# Frequencies of form function correlates in the Dutch verb inflection system

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# FREQUENCIES OF FORM-FUNCTION CORRELATES IN THE DUTCH VERB INFLECTION SYSTEM

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## Introduction

Within the framework of a larger investigation carried out by the first author, concerning the role of morphological characteristics in the reading process, the need arose for statistical data on the frequencies of occurrence of the various verb inflections in Dutch.
It is supposed that suffixes and other types of inflections exert a facilitating influence on the psychological processing of coherent written material. Investigation of the Anglo-American literature reveals that such an effect is most likely to be expected with inflections of verbs (Gladney and Kralee 1967; Greenberg 1970; Wanat 1971), and that verb inflections may operate as perceptually isolatable units (Gibson and Guinet 1971). As in the case of words it has been claimed for inflections that their recognizability is partly dependent on the frequency of occurrence in language use (Murrell and Morton 1974).
Verb inflections are usually related to other elements in the sentence by such linguistic phenomena as tense concord, person and number concord, auxiliary-participle dependence. This implies redundancy/predictability on both syntactic and semantic levels. It is a well documented fact that the more redundant structures are, the more easily they are processed by human beings.
Morphemes, and by implication verb inflections, are the smallest linguistic units combining syntactic and semantic

information. For lack of a better theory we have limited ourselves to identifying grammatical meanings of morphemes with such traditional concepts as person, number, tense, mood, voice, etc., which are called "notions" (Lyons, 1968: 174).

In the present investigation we have tried to answer the following questions :

(1) what inflectional categories (in the taxonomic sense of the word) can be distinguished in the Dutch verb system (*forms*)

(2) what are the grammatical meanings (*functions*) that can be carried by verb inflections

(3) *how many* different functions are carried per inflectional category (theoretical redundancy)

(4) *how often* does a particular inflection carry a particular function (empirical redundancy).

## 1. Inventory of verb inflections

We have mechanistically defined a verb inflection form as any letter combination that remains of a verb form after the verb stem has been deleted. In principle a verb stem is a set of letter strings obtained by removing -EN from a Dutch infinitive[3], and possibly one derived string.

This derivation process is mediated by three ordered rules, which draw on orthographic and phonological information :

(1) a single stressed vowel is geminated before maximally one consonant symbol

(2) one of two identical final consonant symbols is deleted

(3) Z → S and V → F in final position

Any regular form of a Dutch verb may be described as an appropriate concatenation of an element in the stem set and one or more elements in the affix set.

In an attempt to keep the number of inflectional types to be counted within reasonable bounds we have restricted the inventory to only those affixes that can in principle signal the *verbal* use of a weak verb. By this token GE-DSTE is not

a relevant affix, even if the verb form GE*LIEF*DSTE (most beloved) exists, as the form itself can only be used adjectivally or nominally. Similarly the suffix -END is excluded, because it only signals the present participle, which can only be used as an adjective.
On the basis of the criteria 13 suffixes or combinations of prefix, infix[4] and/or suffix have been identified, and are given in table I.

| number | specification | examples | analysis | gloss |
|---|---|---|---|---|
| (1) | ---Ø | loop | loop+Ø | walk |
| (2) | ---e | leve | leef+e | live |
| (3) | ---n | zien | zie+n | see |
| (4) | ---en | leven | leef+en | live |
| (5) | ---t | leeft | leef+t | lives |
| (6) | ---d | beloofd | beloof+d | promised |
| (7) | ---te | maakte | maak+te | made |
| (8) | ---de | vreesde | vrees+de | feared |
| (9) | ---ten | maakten | maak+ten | made |
| (10) | ---den | vreesden | vrees+den | feared |
| (11) | ge---Ø | gezwicht | ge+zwicht+Ø | yielded |
| (12) | ge---t | gekucht | ge+kuch+t | coughed |
| (13) | ge---d | gevreesd | ge+vrees+d | feared |

TABLE I· REGULAR FORM CLASSES

Ambiguous affix combinations may arise in two fundamentally different ways :
(1) two different stems collocated with two different affixes may yield identical surface forms :
KRUIDEN (to season) GE + *KRUID* + Ø GEKRUID (a.o. past partc.)
KRUIEN (to push a wheel barrow) GE + *KRUI* + D GEKRUID (past partc.)
(2) two different affixes collocated with two different spellings of the same stem may yield identical surface forms :

BEZETTEN (to occupy) *BEZET* + TEN [5] (past tense)
*BEZETT* + EN (a.o. present plural)

To accomodate most of these phenomena 9 ambiguous affix classes were introduced, each being the intersection of two regular form classes (Table II). For the sake of conciseness we have avoided the inclusion of form classes involving intersections of three or more regular affix classes. In order

to obtain an estimate of the proportion of regular forms as opposed to irregular forms, a rest category was added comprising strong and irregular uses of verbs.

| number | specification | examples |
|---|---|---|
| (14) | ---e/---te | bezette |
| (15) | ---e/---de | verwedde |
| (16) | ---en/---ten | zetten |
| (17) | ---en/---den | schudden |
| (18) | ---Ø/---t | dorst |
| (19) | ---Ø/---d | verspeld |
| (20) | ---Ø/ge---Ø | getroost |
| (21) | ---t/ge---t | geraakt |
| (22) | ---d/ge---d | gebaard |
| (23) | ge---Ø/ge---t | gedorst |
| (24) | ge---Ø/ge---d | gespeld |
| | analysis (1) | gloss (1) |
| | bezett + e | occupied (adj) |
| | verwedd + e | bet (adj) |
| | zett + en | put (inf) |
| | schudd + en | shake |
| | dorst + Ø | thirsts |
| | verspeld + Ø | pinned on in a different place |
| | getroost + Ø | spared |
| | geraak + t | gets |
| | gebaar + d | gesticulated |
| | ge + dorst + Ø | thirsted |
| | ge + speld + Ø | pinned |
| | analysis (2) | gloss (2) |
| | bezet + te | occupied (pret) |
| | verwed + de | bet (pret) |
| | zet + ten | put (pret) |
| | schud + den | shook |
| | dors + t | threshes |
| | verspel + d | spelled wrongly |
| | ge + troost + Ø | comforted |
| | ge + raak + t | hit (partc) |
| | ge + baar + d | given birth |
| | ge + dors + t | threshed |
| | ge + spel + d | spelled |

TABLE II: AMBIGUOUS FORM CLASSES

## 2. Inventory of grammatical meanings

It was decided that the function category was to be exhaustive in the sense that every traditionally known grammatical meaning that can be carried by the set of affixes defined above had to be incorporated. Finite and non-finite functions will be dealt with separately.
The notions applicable to Dutch finites are : *person* (1st, 2nd, 3rd), *number* (sing., plur.), *tense* (present, past) and *mood* (ind., imp., opt.).
A full specification of these notions is given in table III.

| number | function | abbreviation |
|---|---|---|
| (1) | 1st person singular present tense | 1 pres sing |
| (2) | 2nd person singular present tense | 2 pres sing |
| (3) | 3rd person singular present tense | 3 pres sing |
| (4) | 1st person plural present tense | 1 pres plur |
| (5) | 2nd person plural present tense | 2 pres plur |
| (6) | 3rd person plural present tense | 3 pres plur |
| (7) | 1st person singular past tense | 1 past sing |
| (8) | 2nd person singular past tense | 2 past sing |
| (9) | 3rd person singular past tense | 3 past sing |
| (10) | 1st person plural past tense | 1 past plur |
| (11) | 2nd person plural past tense | 2 past plur |
| (12) | 3rd person plural past tense | 3 past plur |
| (19) | imperative singular | imp sing |
| (20) | imperative plural | imp plur |

