

# Paradigmatic and extraparadigmatic morphology in the mental lexicon

## Experimental evidence for a dissociation

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The present study discusses psycholinguistic evidence for a difference between paradigmatic and extraparadigmatic morphology by investigating the processing of Finnish inflected and cliticized words. The data are derived from three sources of Finnish: from single-word reading performance in an agrammatic deep dyslectic speaker, as well as from visual lexical decision and wordness/learnability ratings of cliticized vs. inflected items by normal Finnish speakers. The agrammatic speaker showed awareness of the suffixes in multimorphemic words, including clitics, since he attempted to fill in this slot with morphological material. However, he never produced a clitic — either as the correct response or as an error — in any morphological configuration (simplex, derived, inflected, compound). Moreover, he produced more nominative singular errors for case-inflected nouns than he did for the cliticized words, a pattern that is expected if case-inflected forms were closely associated with their lexical heads, i.e., if they were paradigmatic and cliticized words were not. Furthermore, a visual lexical decision task with normal speakers of Finnish, showed an additional processing cost (longer latencies and more errors on cliticized than on case-inflected noun forms). Finally, a rating task indicated no difference in relative wordness between these two types of words. However, the same cliticized words were judged harder to learn as L2 items than the inflected words, most probably due to their conceptual/semantic properties, in other words due to their lack of word-level translation equivalents in SAE languages. Taken together, the present results suggest that the distinction between paradigmatic and extraparadigmatic morphology is psychologically real.

**Keywords:** morphological paradigm, clitics, agrammatism, lexical decision, Finnish

The present study addresses the distinction between paradigmatic (case-inflection) versus extraparadigmatic (clitic) morphology as defined in grammatical descriptions.

Structurally, an important aspect of inflection is that inflected word-forms are typically organized into paradigms. Clitics, on the other hand, are defined as bound elements whose grammatical status is somewhere in between a typical word and a typical affix (see Nevis, 2000, for an overview). It is thus of interest to examine whether the structural differences between lexeme-category inherent paradigmatic morphology and non-paradigmaticity are reflected as a processing difference in speaker-hearers. To this end, we present experiments with both aphasic and normal speakers of Finnish on the processing of multimorphemic words carrying case-inflection vs. enclitic particles. If the distinction between paradigmatic vs. extraparadigmatic morphology is psychologically real, we expect to find a processing dissociation between these two types of stimuli. In what follows, we will first introduce the relevant structural aspects of Finnish by shortly reviewing the morphotactic patterns of Finnish nouns and the core properties of Finnish clitics.

The assignment of Finnish polymorphemic nouns like *artikkele-i-ssa-mme* 'in our articles' and *vene-i-ttä-än* 'without his/her boats' into their paradigms is not a straightforward operation, since in this language both the stem and suffixes are typically susceptible to morphophonological changes. Moreover, the language carries a large number of inflectional paradigms. As shown by the examples above, the stem (*artikkele-* [bound stem] and *vene*) can be followed by the plural marker, and then by the case and possessive markers. Additionally, the whole string can be terminated with an enclitic particle (e.g., *artikkele-i-ssa-mme-kin* 'even in our articles'), or a sequence of enclitic particles. All these suffixal categories may also be appended immediately to their lexical host (e.g., *artikkeli-kin* 'article-even', *artikkeli-mme* 'article-our', *artikkeli-ssa* 'article-in', *artikkeli-t* 'article-NOM:PL'). It is thus not trivial to ask about the relative importance of the suffixal categories to the paradigm membership of Finnish nouns as well as how these strings are processed.

As regards Finnish clitics, they are typologically different from the so-called *simple clitics* as exemplified by English reduced auxiliaries like *I will* > *I'll* or from the *verbal clitics* of Romance languages (like the *t* in Fr. *je t'aime*) (for clitic typologies see Halpern, 1998; Zwicky, 1977, 1985; Zwicky & Pullum, 1983; for Finnish clitics, see, e.g., Nevis, 1988). First, Finnish clitics like *-hAn*, *-pAs*, *-kin*, *-kAAAn*, *-kO* are not phonologically reduced forms of words. Second, the meanings of Finnish clitics cannot be merely captured by reference to the semantic properties of these morphemes, as their meanings or functions are usually highly determined by the discourse context. However, there is typically a fuzzy semantic/pragmatic core expressed by each clitic (if this were not the case, they could not be learnable).

