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What is a spelling error?
The discrepancy between perception and
reality

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Abstract

The study examines the perception and reality of the typical site of spelling errors in Hebrew by comparing naturally occurring with deliberate errors from multiple perspectives. The potential for spelling errors in Hebrew derives from a number of homophonous graphemes and from the differential representation of consonants and vowels. Since orthographic units represent both phonological and morphological constructs, Hebrew spellers use morphological cues. The conceptual basis for this study comes from Karmiloff-Smith's idea that once a certain cognitive system is mastered, it may be tampered with and deliberately violated by its possessors. Analyzing such deliberate errors can tell us what their producers know about the system.

The spelling of children, adolescents and adults was tested in a 'natural' condition, where errors were analyzed in a text dictation, and in a 'deliberate' conditions, where subjects were asked to commit deliberate spelling errors.

In the natural condition, spelling errors declined with age, and most of them were in word-internal vowels. In the deliberate condition there were no age differences, and most errors were in consonantal root letters. Thus the most acute problem in Hebrew spelling is in word-internal vowel letters, but in the perception of Hebrew speakers, there is a massive magnification of root errors as the site of spelling errors.

1.0 Introduction

Recently there has been increased psycholinguistic interest in young spellers' understanding of how morphological segments are encoded and mapped onto orthographic segments (Bryant, Nunes & Snaith, 2000; Ravid, 2001; Treiman, Zukowski & Richmond-Welty, 1995). The current paper investigates Hebrew speakers' perception of the typical site of spelling errors in their language, as compared to what this typical site actually *is*, by comparing 'real' or naturally occurring spelling errors with deliberate errors in committed by children, adolescents, and adults. The conceptual basis for this study comes from Karmiloff-Smith's 1992 model of developing meta-cognition. The idea is that once a certain cognitive system is mastered, it may be tampered with and deliberately violated by its possessors. The analysis of such deliberate errors can tell us what the individuals producing them know about the system and how they perceive it.

1.1 Language typology and spelling

Current studies of spelling acquisition in a variety of languages illustrate to what extent it interacts with language typology. In English, where the core lexicon is mostly monomorphemic, 'silent' morphemes are at first not written and later written in both appropriate and inappropriate words (Nunes & Brynant, 2001). In French, where much of the morphology is represented only in the writing system, recognition of morphological units is present earlier on in French novice readers (Colé, 2001). A comparison of Hebrew and Dutch spelling development in gradeschool shows that language typology is crucial in children's ability to make use of morphological cues in their spelling, and that the type of spoken system children are exposed to from birth affects the way they perceive their orthography. Hebrew-speaking children find

morphology an enormously helpful tool in spelling, since they have to use morphological cues in language acquisition from early on. Dutch-speaking Belgian children mostly focus on the acquisition of syntactic patterns, and do not find morphology a good cue provider in the early stages of learning to spell (Gillis & Ravid, 2001). Thus, oral language typology, the nature of its orthography and the pattern of their acquisition are intimately linked.

1.1.1 Hebrew morphology

Hebrew is a Semitic language with a rich and complex morphology. Both inflectional and derivational morphology in Hebrew employ a wide array of morphological devices and express a variety of grammatical and lexical ideas in morphological forms in both speech and writing (Berman, 1987; Ravid, 1990; Schwarzwald, 2001).

The main morphological construct in Hebrew is the Semitic root, which constitutes the formal and semantic core of the Hebrew word. For example, the following words share root *l-m-d* ‘learn’: *lamad* ‘learned’, *nilmad* ‘was learned’, *limed* ‘taught’, *hitlamed* ‘apprenticed’, *lemida* ‘learning’, *limud* ‘learning/teaching’, *talmid* ‘pupil’, *lamdan / melumad* ‘scholar’, *lamid* ‘learnable’, *lomda* ‘educational software’. Semitic roots are discontinuous consonantal unpronounceable entities. To create a word, the root is interdigitated by the (mostly) vocalic *pattern*. For example, to create *limed* ‘taught’, root *l-m-d* combines with the causative verbal pattern *CiCeC* (*C*’s indicate sites for root consonants). Often patterns consist of prefixes and/or suffixes in addition to the obligatory vocalic infixes. For example, to derive *hitlamed* ‘apprenticed’ root *l-m-d* is affixed to the intransitive verb pattern *hitCaCeC*.