TABLE III: GRAMMATICAL FUNCTIONS FOR FINITES[10)]

There is a certain amount of redundancy in the notion system : for instance, an imperative is unmarked for tense and is always second person. Optatives will always be considered as present tenses, ignoring such archaic past tense optative as WARE (were).
It is characteristic of non-finites that they can appear as various parts of speech : within the limitations imposed in section I we distinguish verbal, adjectival, nominal and adverbial use of past participles. Infinitives are divided into a verbal and a nominal category (Table IV). At the side of the nominal infinitive the iterative nominal was in-

corporated in the inventory : LOPEN (walking), GELOOP (the repeated act of walking).

| number | function | | | abbreviation |
|---|---|---|---|---|
| (21) | infinitive | verbally | used | inf verb |
| (22) | infinitive | nominally | used | inf nom |
| (24) | past participle | verbally | used | partc verb |
| (25) | past participle | adjectivally | used | partc adj |
| (26) | past participle | nominally | used | partc nom |
| (27) | past participle | adverbially | used | partc adv |

TABLE IV: GRAMMATICAL FUNCTIONS FOR NON-FINITES[10)]

## 3. The number of form-function correlates

For reasons to be explained later, function classes 13-18 (the optatives) and 23 (iterative) have been left out of further consideration. We shall now examine the theoretical distribution of form-function correlates, i.e. which of the 20 relevant functions can theoretically be expressed by each of the 25 form classes. These data are given in table $V^6$. The table contains 25 subtables, one for each form class, and specifies among other things the functions applicable and their number. Within the regular form classes the number of functions performed ranges between 2 and 9. The ambiguous form classes cover (as a consequence of their definition) the union of the functions carried by their constituent form classes.

The rest category has 16 functions. It may perhaps strike the reader that certain functions must always be expressed by a regular form class. The explanation, however, is quite simple : the regular form classes are based on the verb stem which in turn is defined as infinitive minus -(E)N. Infinitives will therefore always be regular. 1 and 3 pres. plur. are characterised by the same formal means as infinitives.

formclass (1): —Ø

| functions | absfr | relfr |
|---|---|---|
| 1 pres sing | 2327 | 2.23 |
| 2 pres sing | 812 | .78 |
| 3 pres sing | 1583 | 1.51 |
| 2 pres plur | 0 | .00 |
| imp sing | 693 | .66 |
| imp plur | 0 | .00 |
| partc verb | 366 | .35 |
| partc adj | 27 | .03 |
| partc adv | 10 | .01 |
| | 5818 | 5.57 |

formclass (2): —E

| functions | absfr | relfr |
|---|---|---|
| partc adj | 65 | .06 |
| partc nom | 6 | .01 |
| | 71 | .07 |

formclass (3): —N

| functions | absfr | relfr |
|---|---|---|
| 1 pres plur | 330 | .32 |
| 2 pres plur | 16 | .02 |
| 3 pres plur | 2420 | 2.32 |
| imp plur | 0 | .00 |
| inf verb | 3064 | 2.93 |
| inf nom | 119 | .11 |
| | 5949 | 5.69 |

formclass (4): —EN

| functions | absfr | relfr |
|---|---|---|
| 1 pres plur | 1382 | 1.32 |
| 2 pres plur | 58 | .06 |
| 3 pres plur | 5550 | 5.33 |
| imp plur | 3 | .00 |
| inf verb | 16885 | 16.15 |
| inf nom | 1195 | 1.14 |
| | 25083 | 24.00 |

formclass (5): —T

| functions | absfr | relfr |
|---|---|---|
| 2 pres sing | 995 | .95 |
| 3 pres sing | 10987 | 10.51 |
| 2 pres plur | 0 | .00 |
| imp plur | 101 | .10 |
| partc verb | 445 | .43 |
| partc adj | 27 | .03 |
| partc adv | 66 | .06 |
| | 12621 | 12.07 |

formclass (6): —D

| functions | absfr | relfr |
|---|---|---|
| partc verb | 1432 | 1.37 |
| partc adj | 123 | .12 |
| partc adv | 119 | .11 |
| | 1674 | 1.60 |

formclass (7): —TE

| functions | absfr | relfr |
|---|---|---|
| 1 past sing | 95 | .09 |
| 2 past sing | 12 | .01 |
| 3 past sing | 1047 | 1.00 |
| 2 past plur | 0 | .00 |
| partc adj | 78 | .07 |
| partc nom | 4 | .00 |
| | 1236 | 1.18 |

formclass (8): —DE

| functions | absfr | relfr |
|---|---|---|
| 1 past sing | 299 | .29 |
| 2 past sing | 50 | .05 |
| 3 past sing | 2583 | 2.47 |
| 2 past plur | 0 | .00 |
| partc adj | 341 | .33 |
| partc nom | 30 | .03 |
| | 3303 | 3.16 |

formclass (9): –TEN

| functions | absfr | relfr |
|---|---|---|
| 1 past plur | 48 | .05 |
| 2 past plur | 0 | .00 |
| 3 past plur | 284 | .27 |
| | 332 | .32 |

formclass (10): –DEN

| functions | absfr | relfr |
|---|---|---|
| 1 past plur | 66 | .06 |
| 2 past plur | 0 | .00 |
| 3 past plur | 609 | .58 |
| | 675 | .65 |

formclass (11): GE–Ø

| functions | absfr | relfr |
|---|---|---|
| partc verb | 716 | .68 |
| partc adj | 55 | .05 |
| partc adv | 18 | .02 |
| | 789 | .75 |

formclass (12): GE–T

| functions | absfr | relfr |
|---|---|---|
| partc verb | 936 | .90 |
| partc adj | 46 | .04 |
| partc adv | 8 | .01 |
| | 990 | .95 |

formclass (13): GE–D

| functions | absfr | relfr |
|---|---|---|
| partc verb | 3353 | 3.21 |
| partc adj | 197 | .19 |
| partc adv | 65 | .06 |
| | 3615 | 3.46 |

formclass (14): –E/–TE

| functions | absfr | relfr |
|---|---|---|
| 1 past sing | 5 | .00 |
| 2 past sing | 2 | .00 |
| 3 past sing | 71 | .07 |
| 2 past plur | 0 | .00 |
| partc adj | 13 | .01 |
| partc nom | 1 | .00 |
| | 92 | .09 |

formclass (15): –E/–DE

| functions | absfr | relfr |
|---|---|---|
| 1 past sing | 0 | .00 |
| 2 past sing | 0 | .00 |
| 3 past sing | 22 | .02 |
| 2 past plur | 0 | .00 |
| partc adj | 12 | .01 |
| partc nom | 0 | .00 |
| | 34 | .03 |

formclass (16): –EN/–TEN

| functions | absfr | relfr |
|---|---|---|
| 1 pres plur | 22 | .02 |
| 2 pres plur | 2 | .00 |
| 3 pres plur | 124 | .12 |
| 1 past plur | 2 | .00 |
| 2 past plur | 0 | .00 |
| 3 past plur | 12 | .01 |
| inf verb | 344 | .33 |
| inf nom | 16 | .02 |
| | 522 | .50 |

formclass (17): –EN/–DEN

| functions | absfr | relfr |
|---|---|---|
| 1 pres plur | 2 | .00 |
| 2 pres plur | 0 | .00 |
| 3 pres plur | 3 | .00 |
| 1 past plur | 0 | .00 |
| 2 past plur | 0 | .00 |
| 3 past plur | 1 | .00 |
| inf verb | 49 | .05 |
| inf nom | 1 | .00 |
| | 56 | .05 |

