IH and WE were within or very close to the normal range scores on many of the tasks. With the exception of PM, all participants were within the normal range on the spoken word-to-picture matching task.

The cognitive assessment data are summarised in Table 3. Within the domain of memory, participant IH was at ceiling on the Camden Memory Test words subtest, and all other participants below the 11th centile. PO scored at ceiling on the pictures subtest of the same memory assessment, with WE at the 38th centile, with the remaining participants below the 16th centile. The scores for the Rey Complex Figure were limited for KP, PM, and JT, with visuospatial copying scores below the 1st centile and only slightly higher for WE. The remaining participants reproduced accurate versions of this abstract figure. IH scored highly in both the immediate and delayed recall parts of the Rey test (above the 86th centile in each case). With the exception of JT, the remaining participants scored below the 16th centile for both.

Lastly, within the domain of executive-attentional skills, the easiest task here for these participants was the self-assessment of naming, which provided a measure of self-monitoring of speech. Four participants scored at or near ceiling, while another two also scored highly (BM: 82%; JT: 80%). PO, who displayed jargonistic Wernicke's-type speech output, scored lowest at 66%. Three participants were above the 16th centile in terms of problem solving and ability to shift set in the Wisconsin Card Sorting Test (KP, PO, & WE), with scores between the 1st and 16th centiles for the remaining participants on both measures, indicating impairment in these skills. Similarly, participants were towards the bottom of the normal range in their results for the Test of Everyday Attention divided attention subtest, in which one participant scored between the 10th and 25th centiles (PO), and all others below the 10th centile. Performance overall was better on the sustained attention subtest (albeit

TABLE 4
Mean values across each participant's therapy sets with respect to background psycholinguistic variables

	<i>cpwdfreq</i>	<i>phonemes</i>	<i>imageability</i>	<i>arguments</i>	<i>celex</i>
KP	37.23	5.47	4.18	1.63	9.89
PM	37.23	5.47	4.18	1.63	9.89
BM	40.07	5.93	3.50	1.67	3.25
PO	32.47	5.86	3.52	1.58	3.13
JT	37.44	5.40	3.94	1.49	3.19
IH	41.44	5.55	4.08	1.73	3.48
WE	63.00	5.34	4.04	1.65	3.33
MEAN	52.22	5.34	4.04	1.65	3.41

with a limited possible range of scores from 0 to 7), with two participants scoring at ceiling (KP and WE) and the lowest score at 4/7 (PM, BM and JT).

Selection of verb therapy targets

The primary outcome measure in the study was naming accuracy. Three sets of target items were selected for each participant. Items that a participant had consistently failed to name three times in pre-therapy assessments were selected from the Object & Action Naming Battery/OANB (Druks & Masterson, 2000) as this details the psycholinguistic properties of the words in this battery very comprehensively. A total of 60 failed items were collated; these were different items for each participant. Where a participant had not failed a sufficient number of the items from the OANB, items from the IPNP (the International Picture Naming Project) (<http://crl.ucsd.edu/~aszekely/ipnp/1stimuli.html>) were collated; this is an online database of picture stimuli that similarly provides detailed information regarding the psycholinguistic properties of words. These 60 failed items were divided into three sets, each consisting of 20 verbs. Set A were the target verbs for word cue therapy, set B for sentence cue therapy, and set C was reserved as a control set undergoing no treatment. The sets were matched for significant variables such as length (number of phonemes), imageability, frequency, and the number of arguments related to the target verbs.

The OANB items and those from the IPNP have different types of background psycholinguistic properties. For participants whose sets included IPNP items, the number of these was matched across the three sets. For example, in the case of participant WE, each set consisted of 9 items from the OANB and 11 from the IPNP; the OANB items were matched to the other OANB items and likewise for the IPNP items. Table 4 shows the mean measures for word frequency, length, and imageability across the sets collated for each participant.