In addition, Hebrew words are inflected by a variety of morpho-syntactic affixes such as the plural suffix *-im* (as in *tik-im* ‘bag-s’) or future tense marker *t-* (e.g., *te-daber* ‘[she] will-talk’). It follows that the lexical core of Hebrew words is very often expressed by consonants, while its modifications are expressed by internal vowels as well as by prefixed or suffixed consonants. For example, the word *be-migdalex* ‘in your towers’ is composed of the prefixed preposition *be-* ‘in’, the stem *migd* ‘tower’, which consists of root *g-d-l* ‘grow’ and pattern *miCCaC*, and the genitive suffix *-ex* ‘yours,Sg’.

Modern Hebrew employs two versions of the same orthography. The *vocalized* orthography represents all consonants by letters, and all vowels by diacritic vocalization marks and by the letters אהוּי, which we represent here by the Roman capitals AHWY. This vocalized version provides precise phonological information about the written Hebrew word, but is used only in restricted learning and poetic contexts. The *nonvocalized* orthographic version represents vowels partially and ambiguously by the letters AHWY, termed *matres lectionis* ‘mothers of reading’. This orthography is the default version of written Hebrew, used across the board for most purposes, including school instruction from 4th grade onwards. In this orthography, consonants have a much fuller representation than vowels. For example, the word *be-migdalex* ‘in your towers’ is spelled as במגדליך BMGDLYK. The only vowel represented in this word is the final *e* represented by Y.

1.1.2 Sources of spelling errors in Hebrew

Two separate challenges face Hebrew spellers. The first involves *classical homophony*: A number of consonants are expressed each by two graphemes, reflecting historically distinct phonetic segments which have coalesced in Modern

Hebrew pronunciation. For example, current *t* represents two segments which have neutralized in Modern Hebrew: an emphatic unvoiced coronal stop, spelled as ט *T*, and an unvoiced coronal stop, spelled as ת *T*. Both ת and ט are candidates for spelling *t*, which leads to spelling errors in children. Spelling errors typically occur in the 13 homophonous Hebrew letters which together designate the consonants *t, k, x, ʔ, v, s*.

The distribution of spelling errors is critically affected by their morphological roles as either function letters, representing affixes, or as root letters. Roots are numerous and they frequently contain homophonous letters. In contrast, the number of homophonous function letters is small, and each transparently designates a fixed set of affixes. Hebrew-speaking children spell most function letters correctly by second grade, while learning to spell roots correctly is a longer and more arduous task which requires a large vocabulary and repetitious encounters with root-families (Ravid, 2001; Ravid & Bar-On, 2001).

The second problem in spelling Hebrew relates to vowel representation which depends on the vowel, the grapheme representing it, its morphological function, and on orthographic conventions. The graphemes אהוּי AHWY may occur anywhere in the word as consonants. As vowels they fall into two sets: One includes א א and ה ה (both designating *a* and *e*), which usually occur only at the end of the word: For example, *yafe* ‘nice’ spelled יפה YFH. A second set includes ו ו (designating *o* and *u*) and י י (*i*), which may occur anywhere in the word. For example, *kaniti* (I) bought’ is spelled קניתי KNYTY. Thus novice spellers not only have to perceive the double function of אהוּי as consonants and as *matres lectionis*, but also to learn which vowels they represent and where they may appear.

There are three morphological roles that AHWY can fulfill as vowel graphemes:

(1) *Root letters*. While root letters are generally consonantal, in some cases they represent vowel values. For example, one of the few cases when A appears in word-internal position is as a root letter, e.g., A in *karati* ‘(I) read’, spelled QRATY קראתי, root Q-R-A.

(2) *Function letters*. Vowels often participate in expressing function (i.e., non-root) morphological roles, especially in word-final position. For example, Y in *kosi* ‘my glass’, spelled KWSY כוסי expresses genitive case, 1st person singular.

(3) *Internal vowel letters*. W and Y alone also have an additional, in a sense less meaning-bearing role in representing word-internal *o, u, i* as part of the pattern of the word (e.g., *o* in *gadol* ‘big’, spelled GDWL גדול).

Because of its secondary, less salient and less consistent and transparent status in Hebrew spelling, vowel representation tends to be another source of spelling errors in Hebrew. This happens mainly in word-internal sites, even as root letters, and is especially common in those internal vowel letters which carry a less clearly morphological role. For example, the weakest category for Hebrew spellers in Gillis & Ravid (2001) involved spelling the internal vowel *i* marked by internal Y ם in words which had no morphological structure. In a study of word reading in Hebrew (Schiff & Ravid, in revision), we found that words with omitted internal vowel letters are often considered wellformed by mature and literate Hebrew readers.