For instance, the many functions of *-hAn* can be subsumed by something like ‘acknowledgment of the speaker’s own authority’ (according to Karttunen, 1975, as cited by Nevis, 1988, p. 7; see also Hakulinen, 1976), see (1).

- (1) Matti-han asia-sta tietää  
 Matti-*hAn* matter-*ELA* knows  
 ‘[But it is, and I do know,] Matti [that] knows about the matter’

In addition to their semantic aspects, Finnish clitics can be said to differ in terms of the following major features from paradigmatic case-marking (see Karlsson, 1985, who also provides a more detailed division of Finnish word-endings along the dimension of paradigmaticity):

(a) *Paradigm determination*. Depending upon the abstractness of one’s analysis, Finnish nominals can be said to have dozens of inflectional paradigms (Indo-European “declensions”), and noun inflection is determined (even in Finnish) through the canonical two-dimensional matrix of grammatical case (14) and number (2), while clitics are in this respect totally dysfunctional (see also (b), below). (The same statement applies to the inflectional paradigms of verbs, where clitics have no roles in paradigm assignment.)<sup>1</sup>

(b) *Stem change triggering effects*. Suffixes that cause morphophonological changes in the stem create a higher degree of *paradigm cohesion* than do suffixes with no such effect (see also Dressler, 1984). Case and number endings greatly influence the form of the stem in Finnish nouns, while clitics do not have any morphophonological effects on the stem (e.g., *varis* ‘crow’, *varikse-ssa* ‘crow-in’, *variks-i-ssa* ‘crow-s-in’, in contrast to *varis-kin* ‘crow-even’ or *varis-han*).

(c) *Syntactic category allegiance*. Finnish clitics can have as their hosts a wide range of word classes, including not only nouns (like *artikkeli-kin* or *Matti-han*) but also e.g. verbs (*tekee-hän* ‘does’-*hAn*), adjectives (*kylmä-hän* ‘cold’-*hAn*), adverbs (*kauniisti-han* ‘beautifully’-*hAn*) as well as functional categories like adpositions (*taa-kse-han* ‘behind-to’-*hAn*) and interrogative pronouns (*missä-hän* ‘where’-*hAn*).

(d) *Resistance to formal fusion*. Finnish clitics are agglutinative, also as regards their own form (see (b), above, for the leftward morphemes), allowing for the phonological adjustment of vowel harmony only, while case, for instance, fuses with number in several inflectional forms (e.g., gen.pl. *-jen* in *talo-jen* ‘houses-GEN:PL’, derived from the underlying string *talo-i-en*). The nominative singular *-hAn* forms of the last names of the present authors are *Niemi-hän*, *Laine-han* and *Järvikivi-hän* (compare with the genitive singulars *Nieme-n-hän* and *Lainee-n-han*, and *Järvikive-n-hän*). In native Finnish non-compound lexicon, the front-back vowel harmony, which accommodates /ü ö ä/ and /u o a/ to the front-back specification of the word, does not cross phonological word boundaries. Accordingly, the fact that

vowel harmony — here /A/ realized as /a/ or /ä/ — also operates across the clitic boundaries indicates that cliticized words in Finnish are phonological words.

