On the Semantics of Slovak AN compound adjectives

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The aim of this paper is to identify the semantic constraints involved in a Slovak morphological rule forming compound adjectives. The proposed corpus-based analysis follows the theoretical framework of Lexeme-Based Morphology (Aronoff 1994; Booij 2002; Fradin 2003) and focuses on Slovak compound adjectives formed with a base adjective (BsA) and a base noun (BsN). Three types of semantic relations between: (i) both component lexemes, (ii) AN adjective (AN_A) and the noun it modifies in a NP, the so-called head noun (HdN), and (iii) BsN and HdN in AN_A-HdN sequences are examined. Surveying these three sets of relations enables us to identify the semantic constraints imposed by the corresponding Slovak compounding rule. The constraints that are put forward are able to describe accurately all the examined lexemes and are applicable to new-coined AN_A found on the Internet. *

1. Introduction

Slavic morphology offers very interesting research topics and many challenges for modern word-formation theories. Unfortunately, the scarceness of literature reveals that little has been done in the field of Slavic word-formation.

In this paper, we focus on the semantics of Slovak (West-Slavic) adjectival compounds formed with an adjective (hereafter BsA) and a noun (BsN) (Horecký *et al.* 1989; Buzássyová 2003; Makišová 2006) within the Lexeme-Based approach in morphology (Aronoff 1994; Booij 2002; Fradin 2003). We focus on cases like *dlhovlasý* [1] 'long-haired' which is formed by a combination of BsA *dlhý* 'long' and BsN *vlas* 'hair'. A linking vowel /ɔ/ bounds both elements and the compound ends with an inflectional suffix /i:/.

This type of adjectives is common in other Slavic languages, e.g. Cz. *dlouhonosý* 'long-nosed' (Štichauer 2009); Ru. *goluboglazyj* 'blue-eyed' (Bisetto & Melloni 2008), Po. *jasnowłosy* 'fair-haired' (Szymanek

2009), Se/Cr. *beloglavi* 'white-headed' (Makišová 2006), in Germanic languages, e.g. En. *black-haired* (Marchand 1960; Ljung 1970; Crocco-Galèas 2003), Ge. *dunkeläugig* 'dark-eyed' (Trost 2006), Du. *langbenig* 'long-legged' (Hoeksema 1984; Booij 2005), in modern Greek, e.g. *kokinomalis* 'red-haired' (Ralli 2009) and in Latin, e.g. *albicapillus* 'white-haired' (Oniga 1992).

The general aim of this paper is to provide an in-depth semantic analysis of Slovak AN_A in order to predict novel forms. We examine (i) the kinds of properties expressed by these adjectives when they modify a noun, i.e. the so-called head noun (HdN) in a noun phrase, and (ii) the various semantic links observed between the BsA and BsN. Finally, this paper identifies the bundle of semantic constraints imposed by Slovak AN compounding rule through the possible semantic relations connecting both BsA and BsN to HdN.

Our second goal is to apply to Slovak AN_A some analyses previously put forward for similar compounds in other languages. We discuss the morphological structures proper to exocentric compounds (i.e. whose head is external to the compound), and synthetic compounds (i.e. formed by compounding and derivation). Consequently, we suggest a model based on the notion of lexeme (Aronoff 1994; Fradin 2003 among others) which will in turn contribute to provide a well-founded semantic analysis of Slovak AN compounds.

The paper is structured as follows: Section 2 introduces the theoretical approach, our corpus and reviews some existing analyses and their relevance for Slovak data. Section 3 provides the proper semantic analysis. In the conclusion, we suggest a set of semantic constraints at work in the Slovak AN_A compounding rule.

2. Data, methodology and theoretical framework

In this section, we present the AN_A corpus and the methodology used to gather our data. We begin by giving an overview of the categorial combinations found among Slovak adjectival compounds (2.1). In 2.2 we develop empirical arguments in favour of the Lexeme-Based approach. It will be shown that this framework provides satisfying answers in the analysis of two different types of compound adjectives exhibiting AN structure (2.3). Finally, in 2.4 we review some existing analyses of comparable data from other languages.

2.1 AN$_A$ among compound adjectives in Slovak

The data on which the observations put forward in this paper are based come from Slovak National Corpus (SNK). [2] SNK contains 452,819 adjectives corresponding to approximately 26 millions inflected forms.

Before presenting the AN$_A$ data, let us have a brief overview of compound adjectives in Slovak. As far as SNK is not able to identify compounds in general, a randomly chosen list of approximately 1,000 items categorised as adjectives has been established first. Note that we have been driven here by methodological rather than theoretical reasons due to the fuzzy character of the notion of compounding: "Despite the fact that compounding is extremely widespread across languages, the category 'compound' is very poorly defined, and the term is frequently found with different referents" (Bauer 2001: 695).

Only two simple criteria have been used to identify the categorial combinations in Slovak: (i) each and every adjectival form is made up of at least two components and (ii) both components belong to a major category, i.e. noun (N), adjective (A) and verb (V) (Lieber 1992). Approximately 350 compound forms out of 1,000 adjectives were selected according to criteria (i-ii). (1-6) [3] illustrate each of the existing categorial combinations: NN$_A$ (1), NA$_A$ (2), NV$_A$ (3), AA$_A$ (4), AN$_A$ (5), VN$_A$ (6). [4]

(1) kladiv-o-hlav-ý   'having hammerlike head'
     hammer-LNK-head-FLX
(2) sneh-o-biel-y   'white as snow'
     snow-LNK-white-FLX
(3) rakovin-o-tvor-n-ý   'carcinogenic'
     cancer-LNK-form-AZR-FLX
(4) hned-o-zelen-ý   'brown-green'
     brown-LNK-green-FLX
(5) modr-o-ok-ý   'blue-eyed'
     blue-LNK-eye-FLX
(6) strih-o-ruk-ý   'having cutting hands'
     cut-LNK-hand-FLX

Such adjectival compounds are likely to appear after the copula, and are thus predicative. However, this situation is more frequent for adjectives in which the second component is not a noun, i.e. (2-4). Otherwise, for compounds such as (1) and (5-6), the post-copular position is generally observed when the adjective occurs in an enumeration of properties, like in (7).

