Dissociation of English Past Tense Forms in Aphasia

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This paper reports three aphasic patients who show an impairment in the ability to read regular past tense forms (e.g., walked) with relative sparing of the ability to read irregular past tense forms (e.g., slept). These data bear on theories of the mechanism(s) responsible for generating the past tense. In particular, these data support the classical theory which holds that regular past tense forms are generated by applying a symbolic rule to an uninflected stem, whereas irregular past forms are stored in the lexicon and simply retrieved wholesale when needed (see Pinker & Prince (1988) for reviews and discussion). These data argue against theories which hold that both regular and irregular past tense forms are generated by a single mechanism (e.g., Rumelhart & McClelland, 1986).

Previous Reports of the Dissociation of Regular and Irregular Forms

The first report of a dissociation between regular and irregular inflections following focal brain damage comes from Marin et al. (1976) who make the following statement concerning the reading performance of two "asyntactic" (Broca's) patients, H.T. and V.S.: "Both irregular plural nouns and verbs with irregular past tense forms are read several orders of magnitude better than their regular counter-parts" (p. 880). On the basis of a preserved ability to read words which have the -s morpheme but aren't true plurals (e.g., trousers, clothes, buds), they argue that this dissociation is not attributable to a failure to attend to the regular inflectional morpheme or to an articulatory problem.

Coslett (1986) reports two patients, J.G. and B.M., who presented with "phonologic dyslexia." These patients were asked to read 47 regularly inflected words and 47 irregularly inflected words (both were a mix of nouns and verbs) matched for frequency. Both subjects correctly read significantly more irregular forms than regular forms. J.G. correctly read approximately 55% of the regular forms versus 82% of the irregular forms; B.M. correctly read approximately 19% of the regular forms and 85% of the irregular forms.

Coslett (1988) presents an experiment on another phonologic dyslexic. This patient was asked to write 47 regularly inflected words and 47 irregularly inflected words matched for frequency and length (again a mix of nouns and verbs). The patient correctly wrote only 51% of the regular forms versus 98% of the irregular forms. Coslett further reports that most errors involved the omission or substitution of suffixes.

One final patient was reported by Badecker and Caramazza

(1991). The patient was asked to read regular and irregular past tense forms. Irregulars were read significantly better than regulars, 92% and 60% respectively.

The present experiment was designed to bolster the evidence for the dissociability in reading of regular and irregular inflected forms.

Method

Stimuli

The stimuli consisted of 17 regular past tense forms and 17 irregular past tense forms. The items were matched on the frequency of both the stem and past forms (Francis & Kucera, 1982; see Table 1), and matched on pronounceability. The latter was achieved by using primarily monosyllabic, vowel-final regulars (e.g., slow, sigh, pray, die) which avoids potentially difficult word-final consonant clusters in the past forms. Due to the limited number of such verbs, some regulars ending in consonants were included (e.g., slip) but only if an equally "difficult" irregular could be found. See the Appendix for a complete list of the items along with stem and past frequencies.

Table 1

Mean frequency for regular and irregular stems and past forms

	Regular	Irregular
Stem	74.41	71.18
Past	64.41	64.06

Procedure

The 34 past tense forms (17 reg, 17 irreg) were randomized and presented to the subject one at a time on a sheet of paper. The subject was asked to read the word in front of him/her. No time constraints were imposed, and the subject was allowed to try again immediately if the initial response was incorrect. (Feedback on the response was not given during testing, but subjects typically knew when the response they gave was incorrect.) An answer was scored as correct if the subject vocalized the correct past tense form on at least one of his/her tries. It never took more than two tries to correctly read a given word and this occurred only 4 times, once for an irregular form and 3 times for regular forms.

Patients

L.D. is a 63-year-old, right-handed male college graduate. Twelve years prior to testing, L.D. suffered a left hemisphere cerebral vascular accident (CVA). He was diagnosed as a Broca's aphasic

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both on the basis of clinical consensus and the Boston Diagnostic Aphasia Examination (BDAE) (Goodglass & Kaplan, 1972). Neurological examination showed a mild right-sided spastic hemiparesis. Neuroradiological examination indicated a lesion primarily in the left anterior (Broca's) region with some extension to parietal and subcortical temporal regions.

F.C. is a 60-year-old right-handed male who suffered an occlusion of the left middle cerebral artery 9 years prior to testing. He was diagnosed as a Broca's aphasic on the basis of clinical consensus and the BDAE. Neurological examination showed a right hemiparesis. No CT scan is available.

P.J. is a 51-year-old female who suffered a left hemisphere CVA 11 years prior to testing. She participated in a study by Schwartz et al. (1987) and was classified as "agrammatic" by these authors. No CT scan is available but neuropsychological testing suggests a frontoparietal lesion.

Results

All three patients were able to read irregular forms significantly better than regular forms. The number of correct responses broken down by form-type and patient is presented in Table 2 along with significance levels.

Table 2
Number and percent correct in reading regular versus irregular past tense forms.