Given the fundamental structural differences between inflected and cliticized forms (i.e., between lexeme-category inherent paradigmatic morphology and non-paradigmaticity) discussed above, a corresponding processing difference in speaker-hearers of Finnish may arise. Accordingly, we searched for evidence for a processing difference between paradigmatic (case-inflection) and extraparadigmatic morphology. To ensure better validity, we employed three independent sources of evidence. First, we examined single-word and non-word reading errors in an agrammatic deep dyslectic Finnish speaker for differences in the processing of cliticized versus inflected words. Given the abolishment of this patient's grapheme-to-phoneme reading route as well as the practically total lack of phonological errors, any morphological effects in reading should reflect the functions of the direct lexical processing route. Second, we collected data on normal on-line lexical processing by administering a simple visual lexical decision task of case-inflected and cliticized nouns to neurologically intact Finnish-speaking adults. Finally, we carried out an off-line rating task investigating native speaker judgments on the relative wordness of cliticized and inflected words as well as on their learnability as non-native language (L2) word forms.

Since clitics as a linguistic category is a heterogeneous concept (see above), we assume that on-line processing of cliticized strings also differs depending on the type of clitic (cf. E. *I'll < I will*, Fr. *t'aime* and Fi. *Mattihan*, above). Finnish clitics differ from the so-called simple and verbal clitics in a fundamental way: the Finnish bound word clitics occupy an inherent slot in the morphotactic structure of Finnish nouns and verbs as the possible terminal element(s) of these words. However, these enclitic endings are not paradigm-assigners in the way that the categories preceding them are (Karlsson, 1985). Thus, whatever our present empirical findings may be, we would not like to extend them to cover the heterogeneous category of clitics. Rather, we would like to restrict our claims to the domain of extraparadigmatic (inflectional) morphology.

### Experiment 1: Single-word reading in an agrammatic deep dyslectic Finnish-speaking patient

#### *Method*

*Subject.* HH is a right-handed Finnish-speaking male with primary school education. He acquired hemiparesis and aphasia following subarachnoidal haemorrhage and subsequent brain infarction in December, 1985. His CT scan revealed a

large fronto-temporo-parietal lesion that had an unusual lesion distribution: The frontal part of the lesion was mostly medial while the temporo-parietal part extended also to lateral cortical areas. Broca's area was intact while Wernicke's area was partially damaged. Four years post onset, his performance profile on the standardized Finnish version of the Boston Diagnostic Aphasia Examination (*BDAE*, Laine et al., 1993) was compatible with Broca's aphasia. His speech output was severely non-fluent and agrammatic but without dysarthria. HH's spontaneous speech samples were free from morphological errors. He caught our attention due to the high number of morphological errors (substitutions and omissions of bound grammatical morphemes) that he made in reading aloud single inflected words. His word repetition skills were intact. When compared to the normative aphasia sample of the Finnish *BDAE*, HH's mean value of the four Auditory Comprehension subtests was on the 66th percentile. The corresponding value on the five Reading Comprehension subtests was 53. He was so severely agraphic that his writing could not be studied in any detail.

HH's ability to read words was extensively studied over a long period of time, from 4 to over 10 years post onset (Laine, Niemi, Koivuselkä-Sallinen, & Hyönä, 1995; Laine & Niemi, 1997; Mäkisalo, Niemi, & Laine, 1999; Niemi, Laine, & Tuominen, 1994). Clinically, his condition remained stable, and six-year follow-up data reported in Laine and Niemi (1997) indicated an essentially unchanged, severe deficit in reading. His reading of familiar words was prone to morphological, visual and occasionally also to semantic errors. Phonological paraphasias were practically absent. Nonword reading was impossible. HH's reading disorder was thus identified as deep dyslexia, and his remaining reading abilities were assumed to reflect the functions of the direct (lexical) reading route.

Experimental single-word reading tasks revealed HH's sensitivity to morphological structure. First of all, he exhibited disproportionate difficulty in processing inflected words. For example, in a single-word reading task reported by Laine et al. (1995), HH read aloud correctly 214/290 (74%) uninflected nouns while with inflected nouns, his success rate dropped to 40/290 correct (14%). In addition, compounds caused problems for HH: Mäkisalo et al. (1999) found that in the reading of two-member Finnish noun+noun compounds (like *eläin+tarha* lit. 'animal+garden', i.e., 'zoo') HH could read correctly somewhat less than half of the items. In contrast, HH's performance on derived nouns has been comparable to that on matched simplex nominative singular nouns (Laine & Niemi, 1997; Laine et al., 1995).