formclass (18): –∅/–T

| functions | absfr | relfr |
|---|---|---|
| 1 pres sing | 0 | .00 |
| 2 pres sing | 37 | .04 |
| 3 pres sing | 238 | .23 |
| 2 pres plur | 0 | .00 |
| imp sing | 0 | .00 |
| imp plur | 2 | .00 |
| partc verb | 6 | .01 |
| partc adj | 0 | .00 |
| partc adv | 0 | .00 |
| | 283 | .27 |

formclass (19): –∅/–D

| functions | absfr | relfr |
|---|---|---|
| 1 pres sing | 0 | .00 |
| 2 pres sing | 0 | .00 |
| partc verb | 37 | .04 |
| partc adj | 2 | .00 |
| partc adv | 3 | .00 |
| | 42 | .04 |

formclass (20): –∅/GE–∅

| functions | absfr | relfr |
|---|---|---|
| 1 pres sing | 1 | .00 |
| 2 pres sing | 0 | .00 |
| 3 pres sing | 6 | .01 |
| 2 pres plur | 0 | .00 |
| imp sing | 1 | .00 |
| imp plur | 0 | .00 |
| partc verb | 4 | .00 |
| partc adj | 0 | .00 |
| partc adv | 1 | .00 |
| | 13 | .01 |

formclass (21): –T/GE–T

| functions | absfr | relfr |
|---|---|---|
| 2 pres sing | 0 | .00 |
| 3 pres sing | 2 | .00 |
| 2 pres plur | 0 | .00 |
| imp plur | 0 | .00 |
| partc verb | 35 | .03 |
| partc adj | 0 | .00 |
| partc adv | 0 | .00 |
| | 37 | .04 |

formclass (22): –D/GE–D

| functions | absfr | relfr |
|---|---|---|
| partc verb | 91 | .09 |
| partc adj | 1 | .00 |
| partc adv | 0 | .00 |
| | 92 | .09 |

formclass (23): GE–∅/GE–T

| functions | absfr | relfr |
|---|---|---|
| partc verb | 26 | .02 |
| partc adj | 2 | .00 |
| partc adv | 0 | .00 |
| | 28 | .03 |

formclass (24): GE–∅/GE–D

| functions | absfr | relfr |
|---|---|---|
| partc verb | 76 | .07 |
| partc adj | 10 | .01 |
| partc adv | 0 | .00 |
| | 86 | .08 |

formclass (25): strong and/or irregular

| functions | absfr | relfr |
|---|---|---|
| 1 pres sing | 701 | .67 |
| 2 pres sing | 349 | .33 |
| 3 pres sing | 13131 [11)] | 12.56 [11)] |
| 1 pres plur | 2 [11)] | .00 [11)] |
| 3 pres plur | 4 [11)] | .00 [11)] |
| 1 past sing | 1592 | 1.52 |
| 2 past sing | 384 | .37 |
| 3 past sing | 13433 | 12.58 |
| 1 past plur | 358 | .34 |
| 2 past plur | 11 | .01 |
| 3 past plur | 3039 | 2.91 |
| imp sing | 38 | .04 |
| imp plur | 3 | .00 [11)] |
| inf verb | 15 [11)] | .01 [11)] |
| inf nom | 13 [11)] | .01 [11)] |
| partc verb | 6102 | 5.84 |
| partc adj | 1764 | 1.67 |
| partc nom | 104 | 1.67 |
| partc adv | 44 | .04 |
| | 41087 | 39.27 |

TABLE V: ABSOLUTE AND RELATIVE FREQUENCIES OF FORM FUNCTION CORRELATES

## 4. Frequencies of the form-function correlates

### 4.0. Introduction

Our next step was to determine how often each of the affix combinations signals a particular function. The actual frequencies of occurrence of elements in language use cannot be established. It is possible, however, to perform frequency counts on a sample taken from language use. The largest accessible sample was the corpus that has been collected and coded by the "Werkgroep Frequentieonderzoek van het Nederlands" (Uit Den Boogaart 1975), which contains 720.000 words taken from written and oral language in a 5:1 proportion. In the remainder of this article we shall describe how we have analysed and quantified the written language part of this corpus (600.000 words) in terms of form-function correlates. We received two magnetic tapes[7], the first of which contained the complete, coded, original

corpus; the second was an alphabetically ordered list containing each different combination of word + code and its absolute frequencies of occurrence. Naturally the frequency count would be based on the list rather than on the corpus itself. Although the problem can in principle be approached from two different angles we decided to assign the function classes first after which the verbs could be analysed into stem and affixes, using the notional information to reduce the number of alternatives.

## 4.1. Function class assignment

By means of a 3-digit code Uit Den Boogaart specifies for each word in the corpus to what syntactic category and subcategory it belongs. The coding system is based partly on grammatical (notional) and partly on formal criteria (Uit Den Boogaart 1974).

At some stage in the investigation seven of the function classes had to be discarded as it did not seem worthwhile to go to great pains to construct algorithms to detect them. The functions concerned were the six optatives (13-18:1st, 2nd and 3rd person singular and plural), and the iterative nominal (23). The latter turned out to have been coded as a noun, which meant that in a great many cases the distinction of verb and noun could not be made, cf. the homonym GEVAL (1) : the repeated act of falling, and (2) : the case. Singular optatives were coded together with archaic present indicative form (like ZEGGE EN SCHRIJVE; I say and write), which do not formally differ from optatives. Plural optatives were always coded as indicatives so that the proper distinction can only be made on intuitive semantic criteria. These exclusions imposed the necessity to introduce some slight modifications into the form class analysis as certain ambiguities have now disappeared. This problem will be dealt with more extensively later.

Of the remaining 20 functions 6 could be derived from the code immediately : 1st, 2nd and 3rd persons in indicative present singular (1-2-3), verbal and nominal infinitives (21-22) and the adverbally used past participle (27). In the other 14

cases the code narrowed down the number of relevant alternatives to two or three functions.
In one case (concerning two functions) the decision could be made on the basis of the formal characteristics of the verb itself, which meant that the tape containing the list could still be used. In the three other decisions (assignment of grammatical person, verbal/adjectival use and adjectival/nominal use of past participle) it was necessary to take the original context into account.

| function | absfr | relfr | function | absfr | relfr |
|---|---|---|---|---|---|
| 1 pres sing | 3029 | .67 | 2 past plur | 11 | .01 |
| 2 pres sing | 2193 | 2.10 | 3 past plur | 3945 | 3.77 |
| 3 pres sing | 25947 | 24.82 | imp sing | 732 | .70 |
| 1 pres plur | 1738 | 1.66 | imp plur | 109 | .10 |
| 2 pres plur | 76 | .07 | inf verb | 20357 | 19.48 |
| 3 pres plur | 8111 | 7.76 | inf nom | 1344 | 1.29 |
| 1 past sing | 1991 | 1.90 | partc verb | 13625 | 13.03 |
| 2 past sing | 448 | .43 | partc adj | 2763 | 2.64 |
| 3 past sing | 17156 | 16.41 | partc nom | 145 | .14 |
| 1 past plur | 474 | .45 | partc adv | 334 | .32 |
| | | | | 104528 | 100.00 |

TABLE VI: MARGINAL TOTALS FOR FUNCTIONS

### 4.1.1. Number assignment for imperatives

Imperatives have been given a separate code by Uit Den Boogaart, but the code does not express number i.e. singular/plural. On the basis of form analysis procedures, which will be dealt with later, it could be determined whether an imperative had the formal characteristics of an infinitive (-N or -EN), a non-inverted 2nd pers. pres. sing. (-T) or only a verb stem (-Ø). In the former two cases the verb form was recoded as plural imperative, in the latter as singular. In cases where the choice between stem and stem + T could not be made, as e.g. VERGAST ( VERGAS + T or VERGAST + Ø), plural was assigned on arbitrary grounds. It should be noted that theoretically speaking plurally used imperatives are erroneously marked for singular when the

verb stem itself ends in -T. As the subject of an imperative sentence is usually absent, correct automatic assignment would require an analysis of preceding or following sentences, which was beyond the sense of our project (cf. elliptical constructions in 4.1.2.).