	Regular	Irregular
L.D.	3 (18)	10 (59) ^a
F.C.	7 (41)	12 (71) ^b
P.J.	6 (35)	12 (71) ^c

Note. All t-tests are one-tailed

^at(33) = 2.68, p = .006

^bt(33) = 1.78, p = .04

^ct(33) = 2.09, p = .02

The effect of frequency on reading performance is difficult to analyze in these data because of the relatively small number of items. For descriptive purposes however, Table 3 presents the mean stem and past frequencies for those items read correctly versus incorrectly; these data are further broken down by form-type, and patient.

Table 3
Mean stem and past frequencies for items correctly read versus incorrectly read, broken down by form-type and patient.

	Stem				Past			
	Regular		Irregular		Regular		Irregular	
	Cor	Incor	Cor	Incor	Cor	Incor	Cor	Incor
LD	121	64	51	97	79	61	46	90
FC	55	88	98	8*	43	78	84	16 ^a
PJ	110	55	84	41	106	42	75	38

Note. All t-test are two-tailed.

^ap < .1

*p < .05

As Table 3 shows, the only significant difference in mean frequency between items that were correctly versus incorrectly read was in the irregular stem frequencies for F.C. That is, for irregular past tense verbs, those items that F.C. read correctly have significantly higher stem frequencies than those items he read incorrectly. A similar trend shows up in the mean past frequency of irregulars correctly versus incorrectly read by F.C. But again, the small number of items precludes any serious consideration of frequency effects.

In addition to reading past tense forms, P.J. was also asked to read the stem form of each of the items. P.J. showed a dramatic improvement in reading the stem-form of regular verbs (94% correct; cf. 35% on regular past forms). P.J.'s performance on irregular stems (71% correct) did not differ from her performance on irregular past-forms (also 71% correct). So the form of a verb (stem vs. past) makes a difference in reading performance for regular verbs, but not for irregular verbs.

¹ The difference in P.J.'s reading performance for regular versus irregular stems approached significance ($t(33) = 1.84$, $p = .076$, two-tailed). If this difference is real, the relatively poor performance on irregular stems (and past-forms) might be explained in terms of interference from the various, stored inflectional forms of an irregular verb. A regular verb would not have any of the various forms stored along with it, and so there is less interference.

Discussion

The results of these experiments indicate that regular and irregular past tense forms dissociate following focal brain damage. This finding supports theories that hypothesize distinct mechanisms for generating regular versus irregular past tense forms (e.g., Pinker & Prince (1988) and references therein).

One possible alternative explanation of this result is worth considering. It is possible that the patients simply scanned the word from left to right, and then stopped reading as soon as an English word could be identified. Regular pasts would then be unlikely to be read in their entirety because most of them contain an initial substring that is a word in English, namely, the stem form (e.g., slipped). Most irregular pasts do not such an initial substring, and so would be read in their entirety. This possibility is ruled out at least in one case. L.D. was presented with a separate reading task that contained 19 "embedded words" (e.g., country, party, postcard, children). He read 84% of these words correctly (c.f., 18% for regular pasts). Furthermore, there is one regular past-form in the experiment reported above that does not contain an embedded word (tried) and thus should force the patients to read the entire form. None of the three patients read this item correctly.

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Appendix

Verb list including stem and past-form frequency and patient performance on each item from the past form reading task only.
Each patients' actual incorrect responses are provided, "+" indicates a correct response.

VERB	STEM	PAST	L.D.	F.C.	P.J.
- sigh-sighed	1	22	sigh	sigh	signed
- flee-fled	1	22	leave	feeled	+
- weigh-weighed	4	11	weight	weigh	weight
- stride-strode	4	10	spoke	+	stride
slow-slowed	8	12	slow	slow	slow
cling-clung	6	13	+	clung	cling
- tie-tied	9	13	tie	+	tired
- slide-slid	8	24	slid	slide	+
- slip-slipped	7	26	slipper	+	+
- sweep-swept	7	19	+	sweep	+
- owe-owed	10	12	owe	+	owe
- swear-swore	10	14	+	+	store
- flow-flowed	13	4	flower	/flawud/	flowing
- lend-lent	13	3	+	+	+
- view-viewed	18	2	view	+	view
- hide-hid	18	6	hide	hide	+
- die-died	57	63	die	+	+
- drive-drove	46	58	+	+	+
- love-loved	53	45	+	+	+
- spend-spent	53	40	+	+	+
- learn-learned	83	54	+	/riyd/	+
- send-sent	73	69	+	+	send
stay-stayed	97	60	stay	sted	NR
- buy-bought	68	32	+	+	+
- pray-prayed	110	65	pray	play...pray	pray
- speak-spoke	110	86	+	+	spoked
- try-tried	136	120	tired...try	tie	tired
- hold-held	144	125	+	+	+
- show-showed	202	138	shows	showered	shower
- leave-left	191	151	ankle...leave	+	+

use -used	228	137	+		
keep -kept	257	115	keep	+	+
seem -seemed	229	311	seem...steam	seem	+
feel -felt	201	302	feel	+	+

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