Spelling errors in Hebrew can thus be analyzed from a number of perspectives. First, there are homophonous letters with alternative spellings for the same phonological segment. Secondly, errors occur differentially in letters representing

either consonants or vowels. Thirdly, errors in root letters are more likely to occur and to linger on while errors in function letters are rarer and disappear early on.

To understand how these factors interact, consider the letter *W* in its phonological and morphological functions. In the word *mevater* ‘gives up’ spelled MWTR, *W* functions as a root letter marking a consonant, part of root *v-t-r*. In the word *hošiv* ‘seated’ spelled HWŠYB, *W* is a root letter marking a vowel, part of root *y-š-b*. In the string *ve-rac* ‘and-runs’ spelled WRC, it is a function letter marking the consonant *v*, part of the coordinator *ve* ‘and’. Finally, in *sukar* ‘sugar’ spelled SWKR, *W* has a primarily phonological *matres lectionis* role, and marks a vowel without any morphological function.

Given the various sources for spelling errors and their multi-level roles, we focused in this paper on three questions:

- What is the site of typical spelling errors in Hebrew?
- What do Hebrew speakers perceive as the site of typical spelling errors?
- How does this perception change with age and literacy?

Our window on these questions was subjects’ deliberate orthographic transgressions in a given Hebrew text.

2.0 The study

The study is based on the idea that a certain level of explicit and integrated knowledge is necessary in order to carry out deliberate violations or ‘transgressions’ in a specific cognitive domain (Karmiloff-Smith, 1992). Following the study of de Morais & Teberosky (1996) on Portuguese, we asked our subjects to perform deliberate spelling errors. According to de Morais & Teberosky, writing norms are the result of a historical compromise between language typology and writing conventions, and

consequently orthographic transgressions might take different forms in different languages. Spelling errors provide information about the nature of the orthographic system being learnt by pointing at vulnerable sites where a number of linguistic sources – phonological, morphological, lexical and syntactic – are needed for correct performance. Our assumption was that spelling errors are based on systematic knowledge rather than on random attempts, and that committing deliberate errors will expose the underpinnings of this knowledge.

2.1 Population

Study population consisted of 112 subjects, all monolingual Hebrew speakers with no learning disabilities, from a middle to high SES, as follows: 29 4th graders (aged 9;1-11;9, mean age 10;5), 39 7th graders (aged 13;1-12;6, mean age 13;1), 22 11th graders (aged 16;6-17;5, mean age 17;1), and 22 educated adults working in the domain of reading and writing disabilities. All students attended the same school in a city in the north of Israel.

2.2 Research instruments and procedure

We used a 97-word excerpt from a story in a 3rd grade Hebrew reader, which was presented to the study population twice. In the first meeting (Condition I), the text was dictated to the whole class, and dictations were collected in order to detect and analyze naturally-occurring spelling errors. The second meeting (Condition II) took place a week later. This time subjects each received the printed (and vocalized) text, together with an empty sheet on which they were asked to re-write the text with deliberate spelling errors, like a person who cannot spell well or like a child who is not a good speller. Subjects were also instructed not to invent errors which children do not usually make.

2.3 Analysis

Both natural and deliberate errors were classified into two major types: word-level and grapheme-level errors. Word-level errors mostly consisted of whole-word omission and substitution, graphic distortion, segmentation. At the grapheme level (Table 1) graphemes with errors were classified by their phonological role (representing consonants or vowels) and by their morphological category (root letters, function letters, internal vowel letters, and letters in monomorphemic words).

Morph. Role	Root Letter N=88		Function Letter N=56		Letter in monomorphemic word N=20		Internal Vowel N=57
Phon. Role	C N=76	V N=12	C N=31	V N=25	C N=13	V N=7	V N=57

Table 1. Number of potential errors at the grapheme level (N=221), by category

For the natural condition, we predicted that the number of spelling errors would decline with age and schooling, and that most errors at the grapheme level would be substitution errors in root letters. For the deliberate condition, we predicted more grapheme-level errors and fewer word-level errors with age and schooling, given the consolidating perception of ‘spelling error’; and a similar distribution of errors in the first and the second conditions.

3.0 Results

3.1 Condition I: Natural spelling errors

Table 2 presents the amounts of spelling errors in the four morphological categories as percentages out of their respective potential for errors.

