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CAN NOUNS AND VERBS GROW UP?  
CASE STUDY OF WORD-FORMATION RULES  
FOR DENOMINAL VERBS AND DEVERBAL NOUNS

A study of a Polish boy (Michał) based on a speech diary available from the Childes system was performed. All denominal verbs and deverbal nouns (both conventional Polish words and child's innovations) uttered by Michał between the age of 2;0 to 6;8 were analyzed.

The results show a strong semantic influence on the process of formation of grammatical categories and the acquisition of new words. These processes seem to be subordinate to general semantic categories, i.e., predicate-argument structure, and are not dependent on the grammatical categories of parts of speech. The main conclusion refers to the debate on "semantic bootstrapping" theory (Pinker, 1989; Braine, 1992).

Verbs and nouns are claimed to be among the crucial grammatical categories the child has to acquire. Irrespective of basic assumptions concerning innate elements of grammar, researchers agree that at the beginning of the process of language acquisition categories such as verbs and nouns are not ready in mature form. Rather, some concepts have to evolve (more or less radically - dependent on the given theory) to become mature grammatical categories, definable in formal terms. These first concepts "core verbs" and "core nouns" can be semantic categories of names for objects and names for actions (Macnamara, 1982; Gentner, 1981; but see also Maratsos, 1982, for opposite views). Then, what the child has to do during the further acquisition process is to incorporate into these core concepts words which are in fact nouns or verbs but are neither names of objects nor names of actions. Thus derivatives, such as denominal verbs and deverbal nouns, both well established in the language, and innovations, can be interesting material to investigate the process of incorporating new words into the "old categories" (see Braine, 1992). The main goal of this work is to show how development of denominal verbs and deverbal nouns (which may be seen as a process of incorporating new words into old categories) depends on the acquisition of arguments in predicate-argument structure.

Some basic information about word-formation rules in Polish has to be introduced now. In Polish, to derive a noun from a verb one has to add a suffix to the verb stem. The

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The article is based on the author's Master thesis, prepared under the direction of dr hab. Barbara Bokus-Rauch, at the Faculty of Psychology, University of Warsaw, and was first intended (and accepted) as a paper for the International Workshop on the Acquisition of Slavic and Baltic Languages, Cracow, 1993. Reprints requests should be directed to Ewa Haman, Faculty of Psychology, University of Warsaw, Stawki 5/7, 00-183 Warszawa, Poland, e-mail: meh@sci.psych.uw.edu.pl

suffix denotes the class of objects, whilst stem denotes the peculiar feature of the given object, e.g.

*pisarz* (writer):

*pis-* (stem of the verb *писаć* – to write),

*-arz* (suffix denoting agent of action)

There are some specific suffixes for different semantic categories of deverbal nouns (agent nouns, object nouns, instrument nouns, etc.), but rules of attribution of suffixes are not strict at all: some suffixes can appear in different categories in different meanings. The only strict rule is that for action names, which are derived by adding “-nie” or “-cie” suffixes: there are only a few verbs which cannot be transformed into nouns according to this rule, although in some cases it is possible to derive action names with some other suffix.

The most important point here is that deverbal nouns can always be analyzed formally as “stem + suffix” constructions. Denominal verbs, in contrast, are derived only by adding meaningless verb endings to the stem (e.g. *telefon* /a telephone/ – noun, *telefonować* /to phone/ – verb, with *-ować* as verb ending), and generally no suffixes are used here. Thus, meanings of denominal verbs can be unclear, and depend on context in which the verb is used.

### Case study

Case study of the Polish boy (Michał S.) based on speech diary available from the CHILDES system was made<sup>1</sup>. The data were collected by the boy’s mother between the ages of 2;0 to 6;8, excluding the 6;0 - 6;3 period (very little data were available for the period 3;0 - 3;11).