1.2. Assignment of grammatical person for finites

Forms coded as finites by Uit Den Boogaart have been given an additional specification for tense and number, but except in the case of present singular information regarding grammatical person is absent. Therefore an algorithm was developed to supply this information for finites in the present plural, and both singular and plural past tenses. In these cases grammatical person is not formally expressed in the verb itself and has to be derived from the subject, i.e. in a context-sensitive way. Since there are at most one subject and one finite verb per clause, the matching task is relatively easy once a sentence is properly segmented into its constituent clauses. For this purpose a recursive procedure was adopted which starts a new cycle when a subordinator (an element from a closed set of grammatical words such as hypotactic conjunctions and relative pronouns) was met and leaves that cycle as soon as every finite at that level has been assigned a grammatical person. In each cycle the context is scanned for a first or second person pronoun in its nominative form, either singular or plural. When such a personal pronoun is found, the associated grammatical person is assigned to the finite in that clause. When no recognizable pronoun is encountered third person is chosen as a default value.
Within this restricted framework errors cannot be avoided in elliptical constructions in which either the subject or the finite is missing and has to be suppleted from the context. (Reduction with NP or VP deletion : JIJ LACHT EN HUILT (you laugh and cry) and JIJ EN HIJ LACHEN (you and he laugh). Nevertheless the procedure proved adequate in well over 99 % of the 600 cases tested.

1.3. Verbal/adjectival/nominal use of past participles

In the Uit Den Boogaart coding system past participles are

divided into four categories : (1) undeclined, (2) declined, (3) plural nominal, (4) adverbially used.
In our functions system verbal, nominal and adverbial use of past participles were distinguished. It should be obvious that only part of this information could be directly translated from the Uit Den Boogaart code. More particularly, the following two decisions remained : undeclined past participles can be either verbally or adjectivally used, and declined participles are either adjectival or nominal.
In the first decision verbal interpretation is opted for unless the participle is followed by either an undeclined past participle or a nominal entity (nouns, nominally used adjectives etc.), or preceded by a word which requires an undeclined adjective (indefinite article, indefinite pronouns, certain interrogative pronouns etc.). The procedure yielded a rather high error rate, about 20 %, but we have abstained from further refinements, as we saw no means to resolve this problem on short notice.
In the second decision, concerning declined participles, adjectival status is decided upon if the participles occur in one of the contexts conventionally abbreviated in the following scheme :

$$\underline{\qquad\qquad}\ (\text{(paratactic conjunction)})\left\{\begin{matrix}\text{adjective}\\ \text{participle}\\ +\ \text{adj}\end{matrix}\right\}^{*}\left\{\begin{matrix}\text{nominal}\\ \text{participle}\\ +\ \text{nom}\end{matrix}\right\}$$

In all other cases the participle is formally nominal. We have allowed for the possibility that indefinitely many conjoint adjectives precede the final nominal (as expressed by the asterisk).
It should be apparent from this rule, that the context is scanned, and decisions are taken from right to left. The number of errors found in the cases tested amounted to less than 1 %.

## 4.2. Form analysis

The input for the form analysis were two tapes : (I) a selection from the complete alphabetic Uit Den Boogaert list

containing only the verb forms whose functions could be immediately recovered from the code, (II) a complementary tape containing the results of the function class assignment (4.1.) in a format compatible with tape I.
The principle underlying the algorithm is, that every given verb form is split up into all admissible combinations of stem and affix(es). This means that no *a priori* dependency of form and function is assumed, so that e.g. GENIET from an original context IK GENIET (I enjoy) should be analysed as both GENIET + Ø (enjoy) and GE + NIET + Ø (stapled; past part. of the verb NIETEN).
In practice, however, this orthogonality of forms and functions could be dealt with by considering only those form categories that can be associated with the function given and applying some minor alterations later.
As should be apparent from §3., each function is characterized by a particular set of form classes, e.g. infinitive verbal is carried by -N, -EN, -EN/-TEN and -EN/-DEN. A number of functions share the same set of form classes, e.g. infinitive verbal, infinitive nominal, 1st and 3rd persons present plural. Moreover, certain functions are signalled by the combined sets of form classes of two functions, e.g. 2nd person plural may be both expressed by the 'infinitive set' (jullie lopen; you walk) and the 'third person set' (U beiden loopt; You walk).
Of each form under analysis the relevant set or sets of form classes is determined. In the case of more than one set of form classes the possibilities are further narrowed down by means of appropriate formal tests. Then a more detailed decision procedure applies in order to single out the only appropriate possibility within the set. Once a particular set is selected function class information is no longer relevant.
Not in all cases could the decisions be taken exclusively on formal grounds.
All potential cases in which such formal rules would yield unwanted results were collected and listed, and whenever the

need arose the relevant lists were searched. In 4.2.7. we shall discuss these loop-up lists in greater detail. The lists are numbered and included in appendix I.

4.2.1. Infinitives

Verbal and nominal infinitives are inflectionally identical. Infinitives regularly have the -EN suffix, except the group (listed in list 5) ZIJN (to be), GAAN (to go), STAAN (to stand), SLAAN (to hit), ZIEN (to see), DOEN (to do) and their compounds, which forms are analysed as stem + N. (Compounds of) JUDOEN (to jiujitsu) and RUZIEN (to quarrel), however, belong to the -EN group (see also Van De Craen 1971). Ambiguous form classes (-EN/-DEN or -EN/-TEN) are assigned if the verb ends in -DDEN or -TTEN, immediately preceded by one vowel symbol[8]).

4.2.2. Present singular

A number of present tense forms and their compounds are considered irregular, as they cannot be derived mechanically from an existing infinitive (list 9) : e.g. BEN (am), BENT (are), KOM (come) etc.
Within the system the following formally undecidable situations occur :

(a) a -T or -D may or may not be considered to be a suffix and in either case the form is (a derivation of) the stem of an existing Dutch verb, e.g. VERGAST (=VERGAS + T (kills with gas) or =VERGAST + Ø (treats) and VOORSPELD (=VOORSPELD + Ø (pin in front of someone) or =VOORSPEL + D (predicted)).

(b) GE- may or may not be considered as a past participle marking prefix provided that the form ends in -T or -D in a way compatible with the past participle formation rules; example : GETROOST (= GE + TROOST + Ø (comforted) or =GETROOST + Ø (spare)), but not GELEIDT (conducts), as -DT is not an admissible past participle ending.