*Stimulus materials and procedures.* For the present study we administered a single-word reading task to HH. We selected 55 cliticized real nouns, 34 case-inflected nouns and 45 monomorphemic (nominative singular) nouns from the

unpublished *Turun Sanomat* newspaper lexical database (comprising 22.7 million word tokens) using the WordMill lexical search program (Laine & Virtanen, 1999). The three groups were matched for average lemma frequency (Cliticized — 19.8; Inflected — 20.0; and Monomorphemic — 17.0; per million words, respectively;  $F(2, 131) < 1 = 0.846$ ). In addition, the cliticized and inflected nouns were matched for surface frequency (0.1 per million for both item lists), length in letters (8.5 and 8.4, respectively), and number of syllables (3.1 for both item lists). The monomorphemic nouns were 6.5 letters in length and had the surface frequency of 3.3 words per million. Since it was impossible to match the monomorphemic items in terms of surface frequency and length, the critical comparison in the present study is between the inflected and the cliticized words. The monomorphemic words were included primarily in order to assess HH's overall reading performance with respect to his performance in the previous studies. The items were presented to HH in random order and he was asked to read aloud each item without any time pressure. When more than one response was given, only the first one was used in the present analysis.

### *Results and discussion*

With respect to monomorphemic and case-inflected nouns, HH's performance dissociation in the present study was in line with his previous performance: He read correctly 71% (32/45) of the monomorphemic nouns, whereas his performance dropped drastically with the inflected nouns, where he succeeded only once (1/34). Whereas HH's reading performance with monomorphemic nouns is comparable with the previous results (see, e.g., Laine et al., 1995), his performance was markedly worse in the case-inflected nouns. The most likely reason for this was the low surface frequency of the inflected items used in the present study, dictated by low frequencies of cliticized noun forms with which they were matched.

The results from the cliticized words give rise to following observations:

(a) *Clitics Never Appear as a Response Category to Any Stimulus.* HH never succeeds in reading a clitic correctly (0 correct out of 55 cliticized nouns, see Table 1). What is also even more noteworthy is that although he tends to produce incorrect morphological material after the stem in suffixed words and in the second constituent position of two-member compounds, the thousands of errors produced by him through the years in various single-item reading tasks have *never* produced a clitic as the response category, whether correct or incorrect. This was also true for the present clitic reading task. In stark contrast, all other morphological structures have, however, been represented in his incorrect trans-category responses (e.g., derivation → case-inflection in *puhu-ja* 'speak-er' > *puhe-tta* 'speech-PAR');

**Table 1.** Nominative Singulars Produced by HH in Response to Case-Inflected and Cliticized Real Word Items

	Correct	Nom.sg	Total number of items	% Nom.sg
Case-inflected	1	17	34	51.1
Cliticized	0	9	55	16.4

case-inflection → derivation in *kuva-sta* ‘picture-ELA’ > *kuva-us* ‘picture-tak-ing, film-ing’; case-inflection → compound in *nukke-na* ‘doll-ESS’ > *nukke-talo* ‘doll-house’), in addition to his confusions within a morphological type such as case substitutions, which are typical of agrammatic output in inflectionally rich languages (see Menn & Obler, 1990, for agrammatic speech output in languages with different morphological typologies, and Niemi, Laine, Hänninen, & Koivuselkä-Sallinen, 1990, for agrammatic morphology in Finnish narratives).

(b) *Case-inflected Nouns Produce More Nominative Singular Errors Than Do Cliticized Nouns.* For the cliticized nouns, HH produced nine nominative singular substitutions out of the 55 errors (16.4%) whereas for the case-inflected nouns this tendency was clearly more pronounced, resulting in 17 nominative singular substitutions out of 33 errors (51.1%) (Yates corrected  $\chi^2 = 10.61$ ,  $p < .01$ ). The nominative singular tendency is thus higher in the paradigmatic than in the extra-paradigmatic type, although it is the extra-paradigmatic clitic categories that are accompanied by *no* formal changes in the stem.