Group	Root	Function	Monomorphemic	Internal V
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	M	SD	M	SD	M	SD	M	SD
G4	4.43	3.77	2.54	1.77	1.31	2.82	5.90	3.29
G7	1.88	1.73	1.74	1.69	0.12	0.78	2.65	1.94
G11	1.19	1.17	2.08	2.01	0.00	0.00	3.47	2.48
Adults	1.05	1.38	2.40	0.88	0.00	0.00	3.77	2.45

Table 2. Natural errors: Mean percentages and standard deviations of spelling errors out of the potential of each morphological category, by age group

A two-way ANOVA of age group (4) x morphological category (4) on the data in Table 2 revealed an effect for age ($F(3,108)=15.5, p<.001$): Spelling errors decline with age and schooling. A second effect emerged for morphological category ($F(3,324)=66.19, p<.001$): Most errors occurred in internal vowels and root letters, fewer errors in function letters, and almost none in monomorphemic words. These effects were qualified by an interaction of age and morphological category ($F(9,324)=4.01, p<.001$). A post-hoc Bonferroni analysis at the .05 level showed that 4th graders differed from all other groups in internal vowels, root letters, and monomorphemic words, but not in function letters.

3.2 Comparing the two conditions

In order to compare the two conditions, we calculated the respective distributions of natural and of deliberate errors into their categories (word-level and grapheme-level errors, and all types of grapheme-level errors), taking as 100% the total number of errors in each condition. Table 3 below presents the distribution of word-level and grapheme-level errors in the two conditions (note that the categories of word-level errors are compiled together).

		Grapheme-level								Word-level*	
		Root		Function		Monomorphemes		Internal Vowel			
Group	Condition	M	SD	M	SD	M	SD	M	SD	M	SD
4 th grade	1 Natural	35.06	22.87	17.48	19.69	1.90	3.94	39.10	20.19	6.37	8.68
	2 Deliberate	64.26	6.64	12.52	4.63	7.88	2.08	10.48	5.93	4.82	2.37
7 th grade	1 Natural	28.40	24.85	16.73	19.30	0.43	2.67	29.41	23.27	25.04	23.8
	2 Deliberate	63.75	7.76	13.03	5.28	7.67	2.54	12.55	5.30	2.37	2.46
11 th grade	1 Natural	27.12	26.76	24.78	23.38	0	0	47.41	24.12	0.68	3.12
	2 Deliberate	66.25	10.09	11.41	5.57	6.64	3.45	11.57	6.75	4.76	3.03
Adults	1 Natural	16.07	14.76	26.14	13.76	0	0	39.05	21.68	18.74	0.28
	2 Deliberate	60.29	8.17	15.76	5.27	6.36	2.10	13.42	5.40	4.56	1.78

Table 3. Error distribution in the four age groups at the grapheme and word level, natural and deliberate conditions

* Word-level errors consist of 4 categories compiled together here since the overwhelming majority were lexical

A three-way ANOVA of age (4) x condition (2) x error category (8) resulted in an effect for category ($F(7,749)=407.64, p<.001$). There was no effect for age, but a three-way interaction of age x condition x error category emerged ($F(21,749)=3.75, p<.001$). Since clearly age groups differed in the first condition but not in the second one, a further two-way ANOVA of condition (2) x error category (8) resulted in a two-way interaction. A Bonferroni analysis showed that error distribution differed in the two conditions in all the categories presented in Table 3. Figure 1 presents this differential distribution.

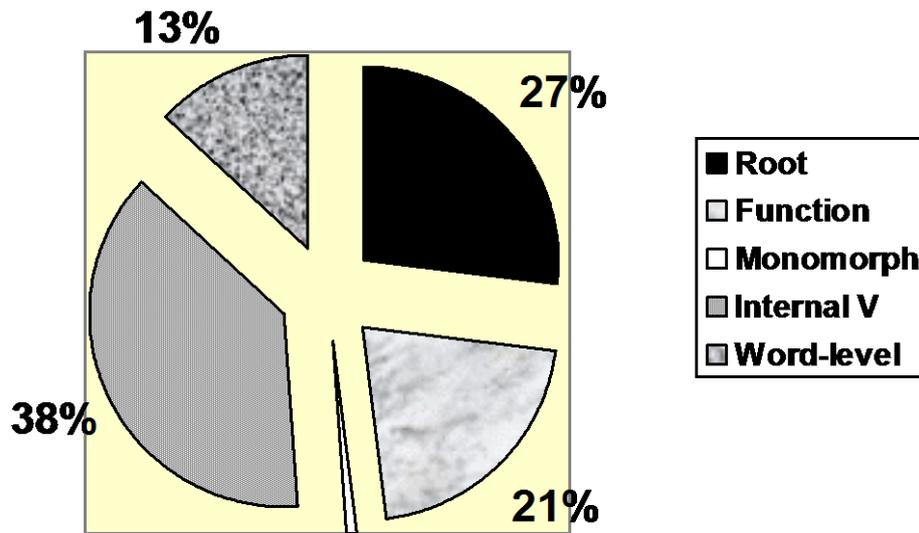


Figure 1(i). Distribution of natural error categories in the first condition.