In order to obtain a reasonably efficient decision procedure we adopted the principle that a -T or -D immediately preceded by H, J or a 2-symbol vowel belongs to the stem, and

constitutes an affix if preceded by any other symbol. There are many exceptions to this rule of thumb, which were incorporated in lists in which ambiguous forms were additionally marked. One group of verb forms remained which could not be analysed automatically. These forms that end in an ambiguous -D and of which it could bot be decided whether or not they would get GE- in the past participle were analysed by hand, e.g. VOORSPELD, which would be past participle when stressed on the second syllable : VOOR'SPEL + D (predicted), or first person singular when stressed on the first syllable : 'VOOSPELD (pin on in front of someone). To determine the status of initial GE- relevant forms were temporarily treated as past participles.

'.3. Present plural.

Present plural forms that end in -N, except KAN (can), are further analysed as infinitives; any other present plural is further analysed as present singular.

'.4. Imperative.

If an imperative ends in -N list 5 is searched to see if it belongs to the GAAN, STAAN etc. category (stem + N). Any remaining form not ending in -EN is a stem. Forms on -EN are looked up in list 4 to see whether the form is a stem (BEKEN (confess)). If not, the form is further analysed as an infinitive. Any other form is further analysed as present singular.

'.5. Past tense singular.

Singular weak preterites regularly end in -DE or -TE. Forms ending in any other way are strong. Form class analysis normally took place on the basis of the last two letters. Ambiguous status was given to forms ending in -TTE or -DDE, immediately preceded by one vowel symbol : BEZETTE = BEZETT + E (occupied) or BEZET + TE (occupied), BEKLADDE = BEKLADD + E (smeared) or BEKLAD + DE (smeared). These forms are ambiguous insofar as the -E reading charecterizes a past participle which does not take a prefix GE-, and the -DE

or -TE form class signals a preterite. Unfortunately forms like ZETTE (put) or KLADDE (smeared) are also considered as ambiguous. Originally the -E reading also stood for singular optative and the algorithm was not properly adapted when the optatives were dropped from the function system (cf. 4.1.).

4.2.6. Past tense plural.

Plural past tense formation normally consists in adding -DEN or -TEN to the verb stem. Second person plural, however, especially when a polite form of address is used (U), may also be inflected as in the singular. Any 2nd person plural preterite not ending in -N is further analysed as a singular.

The detection of strong forms is relatively problematic in the plural as a number of strong plurals exist which end in -DEN or -TEN. The majority of the strong -TEN forms can be identified because they violate phonotactic constraints which are always observed in weak past tenses. As an example we mention the process of voice assimilation which excludes -TEN after a voiced segment; therefore LIETEN (let) and ZATEN (sat) can never be regular weak forms. However a number of cases remained that could not be singled out in this way. The forms concerned were listed (list 10) and are looked up whenever the need arises.

Forms containing geminate D or T after a single vowel symbol are further analysed as if they were infinites, except HADDEN (had), which is strong.

Forms ending in -DEN immediately preceded by a true vowel (1 or 2 but not $3^9$ vowel symbols) are provisionally considered as strong formations because it is abnormal for a Dutch verb stem to end in a vowel (cf. 4.2.2.). This decision is revoked if such a form is found in list 3, which contains verb stems ending in a vowel.

When -DEN was preceded by a consonant symbol no rules for strong form detection could be given; in these cases strong forms are simply found by reference to a list (list 11).

.7. Past participle.

Past participle formation takes place along the following lines : the verb stem is preceded by GE- and followed by either -Ø, -D, -EN or -T. -EN exclusively occurs with strong verbs, weak verbs take the -Ø suffix if the stem itself ends in -T or -D, -T if the last letter of the stem corresponds to a voiceless sound and -D in all other cases. There are only a few strong verbs not taking -EN. GE- is normally prohibited when the verb stem begins with BE-, -GE-, HER-, ER-, VER-, ONT- or with a non-divisible (non stressed) preposition (but cf. Schultink, 1973).
Past participles may be used as adjectives and the adjectives as nominals. In such cases the inflectional paradigm is identical to that of non verb-derived adjectives, the consequence of this being weak past participles ending in -DEN or -TEN.
First of all adjectival and nominal inflections are traced, administrated and removed. Any (truncated) participle not ending in -T or -D is strong. The next step is to see if the form contains the sequence -GE- (not necessarily in initial position) and if so whether or not a true, i.e. a past participle marking, prefix is concerned. The prefix status is decided upon in two discrete steps :

(1) GE- is provisionally true when followed by at least one vowel, not preceded by initial VER-, and not part of one of the following letter sequences : GEREED, GERUST, GERING, GELIJK, GEVANGEN, GEKS, TEGEN, BEGE, ONTGE; any GE- which is not a true prefix according to (1) is left out of further consideration; however, the occurrence of yet another GE- is allowed for and condition (1) is tested repeatedly.

(2) any form with a provisionally true GE- is matched with list 8, which contains all remaining verb stems beginning with GE-. Ambiguities occur when two verb stems exist, one with and one without GE-, both of which are compatible with the form at hand; these stems are specially marked in the list. When true GE- is concluded

to, its presence is registered after which the letters GE are removed from the string, enabling look up procedures in lists, which contain non-prefixed forms only.
With regard to (truncated) forms ending in -T, the forms GEWEEST (been), GEBRACHT(brought), GEDACHT (thought), GEKOCHT (bought), GEZOCHT (sought) and their compounds are classified as strong. If the -T immediately follows a vowel symbol, it must be part of the stem. The question whether the -T in the remaining cases belongs to the stem, constitutes a suffix, or possibly both, has now been reduced to the problem of the present singular form analysis (cf. 4.2.2.).
As far as (truncated) forms on -D are concerned, GEHAD (had) and its compounds are classified as irregular. In forms ending in one vowel symbol + D the D is always part of the stem. A -D preceded by three or more vowel symbols is always a suffix. When preceded by a two symbol vowel -D belongs to the stem unless the (truncated) form is found in list 3, and is ambiguous if a marking to that effect is found in the list. In the forms not yet covered, in which the potential suffix is preceded by a consonant (other than J), the -D is considered to be a suffix unless the form is incorporated in list 7 and ambiguous if marked as such in the list.
On the basis of this information concerning the stem or suffix status of GE-, -T and -D, as well as the adjectival or nominal specifications the final form class assignment is arrived at by the application of simple boolean operations.

4.2.8. Exception lists.

In the form class analysis recourse is made to eleven exception lists. An item in an exception list has the following general form :

(a) a number indicating which list the item belongs to;
(b) ambiguity markers;
(c) an instruction as to whether a form found in (or derived from) the text has to be identical to the

listed form or whether it is sufficient if the text form can be written as a concatenation of two substrings, the latter of which is identical to the listed form;

(d) the listed form, consisting of a string of letters.

Exception lists needed for decisions concerning suffixes were drawn up with the aid of Nieuwborg (1969), a retrograde version of the largest complete dictionary of Dutch (Kruyskamp, 1961), which contains 192,000 words. This dictionary itself was made use of whenever the beginning of the word was relevant. For the inventory of strong preterites not involving consonant alternations Eeckhout (1968) was used; the list was supplemented to the best of our knowledge with verbs additionally exhibiting consonant changes.

In the lists verb forms are always specified with the inclusion of a potential suffix. In the majority of cases a list is used in only one type of decision. In two instances however a list served in two decisions, in which case a suffix listed may be replaced by another suffix.

An item is marked ambiguous if both the listed form without the potential affix and the form concatenated with the affix constitute an existing Dutch verb stem.