Therapy methods

Following assessment, participants received word cue and sentence cue therapies for verb targets in parallel, i.e., both therapies were implemented in all therapy sessions. The alternative to this parallel-administration design was sequential administration of the separate therapies, e.g., first word cue therapy then sentence cue therapy. We

were concerned about the possibility of factors such as decreasing motivation as therapy progressed, or any unpredicted events affecting participants at one time point in the study, acting as a potential confounds in the comparison of therapies if one occurred after the other. Also, Fillingham et al. (Fillingham, Sage, & Lambon Ralph, 2005a, 2005b, 2006) used sequential and concurrent administration of errorless and errorful methods and found no differences in the outcomes of the therapies.

Therapies

The treated sets, set A and set B, were used for word cue and sentence cue therapies respectively. Cueing therapies typically utilise a hierarchy of increasing cues, whereby a target picture is presented and the participant is cued with relatively minimal cues (whether semantic or phonological) which progress to larger cues if naming is not facilitated. While maintaining effort, increasing cue therapies have the potential disadvantage of generating naming errors during therapy which may be self-reinforcing; errorless therapy techniques in the aphasia literature have been developed in order to avoid this potential problem—see Fillingham, Hodgson, Sage, and Lambon Ralph (2003) for a review.

Decreasing cues have been proposed as the optimal interaction of low error and high effort during therapy for amnesic symptoms (Komatsu, Mimura, Kato, Wakamatsu, & Kashima, 2000) and have been applied to the aphasia literature initially within the framework of connectionist models of impaired language processing (Abel, Grande, Huber, Willmes, & Dell, 2005a; Abel, Schultz, Radermacher, Willmes, & Huber, 2005b). Conroy et al. (in press-b) used errorless versus errorful therapies in noun- and verb-naming therapies and then compared decreasing versus increasing cues as an extension of this paradigm (Conroy et al., in press-a). Decreasing cue therapy for nouns and verbs consisted of word cues that initially comprised whole-word cues. The cues were then decreased gradually (e.g., whole-word to part-word cue) to try to ensure continued accurate naming but with sustained effort and engagement in therapy. As soon as a naming error was made, the cue level would increase, in order to minimise the number of errors in therapy. Decreasing cue therapy in the Conroy et al. study was as effective as increasing cues in improving accurate naming of noun and verb targets. The participants with aphasia who took part also expressed a preference for the decreasing over the increasing cue therapy, as the decreasing cue therapy ensured their success in naming items early on in the therapy but with a degree of challenge emerging as therapy progressed. In light of this, we opted to use decreasing cue in the present study. Set A for each participant, therefore, underwent a decreasing word cue therapy, while set B underwent a decreasing sentence cue therapy.

The decreasing cue therapies devised for this study aimed to reduce the cue level given to participants very gradually. This seemed a potentially useful approach given that verbs and sentence cues might be challenging for some of the participants. Table 5 shows the planned reduction in cues over the 10 therapy sessions in the study. Use of the highest cue level, cue 5, across both the word and sentence cue therapies for the first three sessions was intended to facilitate the participants managing the therapy tasks well before gradually introducing greater challenge through lower cue levels. Cue level 4 was used in sessions 4 and 5, which meant that for the first half of the therapy programme (5/10) sessions, participants were

TABLE 5
Cue hierarchy and planned schedule for decreasing cues at each therapy session

Cue level	Sessions	Word cue	Sentence cues	
			Intransitive verbs	Transitive verbs
5	1–3	Whole word in spoken and written form e.g., “driving”	Sentence in spoken and written form (pronoun always used for agent), e.g., “he is skipping”	Sentence in spoken and written form (pronoun always used for agent), e.g., “she is bouncing the ball”
4	4–5	CVC/CCVC phonemic and graphemic prompts, e.g., “driv-”	Sentence frame with CV/CCV phonemic and graphemic prompt for verb, e.g., “he is ski-”	Sentence frame with C/CC phonemic and graphemic prompt for patient ‘ball’, e.g., “she is bouncing the b----”
3	6	CV/CCV phonemic and graphemic prompts, e.g., “dri-”	Sentence frame with C/CC phonemic and graphemic prompt for verb, e.g., “he is sk-”	Sentence frame with CV/CCV phonemic and graphemic prompt for verb, e.g., “she is bou--- (await correct response)... the ---”
2	7	C/CC phonemic and graphemic prompts, e.g., “dr-”	Sentence frame with line in written prompt for verb, pause in spoken prompt for verb, e.g., “he is --”	Sentence frame with C phonemic and graphemic prompt for verb, with action picture, e.g., “she is b----- (await correct response) the -----”
1	8–10	Picture alone	Action picture with written prompt “---- is ----”	Action picture with written prompt “---- is - ----the ---”