All denominal verbs and deverbal nouns (both well-established in Polish and innovations) uttered by Michał were selected from the corpus for further analysis. Derivatives were then categorized according to the following system:

For nouns:

1. Action nouns (names of actions, e.g. *bieganie* – running)
2. Instrument nouns (*zabawka* – a toy, something to play with)
3. Result nouns (*skok* – a jump)
4. Object nouns (*jedzonko* – the meal, something to be eaten)
5. Agent nouns (*pisarz* – writer)
6. Location nouns (*piekarnia* – bakery)

For verbs:

1. Action verbs (verbs derived from names of actions, e.g. *gimnastykować się* – to exercise)
2. Instrument verbs (*telefonować* – to phone)
3. Result verbs (*uradować* – to make someone happy, *radość* /noun/ – happiness)
4. Object verbs (*oskalpować* – to scalp)
5. Agent verbs (*stróżować* – to guard, *stróż* – a guardian)

The classification of denominal verbs partially corresponds to that of Clark (1982).

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<sup>1</sup>The diary comes from Professor Szuman's data which were collected in the 1950s and 1960s in Cracow by his collaborators, usually mothers of the observed children.

Table 1. Frequencies of deverbial nouns across age (innovations in parentheses). Last column shows percentages of total token number in given deverbial noun categories.

| age                        | action nouns | instrument nouns | result nouns | object nouns | agent nouns | location nouns | total of deverbial nouns | % of total tokens |
|----------------------------|--------------|------------------|--------------|--------------|-------------|----------------|--------------------------|-------------------|
| 2;0-2;5                    | 21           | 12(6)            | 5            | 7(4)         | 3(1)        | 0              | 48(11)                   | 0.79%             |
| 2;6-2;11                   | 8(1)         | 10(4)            | 1            | 5            | 2(1)        | 5(2)           | 31(8)                    | 0.83%             |
| 3;0-3;5                    | 4            | 0                | 0            | 0            | 2(2)        | 0              | 6(2)                     | 0.76%             |
| 3;6-3;11                   | 7            | 4(1)             | 4            | 1(1)         | 2(1)        | 0              | 18(3)                    | 1.52%             |
| 4;0-4;5                    | 51(4)        | 16(1)            | 29(1)        | 8(3)         | 12(3)       | 6              | 122(12)                  | 1.94%             |
| 4;6-4;11                   | 25(1)        | 17(1)            | 16(2)        | 3(2)         | 7(1)        | 11(1)          | 79(8)                    | 1.70%             |
| 5;0-5;5                    | 26(2)        | 16               | 23(5)        | 1            | 17(2)       | 9(1)           | 92(10)                   | 2.43%             |
| 5;6-5;11                   | 25(4)        | 10(2)            | 14(2)        | 0            | 4(1)        | 3              | 56(9)                    | 2.53%             |
| 6;4-6;8                    | 7(1)         | 4(1)             | 11(2)        | 0            | 3(1)        | 1              | 26(5)                    | 1.83%             |
| TOTAL:                     | 174(13)      | 89(16)           | 103(12)      | 24(10)       | 50(13)      | 35(4)          | 478(68)                  |                   |
| % of total deverbial nouns | 36.5%        | 18.6%            | 21.6%        | 5.1%         | 10.9%       | 7.3%           | 100%                     |                   |

## Results

### Quantitative characteristics of the data

A total of 541 derivatives was collected: 478 deverbial nouns (88.35% of all collected derivatives) and 63 denominal verbs (11.65%). There were 91 innovations (68 nouns and 23 verbs, 14% of all deverbial nouns, and 36.5% of all denominal verbs respectively).

Fig. 1 shows the percentages of derivatives (verbs and nouns together) in the entire number of tokens in the corpus across ages in 6-month intervals. Proportions of derivatives are relatively low between the ages of 2 and 3;5 (about 1%), and then grow rapidly to reach 2% at the age of 4;0-4;5, and 2.8% between 5;6-5;11. Nevertheless even at the earliest stage of development the use of derivatives cannot be treated as incidental.