Finally, in errors like *avaimen* ‘key-ILL’ > *avain* ‘key:NOM.SG’ and *ötökkä-kö* ‘bug-QUESTION CLITIC’ > *ötökä-t* ‘bug-s’, in which HH replaces the stem allomorph in his incorrect responses into forms that are nevertheless correct morphological formations of the target lexemes. These errors show that HH is not merely stripping off the suffixes but using his knowledge of the respective paradigms. We return to this issue in the Discussion when seeking an account for his tendency to produce more nominative singular errors for the paradigmatic (case-inflected) than for the extra-paradigmatic (cliticized) stimulus words.

## Experiment 2: Lexical decision experiment with case-inflected and cliticized nouns

### *Background*

In order to corroborate that HH’s “avoidance behavior” with cliticized forms reflects a processing difference between paradigmatic and extra-paradigmatic morphology even in a normal Finnish speaker’s mental lexicon, we carried out a vi-

sual lexical decision experiment comparing the recognition of case-inflected and cliticized nouns. The fact that HH's morphological deficit appears to stem from a central-level disorder, rather than from a form-based morphological segmentation problem (Laine *et al.*, 1995), suggests that the case-inflected and cliticized words would differ in terms of their lexical representation. If HH's extraordinary difficulties with cliticized forms reflect an underlying feature present in any normal Finnish speaker, we would expect a processing cost for the cliticized compared to the inflected nouns, surfacing up as longer decision latencies and higher error rates for the former type of words. If, however, HH's reading performance is due to accidental properties of his damaged language processor, we should observe no systematic difference between these word types in lexical decision with normal subjects.

### *Method*

*Participants.* Nineteen students from the University of Joensuu were paid a nominal fee for participating in the experiment. All were native speakers of Finnish and had normal or corrected-to-normal vision.

*Materials.* Twenty nouns with case inflection and twenty nouns with clitics were selected from the unpublished *Turun Sanomat* newspaper lexical database comprising 22.7 million word tokens, using the WordMill lexical search program (Laine & Virtanen, 1999). The stimulus list with case inflection consisted of frequent Finnish nouns with no stem modifications, e.g. *kypärä-ttä* 'helmet-ABESSIVE'. The members of the cliticized set, in turn, included frequent Finnish nouns followed by one of the clitics *-kAAn*, *-kin*, *-kO*, or *-hAn* (five items per clitic type), e.g. *joutsen-ko* 'a swan'- QUESTION CLI. The two sets were matched for average lemma frequency (13.2 and 12.9 per million), surface frequency (0.07 and 0.05 per million), number of syllables (3.2 for both lists), length in letters (8.4 and 8.2), bigram frequency (1118 and 1103), and suffix trigram frequency (382 and 312). Two non-word blocks with corresponding inflectional suffixes or clitics were included, constructed by changing one to three letters from the beginning of frequent Finnish nouns without violating the phonotactic rules of Finnish. An additional list of 60 filler words was selected from the same frequency range as the target sets. The filler list consisted of 37 monomorphemic and 23 derived nouns. The filler list also had a corresponding non-word list constructed as above. Thus, the stimulus list included altogether 200 items (100 words, 100 nonwords).

*Procedures.* A simple visual lexical decision task was administered using a Macintosh Power PC running PsyScope 1.2. The subjects were to decide whether a word



appearing on the screen was a Finnish word or not by pushing the corresponding ‘yes’ or ‘no’ buttons on the button box. Each word was preceded by a fixation point appearing at the center of the screen for 500 ms. After the fixation point disappeared, a word appeared at the center of the screen in black lowercase Chicago 24 point letters on a light gray background. Two hundred items were presented in total, and the order of presentation was randomized for each subject. Response time-out was set at 2000 ms. Each session was preceded by 20 practice trials. Additional 10 trials preceded the first experimental item in each session.