receiving substantial cues from the therapist to aid their production. During the second half of the therapy programme (sessions 6–10), the cue levels reduced more quickly. It should be noted that, in decreasing cue therapies, the cue level is only reduced at the beginning of a therapy session (one cue level down from the previous cue level at which production was accurate). If production is not accurate then the cue level goes back up in steps until correct production is achieved again and maintained at that cue level for the rest of the therapy session. This “staircase” method ensures that participants are given a sufficient cue for correct naming in the context of trying to gradually reduce the degree of assistance.

The decreasing cue hierarchy used for word and sentence cue therapy is shown in Table 5. Examples for intransitive and transitive verbs are shown. Where a target verb was optionally transitive (e.g., “eat”, where both “they are eating” and “they are eating lasagne” are both grammatical correct sentences), the verb was taken to be transitive so as to include as many noun arguments in the sentence cue therapy as possible.

Therapy was delivered in participants’ homes by the first author. Each participant had 10 sessions of therapy, delivered twice weekly over 5 weeks, for approximately 40 to 50 minutes per session. The order of presentation of the therapies was counterbalanced: i.e., session 1 would commence with word cue therapy followed by sentence cue therapy; session 2 would commence with sentence cue therapy followed by word cue therapy. Participants were asked to practise the required cue—either the word cue (the target verb) or the sentence cue (including the target verb) on two picture presentations per target item per session. They were asked to produce the required cue 5 times per picture presentation, so 10 times in total per session. So by

the end of therapy, for the verb targets in Set A, participants had practised production of the word cue over 100 naming attempts, and for verb targets in Set B, participants had practised production of the sentence cue over 100 production attempts.

Post-therapy assessments

This comprised picture verb naming of the three sets of target verbs. Assessment was conducted at an immediate post-therapy point (1 week after the end of therapy) and a follow-up session (5 weeks later). Naming of therapy targets was not directly probed during the treatment phase of the study. These two assessment points allowed us to compare short- with longer-term effects of therapy. Also, the data from within therapy sessions were analysed in order to establish that the participants progressed through the decreasing cues of both types, so that any differences in terms of post-therapy accuracy could plausibly be ascribed to the differences between the therapies. Finally, naming of the items contained in the word cue therapy sets (set A for each participant) was also assessed 1 week after the immediate post-therapy assessment point (to minimise the risk of the items having been primed) in a different presentation context (dynamic video depiction of items from the Verb and Noun Test; Webster & Bird, 2000) in order to examine generalisation of improvements in naming.

With regard to coding of participant responses, we followed the standard practice in most studies of aphasic naming errors; i.e., responses were recorded, scored, and categorised using a simple, straightforward scheme. Where there was any doubt about classification, these were discussed among the authors and decided on together.

RESULTS

Verb-naming accuracy post-therapy

There were highly significant effects for both word cue and sentence cue therapies on post-therapy naming of treated verbs (see Figures 1 & 2). All participants made highly statistically significant improvements from zero baseline in their naming of treated items at both assessment points; immediate and follow-up (McNemar, 1 tailed, $p < .002$ for each participant).