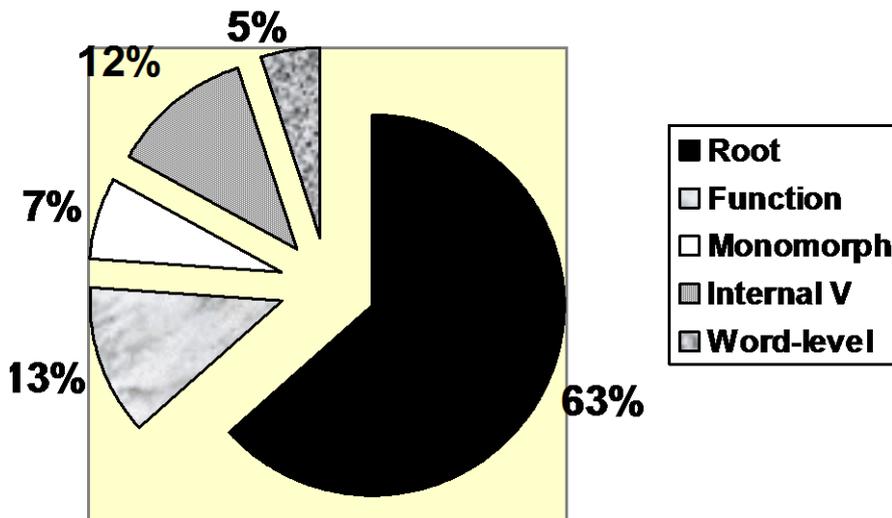


Figure 1(ii). Distribution of deliberate error categories in the second condition.

Figure 1 shows that the majority of the natural errors in the first condition were internal vowel errors, followed by root and function letters, and then by word-level errors. The relative part of errors in monomorphemic words was negligible. In the second condition, in contrast, the overwhelming majority of deliberate errors occurred

in root letters, followed by function letters and internal vowel letters, then by errors in monomorphemic words and finally by word-level errors.

A second analysis was conducted on the distribution of errors in the three categories of root and function letters, and letters in monomorphemic words. Table 4 presents the distribution of consonant and vowel errors in the three morphological classes in the two conditions.

Group	Category	C / V	Root letters		Function letters		Monomorphemes	
	Condition		M	SD	M	SD	M	SD
4 th grade	1 Natural	C	25.86	19.92	17.17	19.90	1.70	3.88
	2 Deliberate		58.09	6.82	9.81	3.38	6.58	1.94
	1 Natural	V	9.20	11.82	0.31	1.69	0.20	1.09
	2 Deliberate		6.17	1.77	2.71	2.83	1.30	0.79
7 th grade	1 Natural	C	19.25	19.28	16.73	19.30	0.43	2.67
	2 Deliberate		56.56	8.06	9.54	3.92	6.05	2.16
	1 Natural	V	9.15	15.54	0	0	0	0
	2 Deliberate		7.19	2.56	3.49	2.93	1.62	0.84
11 th grade	1 Natural	C	22.97	25.97	24.79	23.38	0	0
	2 Deliberate		59.72	10.71	9.35	4.05	5.58	3.08
	1 Natural	V	4.16	10.37	0	0	0	0
	2 Deliberate		6.53	2.88	2.06	2.32	1.07	1.05
Adults	1 Natural	C	14.52	13.95	26.14	13.76	0	0
	2 Deliberate		52.99	8.82	12.59	4.91	4.99	1.49
	1 Natural	V	1.55	5.58	0	0	0	0
	2 Deliberate		7.29	2.38	3.17	3.13	1.37	0.92

Table 4. Distribution of root, function and monomorphemic errors in letters representing consonants and vowels in the two conditions (natural vs. deliberate), by age group. Data represent mean percentages out of the total amount of errors in each condition.

A four-way analysis of age (4) x morphological category (3) x phonological category (2) x condition (2) did not reveal an effect for age. There was an effect for morphological category ($F(2,214)=455.67, p<.001$): root errors were the most frequent. There was also an effect for phonological category ($F(1,107)=1047.83, p<.001$): There were 9 times as many errors in consonants than in vowels. And there was an effect for

condition ($F(1,107)=204.41, p<.001$) – there were 1.7 times as many errors in the deliberate than in the natural condition. A three-way interaction of morphology, phonology and condition ($F(2,214)=181.78, p<.001$) illustrates these findings (Figure 2). Figure 2 makes it clear that errors in root consonants constitute the major difference between the two conditions.