We shall now discuss the various lists one by one.

list 1. contents. Stems ending in a consonant ≠H, ≠J, followed by -T.

function: A -T after a consonant ≠H, ≠J is a suffix unless the form is found in this list. If the -T can be both the final letter of a stem and a suffix, the form is marked as ambiguous.

examples: PEST (teases)
GIST (amb.: guesses, ferments)

list 2: contents: Stem + T of verbs whose stems end in -CH.

function: -T after -CH- is part of the stem unless the form is listed here.

example: LACHT (laughs)

list 3: contents Stem + T of verb stems ending in a tense vowel (a 2 symbol vowel).

function: (1) -T after tense vowel belongs to the stem unless the form is listed here. If the -T can be both a suffix and part of a stem, the form is marked as ambiguous.

(2) Final -D after a tense vowel belongs to the stem unless the form, after substitution of -T for -D, is found in this list. In principle ambiguities are dealt with as under (1). The two kinds of ambiguity are differently marked.

examples: VLEIT (flatters); this list form also corresponds to GEVLEID (flattered).
SPUIT (amb. according to (1): sluices; sprouts);
this form also corresponds to GESPUID (not amb.: sluiced)

KRUIT (carts with wheel barrow);
the form also corresponds to GEKRUID
(amb. acc. to (2): carted with a
wheel barrow; seasoned)

list 4: contents: Stems whose last letters are -EN
function: Imperatives ending in -EN are
treated as infinitives unless found
in this list.
example: REKEN (calculate)

list 5: contents: Infinitive forms with suffix -N.
function: (1) Infinitives found in this list
have no suffix -EN.
(2) A -T after a tense vowel in a
present singular, replaced by
-N belongs to the stem unless
the form is found in the list.
example: GAAN (to go); the form also corresponds
to GAAT (goes)

list 6: contents: Strong past participles that do not
end in -EN.
function: Participles that are found in this
list are strong.
examples: GEWEEST (been)
GEHAD (had)

list 7: contents: Weak past paricipies whose stems
end in consonant + D.
function: The -D after a consonant ≠J constitutes
a suffix unless the text form is found
in the list; a -D is ambiguous if a
form is marked to that effect.
examples: GEROND (rounded)
GESPELD (amb.: pinned or spelled)

list 8: contents: Past participles derived from stems containing a non past participle marking prefix GE-.
function: GE- is ultimately a participle marking prefix unless a form is found in this list. If a verb stem exists with and without GE- the form is marked as ambiguous.
examples: GEBRUIKT (used)
GETROOST (amb.: comforted or spared)

list 9: contents: Irregular present tenses.
function: Forms found in this list are irregular.
examples: BEN (am)
KOM (come)

list 10: contents: Strong plural preterites which end in -TEN and are compatible with the phonotactic constraints on preterite formation.
function: Preterites on -TEN after a voiceless sound are regular unless found in this list.
examples: DACHTEN (thought)
KOCHTEN (bought)

list 11: contents: Strong plural preterites ending in -DEN after a voiced consonant ≠D.
function: Preterites on -DEN after a voiced consonant ≠D are regular unless found in this list.
example: KONDEN (could)

## 4.3. Results.

After the analysis of each text form the absolute frequencies of the resulting form-function correlates are administrated in a 20 by 25 matrix in which cells are reserved for each of the possible 500 combinations of forms and grammatical functions.
On completion of the analysis of all the verbs in the corpus marginal totals and frequencies relative to row total and grand total were calculated. In table V (1) to (25) the functional possibilities are given per form class. Their absolute frequencies of occurrence as well as their frequencies relative to the grand total (104,528) are specified. The subtotals indicated in these tables represent the absolute and relative frequencies of occurrence of each form class. The subtotalled frequencies for functions are given in table VI.
We shall now summarize the most important frequency characteristics of the form-function correlate system.
It appears that about 40 % of the Dutch verb forms as used in texts are strong and/or irregular. The most frequent regular form class is -EN (25 %), followed by -T (12 %). The remaining 23 % is spread over the other 22 form classes. Within the group of ambiguous form classes none is more frequent than 0.5 %. The most frequent function in texts is 3 pres sing (25 %), the second place is taken by the infinitives (21 %), third is 3 past sing (17 %), and past participles constitute the fourth most frequent class (16 %). The most frequent form-function correlates are -T; 3 pres sing (87%/11%) and -EN : (72%/17%).

## 5. Conclusions and prospects.

In a later stage of the investigation the results obtained above will be applied to two problems. The first application has already been mentioned in the introduction, and involves a correlation of the objective frequency data with the results of psycholinguistic reading experiments conducted

by the first author, in an attempt to explain certain aspects of reading behaviour in terms of linguistic expectancy (e.g. Van Heuven, 1976a). As a second application attempts have been made to estimate the consequences of certain spelling reform proposals in terms of reduction of informativeness of verb suffixes. For this purpose all verbs whose suffixes could possibly be affected by spelling reforms were identified and additionally counted, so that now the data of three form-function correlate systems are available (Van Heuven, 1976b).

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NOTES

1) Department of Phonetics, R.E. Utrecht, (Z.W.O. contract).

2) Department of General Linguistics, R.U Utrecht.

3) Not concerning separable adverbial or prepositional elements such as WEG in WEGGAAN (to go away).

4) Prefix GE- may show up as an infix in compound words such as OVERSCHILDEREN (to paint again) OVERGESCHILDERD (painted again).

5) This analysis is imperative if it is assumed that -TEN and -DEN are the only weak verb plural past tense morphemes.

6) The classes left out of consideration are vacuously numbered in the tables, mainly for our own convenience.

7) We thank P.C. Uit den Boogaart of Eindhoven Technical University for putting material at our disposal before its official release was due.

8) Unfortunately ZITTEN (to sit) and BIDDEN (to pray) were found ambiguous.

9) The third element in a sequence of three vowel symbols fulfills a consonant function.

10) Function classes 13-18 and 23 are left out for reasons explained under § 4, p. 41.

11) Presence due to coding errors in the Uit Den Boogaart (1975) corpus.