We analysed the post-therapy data at the group level and then tested for the same effects in each individual participant's data. The post-therapy naming accuracy (immediate and follow-up assessment) was analysed with a two-way ANOVA. This showed a borderline effect of therapy type, no significant effect of time of assessment, and no significant interaction. The main borderline significant effect of therapy type was derived from the greater accuracy for the word cue therapy—global mean word cue therapy naming score = 12.0/20 (SD : 6.16) vs mean sentence cue therapy naming score = 10.3/20 (SD : 4.64): $F(1, 4) = 4.85$, $p = .07$. There was no significant effect of assessment time post-therapy, i.e., the accuracy scores did not reduce significantly between assessment point—global mean accuracy score at immediate assessment = 11.6/20 (SD : 5.7) vs mean accuracy score at follow-up assessment = 10.6/20 (SD : 5.01): $F(1, 4) = 1.5$, $p = .27$. Time and therapy showed no significant interaction, $F(1, 4) < 1$. At the individual level the slight numerical

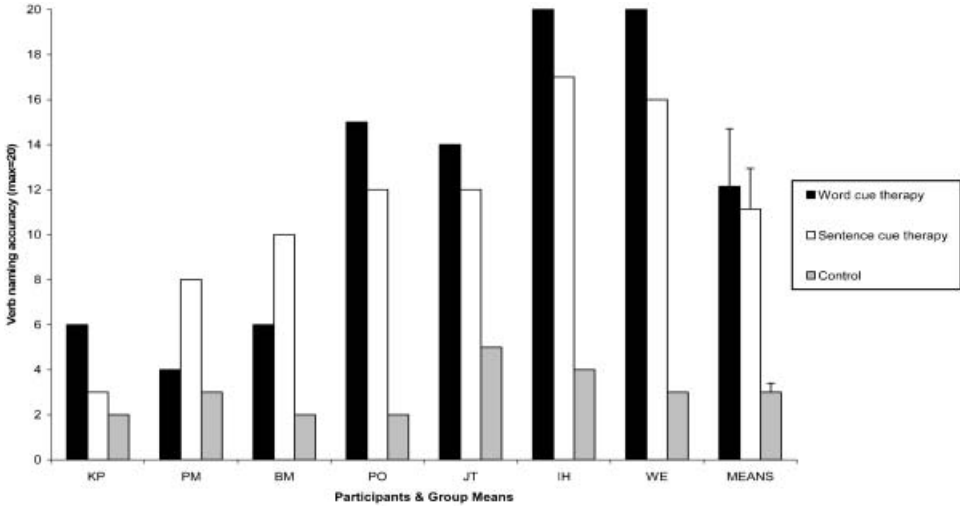


Figure 1. Immediate post-therapy assessment of verb naming. Baseline naming scores are not shown in this Figure as they were zero for all participants (see Method). Error bars denote standard error of the mean.

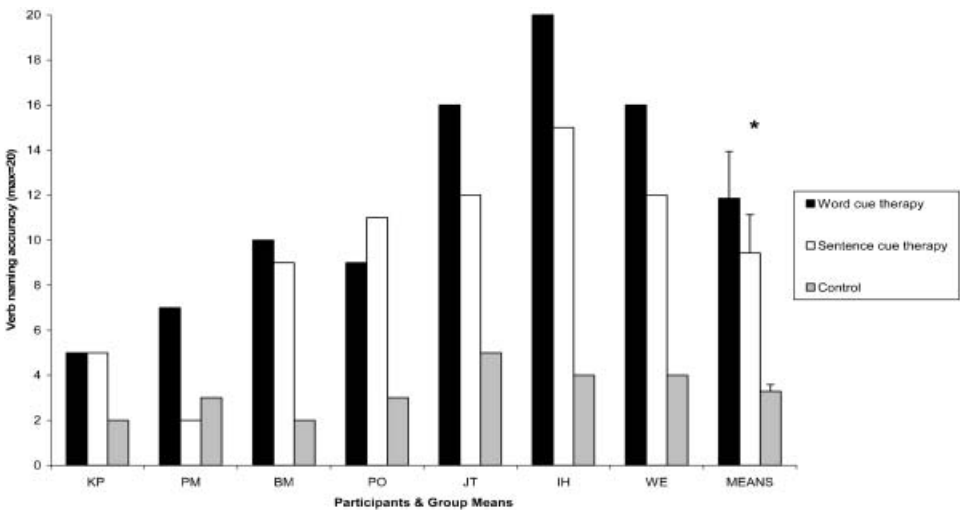


Figure 2. Follow-up post-therapy assessment of verb naming. Baseline naming scores are not shown in this Figure as they were zero for all participants (see Method). Error bars denote standard error of the mean.

decreases in naming accuracy between the two assessment points was statistically significant for only one participant (PO: McNemar, 1-tailed, $p = .05$).