Tables 1 and 2 gives the distributions of deverbial nouns and denominal verbs (respectively) across categories listed above. As shown in table 1 the most frequent among deverbial nouns is the category of action nouns, which makes up 36.5% of the total number of nouns. Result nouns are the second major category (21.6%), and the third one is the category of instrument nouns (18.6%). Among verbs (table 2) the two most frequent categories are instrument verbs and result verbs, both 41.3% of all collected denominal verbs. The remaining verb categories appeared only incidentally in the corpus (frequencies between 2 and 4, i.e., 3.2-6.3%), and thus cannot be a subject for any detailed analysis. Innovations (shown in the tables in parentheses) can be found across the entire age range, and there is no systematic differences over all development, if the total of innovations for each age group is considered.

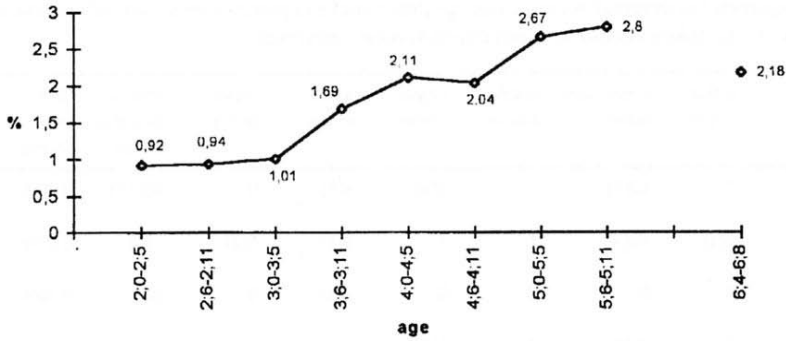


Fig. 1. Percentages of derivatives (denominal verbs and deverbal nouns together) in total of tokens across age

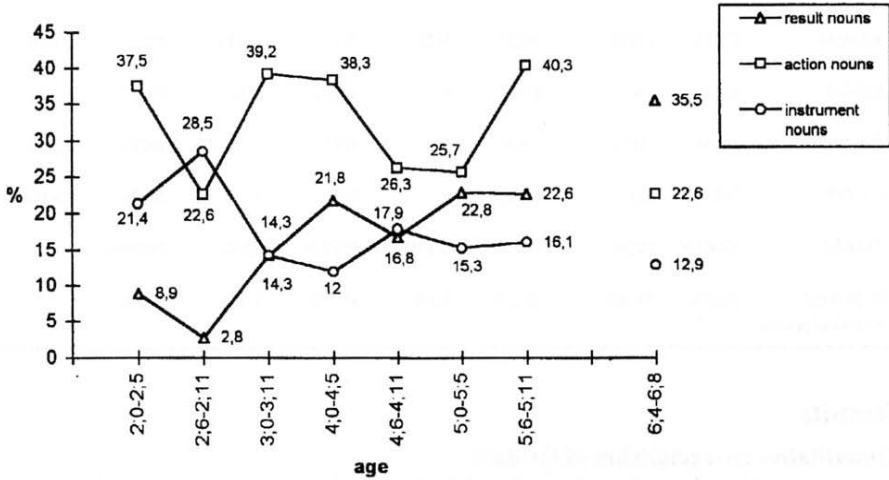


Fig. 2. Percentages of action, instrument, and result nouns in all derivatives across age

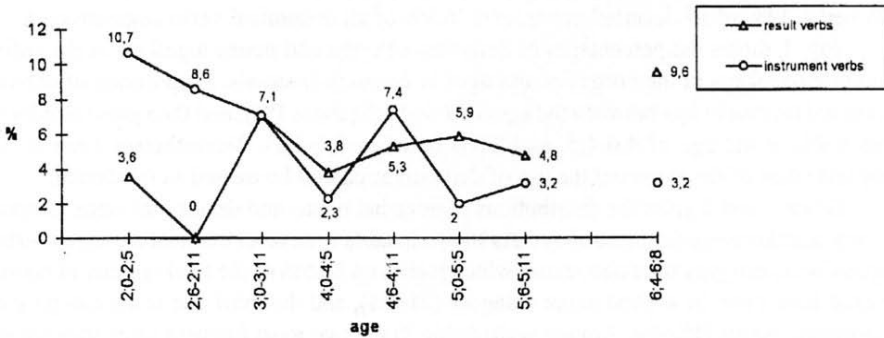


Fig. 3. Percentages of instrument and result verbs in all derivatives across age

Table 2. Frequencies of denominal verbs across age (innovations in parentheses). Last column shows percentages of total token number in given denominal verb categories.