APPENDIX : LOOK-UP LISTS

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 01 AANHEFT | | T | * | 01 DOORBERST | S | T | | 01 KIST | | T | * | 01 PARLEMENT | S | T | | 01 TOERUST | S | T | |
| 01 AANHORT | S | T | | 01 DOORMEST | S | T | | 01 KLUFT | S | T | | 01 PART | S | | | 01 TOETAST | S | T | |
| 01 AANRIST | S | T | * | 01 DOORTAST | S | T | | 01 KNOERT | S | T | | 01 PAST | | T | * | 01 TOOST | S | T | |
| 01 AANROEST | S | T | | 01 DOORZULT | | T | | 01 KORST | S | | | 01 PERMANENT | S | T | | 01 TRAMMELANT | S | T | |
| 01 AANSTAART | | T | * | 01 DORST | | T | * | 01 KORTSTAART | | T | | 01 PEST | S | | | 01 TRANT | S | T | |
| 01 AANTAST | S | T | | 01 DRIFT | S | T | | 01 KORT | | T | * | 01 PINT | | T | * | 01 TROOST | | T | |
| 01 AFBAST | S | T | * | 01 DRUIPSTAART | | T | | 01 KOST | S | | | 01 PLANT | S | | | 01 TRUNT | S | T | |
| 01 AFBERST | S | T | | 01 EEST | | T | | 01 KRENT | S | | | 01 POEST | | T | * | 01 TRUST | S | | |
| 01 AFGEEST | S | T | | 01 ELUST | S | | | 01 KROONENT | S | T | | 01 POLIJST | S | | | 01 TWIST | | T | |
| 01 AFHEFT | | T | * | 01 ENBERST | S | | | 01 KWAST | | T | | 01 POST | S | | | 01 UITBERST | S | T | |
| 01 AFKIST | S | T | | 01 ENT | | T | | 01 KWEEST | S | T | | 01 PRENT | | T | | 01 UITENT | S | T | |
| 01 AFKORT | S | T | | 01 FEEST | S | T | | 01 KWIKSTAART | | T | | 01 PROEST | S | | | 01 UITGAST | S | T | * |
| 01 AFKWAST | S | T | | 01 FLIRT | S | T | | 01 KWIST | S | | | 01 PUNT | S | | | 01 UITGIST | S | T | |
| 01 AFLAST | S | T | | 01 FLORT | S | T | | 01 LANTERFANT | S | T | | 01 RAMENT | S | T | | 01 UITMEST | S | T | |
| 01 AFMEST | S | T | | 01 GARST | S | T | | 01 LAST | | T | * | 01 REDETWIST | S | T | | 01 UITPOEST | S | T | |
| 01 AFMIST | S | T | | 01 GAST | | T | * | 01 LIFT | S | | | 01 RENT | | T | * | 01 UITSPANT | | T | * |
| 01 AFRIST | S | T | * | 01 GEERT | | T | * | 01 LIJST | | T | * | 01 REST | | T | | 01 UITTART | | T | |
| 01 AFROEST | S | T | | 01 GELAST | S | | | 01 LUST | | T | * | 01 RIST | | T | * | 01 UITVENT | S | T | |
| 01 AFSCHAFT | | T | * | 01 GERST | S | T | | 01 MARKT | S | T | | 01 ROEST | | | * | 01 VAALT | | T | |
| 01 AFSCHART | | T | * | 01 GEST | S | | | 01 MAST | | T | | 01 RONDTAST | S | T | | 01 VALT | | T | * |
| 01 AFSTAART | | T | | 01 GETROOST | | | | 01 MEST | | T | * | 01 RONDVENT | S | T | | 01 VAST | S | | |
| 01 AFTAST | S | T | | 01 GIST | S | | * | 01 MISTAST | S | T | | 01 ROOST | | T | | 01 VEEST | S | T | * |
| 01 AFVENT | S | T | | 01 GNORT | S | | * | 01 MIST | | T | * | 01 RUST | | T | * | 01 VELT | | T | * |
| 01 BALLAST | S | T | | 01 GRINT | | | | 01 MUNT | S | | | 01 SCHAFT | | T | * | 01 VENT | | T | |
| 01 BARST | S | | | 01 HAAST | | | | 01 MYST | S | T | | 01 SCHART | | T | * | 01 VERBEEST | S | T | |
| 01 BEANGST | S | T | | 01 HARST | | | | 01 NAAST | S | | | 01 SCHEFT | | T | * | 01 VERBEURT | | T | * |
| 01 BEKIST | S | T | | 01 HART | | | | 01 NAGIST | S | T | | 01 SCHENDEVENT | S | T | | 01 VERDORST | | T | |
| 01 BEKORT | S | T | | 01 HEFT | S | | * | 01 NEST | | T | | 01 SCHIFT | S | | | 01 VEREELT | S | T | |
| 01 BELAST | S | T | | 01 HENGST | S | | | 01 OMENT | S | T | | 01 SCHOFT | S | T | | 01 VERGAST | S | T | * |
| 01 BEMAST | S | T | | 01 HOEST | S | | | 01 OMLIJST | S | T | | 01 SCHORT | S | | | 01 VERGIFT | S | T | |
| 01 BEMEST | S | T | | 01 HOPPEKEEST | | | | 01 OMTAST | S | T | | 01 SEXT | | T | * | 01 VERGIST | | T | * |
| 01 BEPORT | S | T | | 01 HORST | | | | 01 OMVENT | S | T | | 01 SHUNT | S | T | | 01 VERHAAST | S | | |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 01 BERENT | T* | 01 HORT | T* | 01 ONTBAST | S T | 01 SLAPSTAART | T | 01 VERINTEREST | S T |
| 01 BERST | T* | 01 INENT | S T | 01 ONTKIST | S T | 01 SLIERT | T* | 01 VERINTREST | S T |
| 01 BERUST | S T | 01 INGAST | S T | 01 ONTLAST | S T | 01 SMALHART | T* | 01 VERKORT | S T |
| 01 BETAST | S T | 01 INKORT | S T | 01 ONTMAST | S T | 01 SMART | S T | 01 VERLEEST | T* |
| 01 BETWIST | S T | 01 INKT | T* | 01 ONTSTAART | T | 01 SMELT | S | 01 VERMEST | S |
| 01 BEVERSTAART | T | 01 INLIJST | S T | 01 OOGST | S T | 01 SPEELTENT | S T | 01 VERROEST | S T |
| 01 BEZWELT | T | 01 INPRENT | S T | 01 OOST | T | 01 SPRINT | S | 01 VERTAST | S T* |
| 01 BIJTINT | S T | 01 INROEST | S T | 01 OPENT | S T* | 01 SPURT | S T | 01 VERTROOST | S T |
| 01 BILJART | S T | 01 INZULT | T | 01 OPGIST | S T | 01 START | T* | 01 VERVILT | T |
| 01 BLOKSTAART | T | 01 KAART | S | 01 OPKORT | S T | 01 STORT | S | 01 VEST | S T |
| 01 BOERT | T* | 01 KAFT | T* | 01 OPSCHAFT | T* | 01 STUNT | S T | 01 VETMEST | S T |
| 01 BOFKONT | S T | 01 KANT | S | 01 OVERLEST | S T | 01 TART | T* | 01 VIJST | T * |
| 01 BONT | S T | 01 KARST | S T | 01 OVERENT | S T | 01 TAST | T* | 01 VILT | T * |
| 01 BRUILOFT | S T | 01 KAST | T* | 01 OVERKIST | S T | 01 TEMPEEST | S T | 01 VOORTHAAST | S T |
| 01 BULT | S | 01 KEEST | T* | 01 OVERLAST | S T | 01 TENT | T | 01 VOORTTWIST | S T |
| 01 BUURT | T* | 01 KERST | S T | 01 OVERTAST | S T | 01 TEST | S | 01 WANT | T * |
| 01 CEMENT | S T | 01 KIFT | S T | 01 PAART | T* | 01 TINT | T* | 01 WEGHAAST | S T |