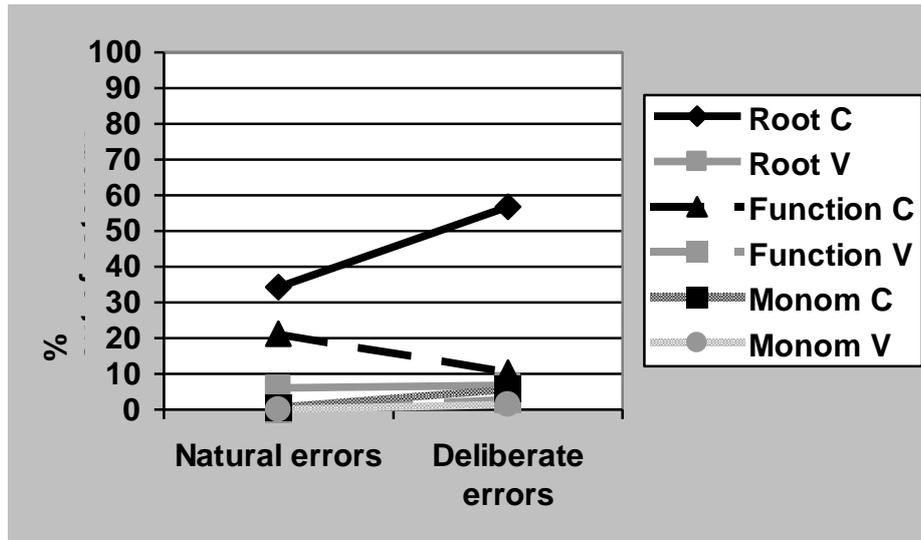


Figure 2. Three-way interaction of errors in morphological category (root letters, function letters, monomorphemic words), phonological category (consonants (C) versus vowels (V)), and condition (first condition – natural errors, versus second condition – deliberate errors).

Since the major difference between the two conditions was in the consonantal root letter category, we decided to conduct a morpho-phonological analysis of consonantal root letter errors including the type of error committed - substitution, addition, omission - in the two conditions. Table 5 presents the data.

Group	Category Condition	Substitution		Omission		Addition	
		M	SD	M	SD	M	SD
4 th grade	1 Natural	25.51	20.11	0	0	0.34	1.86
	2 Deliberate	57.35	7.39	0.42	0.74	0.32	0.78
7 th grade	1 Natural	19.25	19.28	0	0	0	0
	2 Deliberate	54.65	8.50	1.66	1.60	0.28	0.59

11 th grade	1 Natural	19.79	23.93	0	0	3.17	14.55
	2 Deliberate	58.95	19.93	0.64	1.09	0.13	0.43
Adults	1 Natural	12.81	14.36	0.57	2.66	1.14	5.33
	2 Deliberate	50.64	9.20	2.25	1.84	0.11	0.35

Table 5. Distribution of substitution, addition and omission errors in consonantal root letters in the two conditions (natural vs. deliberate), by age group.

Data represent mean percentages out of the total amount of errors in each condition.

We conducted a 3-way analysis of age (4) x condition (2) x error type (3) on the percentages of consonant root letters out of the total of substitution, addition and omission errors.

There was an effect for age ($F(3,107)=2.94, p<.04$) – adults made fewer errors; and an effect for condition ($F(1,107)=289.11, p<.001$), discussed above. There was also an effect for error type ($F(2,214)=1113.86, p<.001$), showing that there were 37 times as many substitution than other types of errors. Two interactions emerged. One interaction of age x error type ($F(6,214)=3.89, p<.001$) showed that the older the age group, the more errors of the substitution type. A second interaction of condition and error type ($F(2,214)=237.85, p<.001$) derived from the fact that in the first condition consonantal root letters constituted 19% of the substitution errors while in the second condition they were 55% of the substitution errors.

4.0 Discussion

This paper presents an analysis of natural and deliberate spelling errors aimed to detect what Hebrew speaker/writers perceive as the site of spelling errors in Hebrew (deliberate condition) compared with the errors that they actually commit (natural condition).