| age                        | instrument verbs | result verbs | object verbs | action verbs | agcnt verbs | other den. verbs | total of den. verbs | % of total tokens |
|----------------------------|------------------|--------------|--------------|--------------|-------------|------------------|---------------------|-------------------|
| 2;0-2;5                    | 6(2)             | 2            | 0            | 0            | 0           | 0                | 8(2)                | 0.13%             |
| 2;6-2;11                   | 3(2)             | 0            | 1(1)         | 0            | 0           | 0                | 4(3)                | 0.11%             |
| 3;0-3;5                    | 1(1)             | 1(1)         | 0            | 0            | 0           | 0                | 2(2)                | 0.25%             |
| 3;6-3;11                   | 1(1)             | 1            | 0            | 0            | 0           | 0                | 2(1)                | 0.17%             |
| 4;0-4;5                    | 3(2)             | 5            | 1(1)         | 1(1)         | 1           | 0                | 11(4)               | 0.17%             |
| 4;6-4;11                   | 7(3)             | 5(1)         | 0            | 2            | 1           | 1                | 16(4)               | 0.34%             |
| 5;0-5;5                    | 2                | 6(5)         | 0            | 0            | 0           | 1                | 9(5)                | 0.24%             |
| 5;6-5;11                   | 2                | 3(2)         | 0            | 1            | 0           | 0                | 6(2)                | 0.27%             |
| 6;4-6;8                    | 0                | 1            | 3            | 1            | 0           | 0                | 5                   | 0.35%             |
| TOTAL:                     | 26(11)           | 26(9)        | 3(2)         | 4(1)         | 2           | 2                | 63(23)              |                   |
| % of total denominal verbs | 41.3%            | 41.3%        | 4.7%         | 6.3%         | 3.2%        | 3.2%             | 100%                |                   |

### Developmental changes

Figures 2 and 3 show changes in the proportions of instrument and result nouns (Fig. 2) and instrument and result verbs (Fig. 3) across age, as a percentage of all derivatives in each age group. For periods 3;0-3;5 and 3;6-3;11 the data were cumulated for the reasons explained above. There are some interesting differences between the developmental course of result and instrument nouns (Fig. 2), and intriguing parallel differences can be found between result and instrument verbs (Fig. 3). As it shown in Fig. 2, instrument nouns make up just 21.4% and 28.5% in the two first age intervals, and are the second major category between nouns in these periods, then decrease with age, and make up only 12.9% of all derivatives in the last (6;4 - 6;8) age group. Result nouns develop in just the opposite direction, starting at the level of 8.9% at the age 2;0-2;5 and reaching 35.5% at the age over 6 years. Even a rough statistical analysis proves these differences to be significant. A  $2 \times 3$  chi square test (category: instrument vs result nouns, by age: 2;0-3;11, 4;0-4;11 and 5;0-6;8 intervals) gives  $\chi^2=12.16$ ,  $p<.005$ .

Fig. 3 demonstrates parallel changes in instrument and result verbs. Instrument verbs start at the relatively high level of 10.7% of all derivatives (75% of denominal verbs) at the age of 2;0-2;5 and drop to 3.2% (20% of denominal verbs) in the last age interval. In contrast, the proportion of result verbs grows from 3.6% in the first age interval to 9.6% of all derivatives in the last interval (25% and 60% of all denominal verbs respectively). Again the  $2 \times 3$  chi square test gives a significant result ( $\chi^2 = 6.14$ ,  $p<.05$ ). Additional

tests performed on innovations demonstrated even stronger differences ( $\chi^2 = 15.75$ ,  $p < .0005$  for instrument and result nouns, and for verbs  $\chi^2 = 13.17$ ,  $p < .005$ ).