| 01 WEGROEST | S T | 03 BRANIET | S T | 03 OPLUIT | T | 04 BEJEGEN | T | 04 OMREKEN | T |
| 01 WHIST | S T | 03 BREIT | T # | 03 OPRUIT | T | 04 BEKEN | T | 04 OMREN | T |
| 01 WISPELSTAART | S | 03 BRIJT | S T | 03 ORIET | S | 04 BEOEFEN | T | 04 ONDERKEN | T |
| 01 WORTELENT | S T | 03 BRUIT | S | 03 OVERLUIT | T # | 04 BEREN | T* | 04 ONTCHRISTEN | T |
| 01 ZANT | S T | 03 BUIT | T* | 03 PEET | T | 04 BEROKKEN | T | 04 ONTEIGEN | T |
| 01 ZIFT | S | 03 CORVEET | S T | 03 PEUT | T* | 04 DOORPEN | T | 04 ONTKEN | T |
| 01 ZILT | S | 03 DIJT | S | 03 PLEIT | T* | 04 DOORREN | T | 04 ONTKERSTEN | T |
| 01 ZOOGENT | S T | 03 DOET | S | 03 REIT | T* | 04 DTEKEN | S | 04 ONTPEN | T |
| 01 ZULT | T* | 03 DOMINEET | S T | 03 RIJT | T* | 04 EFFEN | T | 04 ONTWEN | T |
| 01 ZWALUWSTAART | T | 03 DOORBREIT | S | 03 ROEKOET | S T | 04 EIGEN | T | 04 OPKLUWEN | T * |
| 01 ZWART | S | 03 DOORSPUIT | T* | 03 RUIT | T* # | 04 EREKEN | S | 04 OPPEN | T |
| 02 ALACHT | S | 03 ECHOOT | S T | 03 SCHREIT | S | 04 ERKEN | T | 04 OPREKEN | T |
| 02 COACHT | S T | 03 ELIET | S | 03 SHAMPOOT | S T | 04 ERREKEN | S | 04 OPREN | T |
| 02 DLACHT | S | 03 FARIZEET | S T | 03 SKIET | S | 04 ETEKEN | S | 04 OPROKKEN | T |
| 02 DOUCHT | S T | 03 GAAT | S | 03 SPIET | S # | 04 FTEKEN | S | 04 ORDEN | T |
| 02 ELACHT | S | 03 GEIT | S | 03 SPREIT | S T # | 04 GEILKEN | T | 04 OVEN | T |
| 02 FLACHT | S | 03 GLEET | S # | 03 SPUIT | T* | 04 GEWEN | T | 04 PEN | T |
| 02 GRIJNSLACHT | S | 03 GREIT | S T | 03 STAAT | S | 04 GOEDKEN | T | 04 PTEKEN | S |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 02 | JOECHJACHT | S T | 03 | HEIT | S T | 03 | SUIT | S T | 04 | GTEKEN | S | 04 | REGEN | S | | | | | |
| 02 | JUICHT | S | 03 | HEROOT | S | 03 | TAXIET | S T | 04 | HAVEN | T | 04 | REKEN | T | | | | | |
| 02 | KROCHT | S T | 03 | HOET | S T * | 03 | TEAT | S T | 04 | HERKEN | T | 04 | REN | T | | | | | |
| 02 | KUCHT | S T | 03 | HOEZELT | S T | 03 | THEET | S T | 04 | HERSEN | S | 04 | ROKKEN | T | | | | | |
| 02 | LACHT | T | 03 | ILIET | S T | 03 | TIJT | T | 04 | HOOFDREKEN | T | 04 | RONTGEN | T | | | | | |
| 02 | LLACHT | S | 03 | INLUIT | ± | 03 | TUIT | T * | 04 | INMEN | T | 04 | RTEKEN | S | | | | | |
| 02 | LUNCHT | S T | 03 | JIJT | S T | 03 | UITBUIT | T * | 04 | JEN | T | 04 | RUFEN | T | | | | | |
| 02 | LYNCHT | S T | 03 | JUDOOT | S T | 03 | UITLUIT | T # | 04 | JTEKEN | S | 04 | SASKEN | T | | | | | |
| 02 | MATCHT | S T | 03 | KARWEIT | S T | 03 | UITRUIT | S T | 04 | KEN | T | 04 | SCHEN | T | | | | | |
| 02 | MLACHT | S | 03 | KEUT | S T | 03 | UITSPUIT | T * | 04 | KERSTEN | T * | 04 | SREKEN | S | | | | | |
| 02 | NLACHT | S | 03 | KLAPPEIT | S T | 03 | VERLEIT | S T # | 04 | KETEN | T * | 04 | STEVEN | S | | | | | |
| 02 | POCHT | S | 03 | KLEIT | S T | 03 | VERTUIT | S T | 04 | KLUWEN | T | 04 | TEKEN | T | | | | | |
| 02 | PRACHT | S T | 03 | KNIET | S | 03 | VLEIT | S | 04 | KRUISSCHEN | T | 04 | TKETEN | S | | | | | |
| 02 | RACHT | T | 03 | KRUIT | S * | 03 | VLIJT | S | 04 | KTEKEN | S | 04 | TOEEIGEN | T | | | | | |
| 02 | RLACHT | S | 03 | KUKELEKUUT | S T | 03 | VRIJT | S # | 04 | LIJKEN | T | 04 | TOEKEN | T | | | | | |
| 02 | SPEECHT | S T | 03 | LAAT | S # | 03 | ZIET | S | 04 | LOOCHEN | S | 04 | TOEPEN | T * | | | | | |
| 02 | TLACHT | S | 03 | LANTERLUIT | T | 03 | ZIJT | S | 04 | LTEKEN | S | 04 | TREKEN | S | | | | | |
| 02 | VERINDISCHT | S T | 03 | LAVEIT | S | 03 | ZUIT | S T | 04 | MEN | T | 04 | TREN | S | | | | | |
| 03 | AANBREIT | S | 03 | LEIT | T # | 03 | ZWEIT | S T | 04 | MISKEN | T | 04 | TTEKEN | S | | | | | |
| 03 | AAT | T | 03 | LUIT | T # | 04 | AANPEN | T | 04 | MISTEKEN | T | 04 | UITOEFEN | T | | | | | |
| 03 | AFBUIT | T | 03 | MANDIET | S T | 04 | AANSCHEN | T | 04 | MORGEN | T | 04 | UITPEN | T | | | | | |
| 03 | AFLUIT | T | 03 | MEIT | S | 04 | AANKEN | T | 04 | MOTORREN | T | 04 | VARKEN | T | | | | | |
| 03 | AFRUIT | T * | 03 | MENIET | S | 04 | AFMEN | T | 04 | NAREKEN | T | 04 | VASTPEN | T | | | | | |
| 03 | AFSPUIT | T * | 03 | MIET | S | 04 | AFPEN | T | 04 | NAREN | T | 04 | VEREFFEN | T | | | | | |
| 03 | ALIET | S | 03 | NALUIT | T # | 04 | AFREKEN | T | 04 | NATEKEN | T | 04 | VEREVEN | T | | | | | |
| 03 | ARIET | S | 03 | NEIT | S T | 04 | AFREN | T | 04 | NEERPEN | T | 04 | VERKEN | T | | | | | |
| 03 | AUTOOT | S T | 03 | NEURIET | S | 04 | AFWEN | T | 04 | NKETEN | S | 04 | VERORDEN | T | | | | | |
| 03 | BAKKELEIT | S T | 03 | OLIET | S | 04 | ALKEN | T | 04 | NREKEN | S | 04 | VERREN | S | | | | | |
| 03 | BEIT | S T | 03 | OMLUIT | T # | 04 | ARMPEN | T | 04 | NREN | S | 04 | VERWEN | T | | | | | |
| 03 | BELUIT | T | 03 | ONTTUIT | S T | 04 | AUTOREN | T | 04 | NTEKEN | S | 04 | VIGGEN | T | | | | | |
| 03 | BETIJT | S T | 03 | ONTWEIT | S T | 04 | BAKEN | S | 04 | OEFEN | T | 04 | VOORBIJREN | T | | | | | |
| 04 | VRIJKEN | T | 07 | HARD | S | 07 | VERMOORD | S T | 10 | DACHTEN | S | | | | | | | | |
| 04 | WEN | T | 07 | HORD | S T | 07 | VERSCHULD | S T | 10 | KOCHTEN | S | | | | | | | | |
| 04 | WIELPEN | T | 07 | INWEND | S T | 07 | VERSPELD | S T | 10 | MOESTEN | S | | | | | | | | |
| 04 | ZEGEN | S | 07 | KAARD | S | 07 | VOLEIND | S T | 10 | SMOLTEN | S | | | | | | | | |