### *Results and discussion*

Table 2 summarizes the results from the lexical decision experiment. Prior to data analysis, erroneous responses as well as responses more than three standard deviations below or above the individual mean were excluded. Pair-wise comparisons (a paired samples two-tailed *t*-test for subjects and an independent samples two-tailed *t*-test for items) between inflected and cliticized words revealed that the latter type of stimuli elicited significantly longer reaction times in both the subject analysis,  $t_1(18) = 6.77, p < 0.001$ , and in the item analysis,  $t_2(38) = 2.80, p < 0.01$ . Analyses on the errors showed a similar pattern,  $t_1(18) = 3.14, p < 0.01$ ;  $t_2(38) = 2.22, p < 0.05$ .

**Table 2.** Mean Reaction Times (in ms) and Error Percentages in the Lexical Decision Task

	RT (SD)	Errors (SD)
Case-inflected nouns	660 (182.0)	2.6 (3.8)
Cliticized nouns	781 (210.7)	6.8 (5.7)

The results from the lexical decision experiment indicate a clear-cut processing cost for cliticized nouns as compared to otherwise matched case-inflected nouns. This is in line with the oral reading results obtained from HH that suggested an additional processing difficulty with cliticized forms as compared to inflected forms.

Furthermore, the present results are in line with the view that the observed difference would stem from an underlying difference in how inflected and cliticized words are represented, and, therefore, a more general difference in the mental lexicon. More generally, they point to a difference in the mental representation of paradigmatic and extraparadigmatic morphology. However, it is also possible that there is a simpler explanation for the result: instead of reflecting a representational difference, the results may (at least partly) stem from the fact that the present type of clitics tend to be semantically less salient and often contextually and pragmatically motivated. As a result, without the appropriate sentence and dis-

course context cliticized words may simply be harder to categorize as words than inflected words, which fact, in turn, would show in prolonged decision latencies and elevated error rates for the former items. The following experiment inquired into this possibility with off-line rating tasks.

### Experiment 3: Subjective wordness and L2-learnability ratings

#### *Background*

In order to test whether a lower perceived lexicality could account for the results of Experiment 2, we ran an off-line rating experiment with new participants. The participants evaluated a set of monomorphemic, inflected and cliticized forms sharing the same stem with respect to both their relative acceptability as Finnish words. If the cliticized and inflected items differ on this measure, wordness may have affected the lexical decision results. Moreover, in this task the participants also evaluated the relative difficulty that these items would present to a non-native learner of Finnish.

Based on L1 acquisition data (e.g., Toivainen, 1980; Niemi & Niemi, 1987) and the grammatical status of cliticized forms as phonological words, one would expect that naïve native Finnish speaker-hearers would also regard cliticized words as “words” in the wordness ratings, on a par with the case-inflected forms. However, as the cliticized words — here presented in isolation — are rich in their semantics, requiring meaning interpretation at the syntactic and/or discourse level (depending on the type clitics and its host), we will also predict that the L2 learnability ratings would be lower for the cliticized words than for the case-inflected ones. This assumption is also based on the fact that we know of no other language that would have translation equivalents to the Finnish clitics. Thus, it is also hypothesized that naïve Finnish speakers know that these complex forms lack lexical translation equivalents in most (all?) languages.

#### *Method*

*Participants.* Sixteen students from the University of Turku volunteered for the experiment. All were native speakers of Finnish.

*Materials and procedure.* Fifty-four of the fifty-five cliticized words used in the single-word reading experiment (above) were selected by randomly dropping one of the items, and for each one both a monomorphemic and case-inflected counterpart was selected. The resulting three sets of words were counterbalanced across

three lists. Additional 55 filler items consisting of derived and compound words were added to each list. Three filler items preceded the first experimental item.

The materials were presented to the participants in a pseudosemi-randomized order as a paper-and-pencil task on an experimental sheet. In this two-part task, the participants rated each item separately on a five-point scale for both wordness and subjective L2-learnability: They were instructed to rate each word according to (a) how acceptable a Finnish word they thought a particular item was (5 categories, ranging from 1 = *a very bad item as a Finnish word* to 5 = *a very good item as a Finnish word*), and (b) how easy/difficult they felt a particular word would be to learn for a person learning Finnish as a second/foreign language (5 categories, ranging from 1 = *a very difficult item to learn* to 5 = *a very easy item to learn*), respectively.