Despite our predictions as to the potential benefits of sentence cue therapy, the mean naming scores immediately after the two therapies were very similar with slightly better scores for word than sentence cue therapies, as noted above in the ANOVA for the group-level data. For individual participants, the differences in naming accuracy after the two therapies were small and none was statistically significant (all: $\chi^2 < 2.5$, $df = 1$, $p > .1$). The differences between the two therapies

grew a little at follow-up assessment (see Figure 2) with slightly better verb naming after word rather than sentence cue therapy (mean accuracy for word cue therapy: 12/20; sentence cue therapy: 9/20). A Wilcoxon test demonstrated that this difference was reliable in the post-therapy assessment grouped data ($W_{s+} = 19$, 1-tailed, $p = .04$), but the effects in the individual data were too small to reach statistical significance (all $\chi^2 < 2.2$, $df = 1$, $p > .13$) with the exception of IH for whom the difference was close to significance ($\chi^2 = 3.5$, $df = 1$, $p = .06$).

Participants' naming of the control items improved minimally for the most part—typically 2 to 4 items per participant with an overall participant mean of 3/20 at both assessment points. The performance differences between the treated and untreated items were highly significant at the group level ($W_{s+} = 28$, 1-tailed, $p = .01$ at both immediate and follow-up assessments). At the individual level the difference between treated and control sets was significant for only four participants (PO, JT, IH, WE: all $\chi^2 > 4.8$, $df = 1$, $p < .03$) at the immediate assessment, and five participants (BM, PO, JT, IH, and WE: all $\chi^2 > 4$, $df = 1$, $p < .05$) at the follow-up assessment. For the remaining participants (KP & PM), the differences were non-significant (both: $\chi^2 < 1.4$, $df = 1$, $p > .2$). This reflected their low accuracy scores for the treated sets rather than improved naming of the control items. The mild exception to this overall pattern was participant JT who named five control items in both the immediate and follow-up assessments, which is small but statistically significant changes in naming of the control items (McNemar, 1-tailed, $p = .04$) from baseline to post-therapy assessment.

Analysis of participant progression through the two therapies

As well as investigating naming accuracy after therapy, it is also informative to analyse progress during therapy. In this study, the reducing cue method licenses the opportunity to monitor intra-therapy progress by noting which cue level was required for successful naming in each session. The best achievable pattern of decreasing cues for a specific therapy item is shown in Table 5 above.

The mean cue level that the participants received during therapy is shown in Figure 3. The maximum cue level was 5 and the minimum 1 (see Table 5). Perhaps the most striking aspect of this figure is that progress during the two therapies was tightly coupled for all participants, despite the fact that the overall therapy outcome varied across participants. This confirms that they all were able to follow and engage in the more complex sentence cue procedure. In addition, it further underlines the result emerging from this study that the word cue (arguably impoverished) therapy produced comparable effects not only after therapy but also during therapy.

Generalisation of verb naming post-therapy

Results from the comparison of naming pictures (set A items) versus dynamic videos (same items but a dynamic video of the target action name) are shown in Figure 4. The small difference favouring picture to video naming was not significant at the group level nor for any individual participants ($W_{s+} = 24$, 2-tailed, $p = .1$), indicating that the vast majority of the post-therapy improvements in verb naming did generalise to naming of other types of depictions of the same items.