4.1 Natural spelling errors

In the first condition, we focused on natural spelling errors in four morphological categories (root letters, function letters, monomorphemic words, and internal vowels) as a percentage out of the potential for errors in each category. We found that the number of natural errors declined with age and schooling, and that 4th graders made more spelling errors of most types than the other age groups. We had predicted that root errors would be the most numerous, but counter to our prediction, most errors were committed in internal vowel letters, which do not have a clear morphological function. However, as we had predicted, there were indeed more root than function letter errors. Monomorphemic words had the fewest errors. While errors in root letters dwindled with age, errors in internal vowel letters continued to occur in the adult group at a rate of about 4% out of the error potential.

Thus we have detected *two* major loci of spelling errors which actually occur in Hebrew: Internal vowel letters and root letters. While the finding that root letters are harder to spell than function letters reconfirms previous findings (Gillis & Ravid, 2001; Ravid, 2001), the finding about the prevalence of errors in internal vowels reflects a well-observed though not yet empirically researched phenomenon in Hebrew: the problem of *plene* (nonvocalized) spelling which requires the insertion of *matres lectionis* AHWY to disambiguate the consonantal representation (Schwarzwald, 2001). This study shows that when word-internal vowel letters have no canonical morphological role either as root or function letters, their status is precarious, and their erroneous spellings persist long after morphologically-aided spelling patterns are mastered.

4.2 Comparing the two conditions

A comparison of the two conditions resulted in a number of important differences between the way Hebrew speaker/writers perceive spelling errors and the way they actually perform them.

First, contrary to the findings in de Morais & Teberosky (1996), even young Hebrew spellers perceived spelling errors as errors at the grapheme level. While 13% of the errors in the natural condition were word-level, due to word omission during the dictation (mostly in the 7th graders and in the adults), consistently less than 5% of the errors in the deliberate condition were word-level.

Second, spelling performance is variegated but its perception is consistent. In the natural condition, the morphological categories had differential weights in the four age groups, with large standard deviations. In the deliberate condition, the internal distribution of deliberate spelling errors was similar across the board in all age groups, and standard deviations were small. Taken together, these findings indicate that while actual spelling performance may vary, the perception of spelling errors is fairly homogeneous.

Third, the sites of actual and perceived (deliberate) spelling errors were not identical: Counter to our prediction, natural and deliberate spelling errors patterned differently in the two conditions. The largest class of *natural* spelling errors was that of *internal vowel errors* (38%). A separate morpho-phonological analysis of this error class, which is not presented in this paper for lack of space, showed that most of these errors, notably in the younger age groups, were addition errors, while in the older age groups they were omission errors. The second largest class was root letter errors (27%), followed by function letter errors (21%). Only 1% of the errors were in monomorphemic words.

In the *deliberate* condition, the largest part by far (64% of the total number of errors) was occupied by root errors, followed by the much smaller parts of function letters (13%) errors and internal vowels (12%). Errors in monomorphemic words occupied 7%. The site of *perceived* spelling errors is thus the *root letter*. More specifically, we found as a result of the morpho-phonological analysis that it is the *consonantal* letter in general and the *consonantal root letter* in particular that is targeted and magnified as the perceived site of spelling errors. And moreover, the overwhelming majority of consonant root errors in the deliberate condition is of the *substitution* type. Thus, homophonous root letters which represent consonants are perceived as the site of spelling errors by Hebrew speaker/writers.

4.3 The discrepancy between perception and reality

How can this discrepancy between the way Hebrew spellers think about spelling errors and the kind of errors they actually make be reconciled? Natural spelling errors of omission and addition are committed in internal vowel letters, but this site is ignored in the perception of speaker/writers, who focus on a hugely magnified site of consonantal root errors of substitution. In fact, the two error sites observed in this study highlight two extremes in the interface of Hebrew morphology with its written representation: Consonantal root representation, carrying the most morphological information and thus having the most stable representation; and marking internal vowels in written Hebrew, carrying the least morphological information and consequently a highly unstable system.

On the one extreme, consider the primacy of the consonantal root as the major lexical unit in spoken and written Hebrew morphology. The psycholinguistic status of the Semitic root in both processing and development has been established in a variety

of studies (see, for example, Deutsch & Frost, in press; Ravid, in press). The root carries the core lexical information in a morphological family and is the basis for creating new words. This primary lexical unit is mainly perceived by Hebrew speakers as a consonantal entity: Even though a number of historical roots contain elements that surface as vowels (e.g., root *q-r-y* ‘happen’), all new roots with no exception are consonantal (Ravid, 1990).