### Results and discussion

For the statistical analyses subject and item means were calculated (Table 3). Analyses of variance with Task Rating (wordness, L2-learnability) and Word Type (monomorphemic, inflected, cliticized) as within-participant (F1) and item (F2) factors revealed significant main effects of both Task Rating,  $F_1(1, 15) = 20.41$ ,  $p < .001$ ;  $F_2(1, 53) = 145.55$ ,  $p < .001$ , and Word Type,  $F_1(2, 30) = 34.50$ ,  $p < .001$ ;  $F_2(2, 106) = 220.55$ ,  $p < .001$ , as well as a significant interaction,  $F_1(2, 30) = 21.87$ ,  $p < .001$ ;  $F_2(2, 106) = 66.48$ ,  $p < .001$ . Separate ANOVAs for the wordness and learnability ratings showed significant effects of Word Type for both (all  $F_s > 15.00$ ,  $p_s < .001$ ). Subsequent  $t$ -tests showed that in both experiments monomorphemic words received significantly higher ratings than either inflected or cliticized words ( $t_s > 2.80$ ,  $p_s < .01$ ). However, whereas the observed difference in scores between the inflected and cliticized words was not statistically significant in the wordness rating ( $t_s < 1.42$ ,  $p_s > .16$ ), the cliticized words were rated significantly more difficult to learn than the inflected words,  $t_1(15) = 2.89$ ,  $p = .011$ ;  $t_2(53) = 3.43$ ,  $p < .001$ .

The results obtained from the wordness and L2-learnability indicate that although Finnish cliticized words are rated more difficult to learn as items in a non-

**Table 3.** Mean Subjective Ratings for Wordness (1 = very bad, 5 = very good) and L2-Learnability (1 = very hard to learn, 5 = very easy to learn)

	Wordness (SD)	L2-learnability (SD)
Monomorphemic	4.38 (.70)	4.12 (0.80)
Inflected	3.74 (.75)	2.81(0.76)
Cliticized	3.66 (.78)	2.53 (0.86)

native language, they are regarded as “words” by linguistically naive native speakers of the language to the same degree as are case-inflected forms.

## Discussion

We set out to explore the psychological reality of the distinction between paradigmatic and extraparadigmatic morphology using neurolinguistic and psycholinguistic data. The oral reading results obtained from our morphologically impaired deep dyslectic patient indicate severe difficulties with inflected nouns, but even worse performance with cliticized items as he did not produce even a single cliticized form in his oral reading responses, be they correct or incorrect as response types. The patient’s extraordinary difficulty with cliticized forms in output was corroborated with the lexical decision results with normal speakers of Finnish who exhibited markedly longer reaction times and higher error rates with cliticized than with otherwise matched case-inflected items. Finally, the off-line rating experiment suggested that the cliticized items are not harder to recognize because of lower perceived wordness. Rather, they are apparently conceptually more demanding, as indicated by their lower values on the L2-learnability rating.

Certain qualitative aspects of our patient’s performance deserve further discussion. Similar to his performance with case-inflected and derived words and with compounds, HH showed awareness of the existence the post-stem material presented to him also in nouns appended with a clitic, since he often attempted to fill in the post-stem morphological slot with some morphological material (but never with a clitic). Thus, these recurrent instances show that he attempted to access his morpholexical store. However, he never succeeded in producing a clitic to any real word stimuli of *any* morphological configuration, while all the other morphological structures appear in the incorrect (and correct) responses.