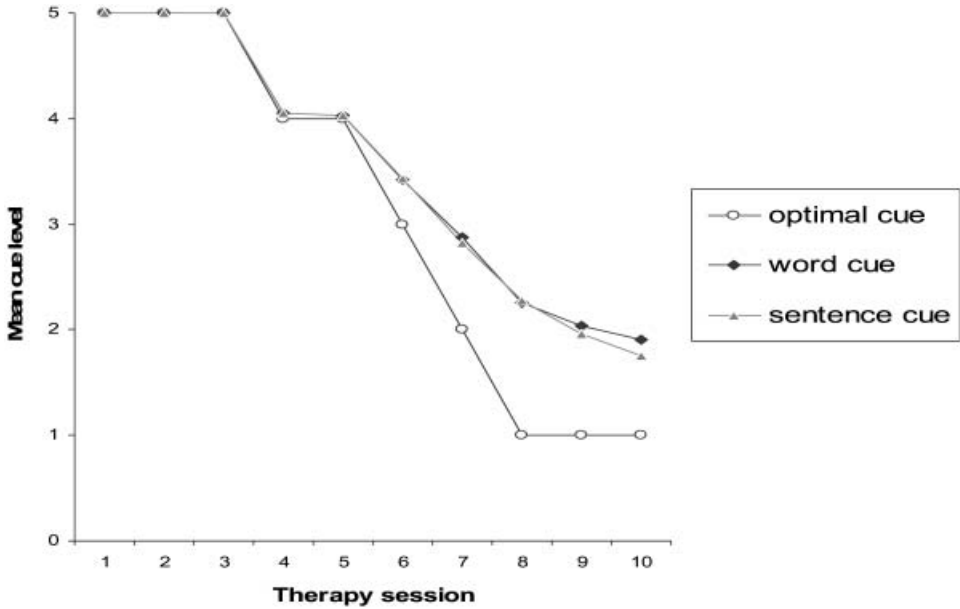


Figure 3. Mean sentence vs word cue levels required during therapy across the participants. The optimal cue level presented in this figure represents the best possible performance by a participant in terms of progressing through the decreasing cues.

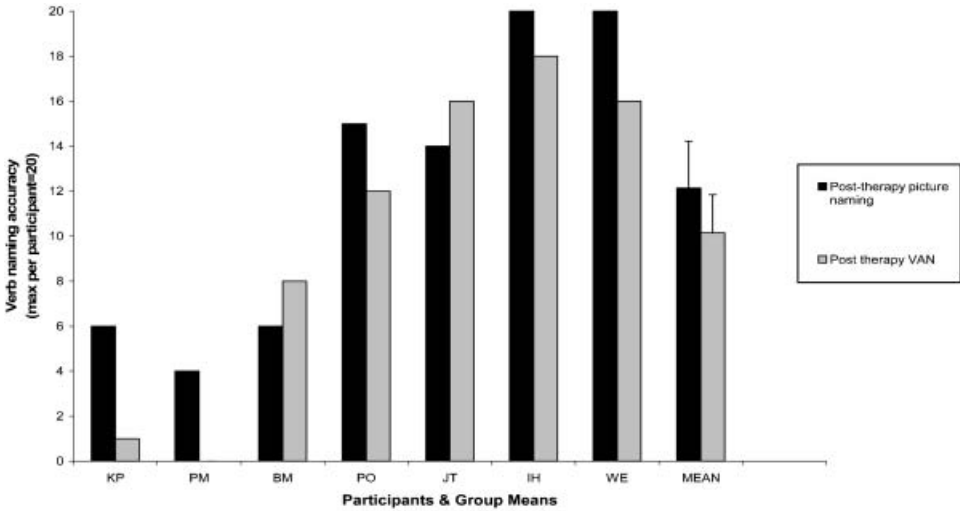


Figure 4. Post-therapy picture naming and performance on the VAN test.

DISCUSSION

The primary aim of this study was to compare the efficacy of word versus sentence cue therapy for improving verb naming in aphasia. Given the centrality of verbs to sentence production and that the noun arguments associated with a given verb are an important part of its meaning, we predicted that asking participants with aphasia to

process both the verb and its argument in a sentence cueing task would enhance the therapy gains relative to those for single-word cueing. Various studies in the literature have used verb-cueing therapies (Pashek, 1998; Wambaugh et al., 2001, 2002), while others have utilised the relationship between verbs and noun arguments (Fink et al., 1992; Murray & Karcher, 2000; Schneider & Thompson, 2003; Webster & Gordon, 2007; Webster et al., 2005). Until now, however, no studies have compared the two methods directly. As a secondary research question we examined the extent to which improvements in naming verbs after single-word cueing therapy would show generalised gains in naming the same verbs in a different presentation format (dynamic video as opposed to the static picture format used in therapy).