On the other hand, similarities in the development of instrument words (nouns and verbs) and result words also seem to be striking. Pearson's correlations computed over the data shown on Figures 2 and 3 give for instrument nouns and instrument verbs  $r = .68$ , and for result words  $r = .82$ .

### Semantic explanation of the results

The analysis of both differences within nouns and verbs, as well as between derivatives based on the same semantic relation (result or instrument) show a strong semantic influence on the process of the formation of grammatical categories and the acquisition of new words. It seems that these processes are subordinate to general semantic categories, i.e., predicate-argument structure, and not dependent on the grammatical categories of the parts of speech. This conclusion can be supported by two additional effects.

First is the sequence of category occurrence which seems to depend on the semantic complexity of a given category of derivatives. The most frequent among nouns, and across almost all age intervals, is the category of action nouns. Transformation of a verb into an action name (e.g. *biegać* – to run, *bieganie* – running) seems to be the simplest one, because there is no change of designate: both verb and action noun denote actions. It is reasonable thus to expect that this category, as the semantically simplest one, should occur first and be the most frequent one, assuming that the acquisition of the word formation rules depends on the overall development of semantic categories.

Instrument nouns are the next major category in the 2;0-2;5 interval. Instrument is an important element of basic predicate-argument structure underlying verb phrase meanings. Other argument-based categories of deverbal nouns (agent, object, and location nouns) are not so frequent in the whole corpus and cannot be easily interpreted (although note that about 30% of occurrences of object nouns took place in the 2;0-2;5 period).

The result nouns are based on more complex semantic relations: the conceptual causal relation between the action (represented in the predicate-argument structure) and the final state of reality. Presumably this relation should be acquired relatively late in development, and thus the proportion of this category of deverbal nouns is expected to grow with age.

The second effect which confirms the "semantic explanation" is the order in which innovations appear in Michał's speech.

Although there are no systematic differences in the total proportion of innovations across age, an interesting change can be observed within particular categories. Whilst in argument-based categories (agent, object, instrument and location, for both nouns and verbs) innovations are present at the beginning, and their proportions are relatively stable or slightly decrease across age, then in the case of result nouns and verbs first uses are only words well-established in Polish. First innovations occur after the age of 3;0 (verbs) or 4;0 (nouns), and become more frequent only about the age of 5. This shift in innovation proportions is parallel to the general increase in result word frequencies, which also takes place between 4 and 5. Whilst well-established (conventional) words can be used before an appropriate word-formation rule is acquired (although availability of such a rule can facilitate learning and use of derivatives), such a rule is necessary to produce an innovation.

The final analysis concerned the use of suffixes in deverbal nouns. It was shown that there is no tendency at any stage to use only one suffix to mark general verb-to-noun transformation. Rather, it was found that, regardless of age, specific suffixes mark different categories of deverbal nouns (e.g. *-nie* for action nouns, *-ka* for instrument nouns,  $\emptyset$  for result nouns; note that in mature Polish the same suffixes can be used across categories and different suffixes can appear as the same category markers). This again supports the "semantic explanation": from the beginning, the formation of derivational rules seems to be based on the semantic relations, and not on the general transformations of grammatical categories of verbs and nouns.

## Conclusions

The results of case study presented here lead to the conclusion that the main factor determining the development of word-formation rules and the process of incorporating nontypical words (derivatives) into grammatical categories of verbs and nouns is the overall semantic development, and the acquisition of predicate-argument structure in particular. Thus the present material could be also analyzed in terms of Pinker's theory of argument structure acquisition, as the author intends to do in the future.

The main conclusion could also contribute to the debate on "semantic bootstrapping" (see Pinker, 1989, and Braine, 1992), indicating primacy of semantic factors in the acquisition of mature grammatical categories, but further research (including experimental study and analysis of metalinguistic utterances) would be necessary to fully explain the relation between the present study and this discussion.

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