HH also tends to produce more nominative singular responses to case-inflected nouns than to cliticized nouns. This nominative singular tendency may at first seem paradoxical, since it could be argued that the extraparadigmatic material of the cliticized forms could merely be deleted, since they, for instance, never trigger morphophonological changes in the stem. However, HH’s nominative singular responses to inflected forms with stem changes indicate that he is outputting *real* nominative forms produced within the paradigm of the target lexeme, and not non-freestanding stem forms that would be the result of mere stripping the bimorphemic form of its post-stem material. Also in errors like *ötökkä-kö* ‘a bug’-QUESTION CLI > *ötökä-t* ‘bugs’ he has to choose the correct weak stem *ötökä-* instead of the strong grade stem *ötökkä-* to accommodate the former to the following inflectional category marker (*-t* of NOM.PL.). Note that the crucial observation here

is that the nominative singular stem is identical to the strong grade stem *ötökkä-*, and a “stripping and adding” solution should produce \**ötökkä-t*. Since all the available data speak for on-line composition of *case-inflected* nouns like *ötökät* in Finnish (e.g., Järvikivi & Niemi, 2002; Järvikivi, Pyykkönen, & Niemi, 2009; Laine et al., 1995, Niemi et al., 1994), we are left with the conclusion that HH actively uses *paradigmatic* information in his responses to these single-word stimuli. Now, accepting our line of argumentation this far, the superficial paradox of having more nominative singular errors in case-inflected forms than in cliticized nouns is solved: this asymmetry would be expected, *if* case markers were more closely associated with their stems than the clitic(s). In other words, this pattern is expected if case markers were indexed to their lexical hosts in the mental morphology/lexicon network, or *if* they, but *not* the clitics, were part of the target paradigms. In addition, since clitics never appear as an error category (or as any response for that matter) in the single-word reading tasks with HH, while inflectional categories typically do, we may claim that HH’s data do manifest a behavioral partition between paradigmatic inflection and extraparadigmatic suffixation (i.e., cliticization).

One might object that the observed difference could be due to the inflected nouns having been processed via whole word representations and — due to their extremely low token frequencies — the cliticized words would have undergone more time-consuming morphological decomposition. This is unlikely, however, for several reasons: First, the noun stems that we used were relatively frequent familiar Finnish words, whereas the surface frequency of the target word forms was extremely low, only .07 and .05 occurrences in million words in the lexical decision task and 0.1 in HH’s reading experiment. This is way below the limits that have been suggested as the minimum frequency of occurrence for an inflected full form to develop a whole word representation (see Gordon & Alegre, 1999). Second, it has been repeatedly shown that in visual lexical decision Finnish inflected words induce longer reaction times and higher error rates than matched monomorphemic words in much higher frequency ranges than the present ones (Bertram, Laine, & Karvinen, 1999; Niemi, Laine, & Tuominen, 1994; Hyönä, Vainio, & Laine, 2002), suggesting that most inflected words in the Finnish language are processed via their morphemic constituents. In fact, recent studies indicate that the surface frequencies needed for the development of full forms of inflected items in Finnish are much higher than those for inflectionally more limited languages, such as English and Swedish (Lehtonen & Laine, 2003; Lehtonen, Niska, Wande, Niemi, & Laine, 2006; Soveri, Lehtonen, & Laine, 2007).

In sum, we conclude that converging evidence from the reading performance of a morphologically impaired deep dyslectic as well as from the lexical decision and off-line rating results with normal adult subjects point to a processing differ-

ence between cliticized and inflected nouns, and, thus, to a difference between paradigmatic and extraparadigmatic morphology in the Finnish mental lexicon.

## Notes

1. Perhaps somewhat atypically, Finnish case-markers can be attached to adpositions (e.g., *taa-kse* 'behind-to' *taka-na* 'behind-at') and infinitives (*istu-ma-ssa* 'sit-INF-INE', *istu-ma-sta* 'sit-INF-ELA'). The adpositions are, however, typically transparently noun-derived (e.g., *taka* 'back', like in *taka-osa* 'back-part') and they often behave syntactically in a noun-like fashion (*minun taa-kse-ni* 'my back-to'-POSS:1p sg, cf. *minun auto-kse-ni* 'my car-to'-POSS: 1p sg).
2. The following abbreviations may not be self-explanatory: ABE abessive, ADE adessive, CLI clitic, ELA elative, ESS essive, INE inessive, PAR partitive.

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