We implemented this direct comparison in two therapies based on decreasing cue hierarchies (Abel et al., 2005b; Conroy et al., in press-a; Komatsu et al., 2000). This method is designed to provide sufficient support for naming while also maintaining effort. Seven participants with aphasia completed sentence- and word-cueing therapies. Their performance both during therapy and at two post-therapy time points was assessed. Verb naming showed large and comparable improvements after both therapies and these gains were maintained between the immediate post-therapy assessment point and the follow-up assessment point 5 weeks later. In contrast to our expectation, immediately after therapy both types of intervention had produced equivalent improvements in verb naming (measured both at the group level and in each individual's data). At the follow-up assessment, however, there was a statistically significant difference at the group level with greater gains resulting from word cue as opposed to sentence cue therapies. This difference emerged despite the fact that the therapies appeared to present similar levels of difficulty for the participants. Indeed, their inter-session progress during each therapy was tightly matched (i.e., each participant moved down the decreasing cue hierarchy in an almost synchronised fashion).

There are at least three possible explanations for these results. First, while many researchers have suggested that the argument structure of verbs is integral to its meaning, others have suggested that there is a separation of lexical and syntactic aspects in speech production—especially when considering single word production (Caramazza, 1997; Shapiro & Caramazza, 2003). In these alternative proposals, meaning activates lexical/phonological forms directly while grammatical aspects are activated in parallel. If this proposal is correct, then provision of (additional) argument structure information in naming therapy might be superfluous and one might expect the equivalent therapy improvement observed in the present study. Second, it might be the case that poor verb naming often reflects an inability or inefficiency in activating the phonological word form rather than in the semantic-syntactical aspects of verbs, *per se*. If this is correct, then again the sentence cues might include superfluous information for the people with aphasia. Finally, although we attempted to equate the steps used in the sentence and word therapies, it is impossible to be absolutely certain about their equivalency. So, for example, it might be the case that the sentence-cueing therapy is more demanding for people with aphasia and these extra linguistic and/or cognitive demands might have suppressed the therapy effect.

As well as finding significant effects for both word and sentence cue therapies, we also found that improvements in verb naming generalised across contexts: gains demonstrated on naming to picture carried over to naming from video depictions of the same actions. From a theoretical perspective this is potentially important as it

might indicate that (as noted above), the verb-naming problems of these participants had less to do with semantic-syntactical aspects but more to do with impaired activation of their phonological forms. Consequently, when the link between meaning and phonological form is re-established through therapy, this can generalise from one depiction to another given that the meaning of each is the same. This is in contrast to participants with core semantic deficits—e.g., those with semantic dementia—who can relearn the link between pictures and names, but this does not generalise from one depiction to another unless they are very visually similar (Sage, Eshan, Scott, & Lambon Ralph, 2007). Generalisation across depictions is also clinically important, in that it validates the use of simple static pictures to both assess and offer therapy for verb naming. Since words that were not selected for therapy (i.e., the control set) did not improve, this study also underlines the need, already noted in the literature, for therapy targets to be selected on the basis of personal functional relevance to the participant with aphasia (Raymer et al., 2007). In a previous study we also found that single verb naming therapies generalised for those specific items addressed by therapy across different elicitation contexts (e.g., composite picture description and in narratives) (Conroy et al., in press-c). Taken together these results suggest that single verb naming therapies are effective not only in improving verb naming but also have the potential to impact positively on everyday communication.

Cognitive measures were relevant in the present study as they helped provide a fuller background picture of the participants and were also pertinent to the issue of semantic and executive linking discussed in the introduction (and is a practice recommended in standard neuropsychological texts: e.g., Shallice 1988). We have carried out some preliminary correlational analyses with these participants where we found that language but not cognitive measures predicted the degree of gain in naming therapy. However, these analyses were limited in power so we did not include these in the study, but future studies will be able to collate all these measures together and analyse the results across studies.

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