Subjects had been asked to perform deliberate errors “like a person who cannot spell well or like a child who is not a good speller”, and were instructed “not to invent errors which children do not usually make”. Their main response was to perform deliberate errors in the consonantal root, typically exchanging one homophonous root letter for another. These are indeed typical spelling errors prevalent in gradeschool age but not beyond it. This choice indicates to what extent Hebrew speaker/writers reject alternative root spellings and regard the root as a unified entity across phonology, semantics, and orthography. Root representation in writing is the consistent, stable, consensual facet of Hebrew orthography, and violating it is considered a real ‘spelling error’ typical of children and illiterate persons.

Internal vowel representation is the other morphology / orthography extreme. Though vowels participate in clearly morphological constructions such as function morphemes (e.g., final *-u* on verbs, indicating 3rd person plural, e.g., *halxu* ‘they went’) and even in roots (see above), marking internal vowels is mainly subject to phonological constraints: As a rule, pattern-internal *a*, *e* are not marked at all, and *i*, *o*, *u* are marked by *Y* ם and *W* ן mainly in stressed syllables (Schwarzwald, 2001). Thus, internal vowel letters carry little if any morphological value and are marked inconsistently. Consequently, the status of internal vowel representation is unstable and

a range of alternative spellings is acceptable to mature and literate speaker/writers. This explains the apparent paradox: Internal vowel errors are relatively prevalent in older spellers, and at the same time they go unnoticed by spellers who do not regard them as “real” spelling errors.

Current Hebrew spelling with its typical errors is thus the consequence of a long history of a Semitic orthography adapting to the need for expressing more than consonantal value, on the one hand, and resonating to units in a highly complex morphological system, on the other.

References

- Berman, R.A. 1987. Productivity in the lexicon: new-word formation in Modern Hebrew. *Folia Linguistica* 21, 225-254.
- Bryant, P., T. Nunes & R. Snaith. 2000. Children learn an untaught rule of spelling. *Nature* 403, 157-178.
- Colé, P. 2001. L'influence de la structure morphologique des mots dans les premières étapes de l'acquisition de la lecture. Écriture et sens linguistiques, Colloque organisé par l'Université de Strasbourg et le CNRS, Strasbourg University, 29 & 30 novembre 2001.
- De Morais, A.G., & A. Teberosky. 1996. Beginners' explicit knowledge of Portuguese spelling. In G. Rijlaarsdam, H. Bergh & M. Couzijn (eds.) *Theories, models & methodology – current trends in research on writing*. Amsterdam: Amsterdam University Press.
- Deutsch, A. & R. Frost. In press. Lexical organization and lexical access in a non-concatenated morphology: Evidence from Hebrew. In J. Shimron (ed.) *Language processing and language acquisition in a root-based Semitic morphology*. Amsterdam: Benjamins.
- Gillis, S. and D. Ravid. 2001. Language-specific effects on the development of written morphology. In S. Bendjaballah and W. U. Dressler (eds.) *Morphology 2000*. Amsterdam: Benjamins, 129-136.
- Karmiloff-Smith, A. 1992. *Beyond modularity: a developmental perspective of cognitive science*. Cambridge, MA: MIT Press.
- Nunes, T. & P. Bryant. 2001. The role of morphology in the development of written word knowledge. Paper presented at Écriture et sens linguistiques, Colloque

organisé par l'Université de Strasbourg et le CNRS, Strasbourg University, 29 & 30 novembre 2001.

Ravid, D. 1990. Internal structure constraints on new-word formation devices in Modern Hebrew. *Folia Linguistica* 24, 289-346.

Ravid, D. 2001. Learning to spell in Hebrew: Phonological and morphological factors. *Reading and Writing* 14, 459-485.

Ravid, D. In press. A developmental perspective on root perception in Hebrew and Palestinian Arabic. In J. Shimron (ed.) *Language processing and language acquisition in a root-based Semitic morphology*. Amsterdam: Benjamins.

Ravid, D. & A. Bar-On. 2001. The Semitic root in acquisition. Paper presented at GALA (Generative Approaches to Language Acquisition), University of Lisbon (Cidade Universitária - Faculdade de Letras), Palmela, Portugal, September 14-16, 2001

Schiff, R. & D. Ravid. 2001. Vowel representation in written Hebrew: Phonological, orthographic and morphological contexts. Paper under revision.

Schwarzwald, O.R. 2001. *Modern Hebrew*. Munich: Lincom Europa.

Treiman, R., Cassar, M., & Zukowski, A. 1994. What types of linguistic information do children use in spelling? The case of flaps. *Child Development* 65, 1310-1329.