(7) S-ú   krásn-e,   blonď-av-é   a   modr-o-ok-é.
    be   beautiful   blond-AZR   and   blue-eyed
    3.PL.PRS   F.NOM.PL   F.NOM.PL   F.NOM.PL
    '(They) are beautiful, blond and blue-eyed.'

As for the general properties of Slovak adjectival compounds, one may observe that: (i) they are formed from two uninflected lexemes, cf. 2.2, and (ii) the components boundary is interfixed by a linking vowel /ɔ/, considered as a formal indicator of morphological compounding (Bisetto & Melloni 2008). Violating at least one of constraints (i-ii) would result into ungrammatical forms. Thus, the following forms are ungrammatical because both components are inflected (8), and because the adjective is lacking the obligatory linking marker (9).

(8) *modr-é-o-ok-o-ý   'blue-eyed'
     blue-NEU.NOM.SG-LNK-eye.-NEU.NOM.SG-FLX
(9) *modr-ok-ý   'blue-eyed'
     blue-eye-FLX

Another property shared by cases in (1-6) is that their citational form ends with the inflectional suffix *-ý* /iː/ [5] (i.e. FLX) indicating masculine gender, nominative case and singular number. Note that Slovak makes a clear distinction between inflectional and derivational affixes (Manova 2005: 5).

In addition, we follow Fradin (2009) who hypothesises that compounding can involve only components deprived of inflectional marking that could not have been generated syntactically. [6]

Note that Slovak also exhibits other types of compound-like constructions in which the first component does not belong to a major category. In such a case, the components boundary is not interfixed by a linking element. The following examples illustrate morphologically complex adjectives whose first component is a numeral (10), an adverb (11) [7] or a preposition (12).

(10) štvor-mesač-n-ý   'four months old'
     four-month-AZR-FLX
(11) mnoho-jazyč-n-ý   'multilingual'
     many-language-AZR-FLX
(12) pred-svadob-n-ý   'premarital'
     before-wedding-AZR-FLX

The data presented so far give raise to various questions about the nature of the first components: Are they lexemes or not? (10-12) lead us

to answer negatively to this question. However, it is debatable to discard numerals (10) (Fradin & Saulnier 2009) because their instantiations seem to belong to an open class in Slovak. As for prepositions (12), it is not clear whether they still behave as prepositions or if they have become true prefixes (Scalise 1994; Amiot 2004). In addition, could the lacking of bounding vowel be an argument to consider the first component as a prefix rather than as a lexeme? All these issues are still open, and, as such, deserve a particular attention in order to determine their status in morphology.

Concerning the suffixed BsNs in (10-12), another interesting fact has to be pointed out: the forms under which the nouns surface never appear in the word-forms correlated to the corresponding lexemes. The sequences °/mɛsaʧ/, °/jaziʧ/ and °/svadɔb/ are stem allomorphs (Aronoff 1994; Booij 1997) of the lexemes MESIAC (10) 'month', *jazyk* 'language' (11) and *svadb-a* 'wedding-FLX' (12). These stems are used only in compounding and derivation, but never in inflection. We believe that the existence of these forms constitutes a strong argument favouring the Lexeme-Based over the Word-Based approach for the treatment of Slovak lexemes. In particular, the model underlying our analysis is able to explain in a satisfying manner the allomorphic variations, and, as such, is well-adapted and fully compatible with our data. Section 2.2 introduces this framework in more detail.

2.2 Lexeme-Based Morphology

Lexeme-Based morphology (Aronoff 1994; Booij 2002; Fradin 2003 among others) offers two main advantages for the description of Slovak AN_A. First, it accounts in a satisfying way for the rich system of allomorphy in Slovak, and more importantly, second, this approach allows us to predict novel and grammatical forms, as will be shown in 4. Before surveying the semantic constraints at work in Slovak compounding, we present the two basic statements supporting this approach: (i) lexemes are the minimal lexical units (2.2.1) and (ii) lexeme-formation processes are conceived in terms of morphological rules (2.2.2).

2.2.1. Lexeme

In this paper, we adopt the representation of lexeme (LXM) proposed by Fradin (2003: 102) following Lyons (1968) and Matthews (1974). Fradin conceives the LXM as an abstract entity lacking inflectional marking. LXMs represent multidimensional entities characterised by three features: (i) phonological representation (F), (ii) syntactic combinatorics (SX) and (iii) meaning (S). Adjectival lexemes can be described as in (13):

(13) LXM   červen-ý_a
    (F)   /tʃɛrvɛn/
    (SX)   cat: A, infl: I^{st} paradigm [8]
    (S)   'red'

Any lexeme, like in (13), is provided with a phonic sequence (F), identical to stem in the sense of Stump (1995). The stem is the LXM's formal representation and is used as a formal base in order to produce a new lexeme or a correlated word-form. If the LXM has more than one form, the stem allomorph may be indicated in the (F) dimension, cf. (14). (SX) trier contains the LXM's category but also information about its combinatorics, i.e. argument structure when relevant, inflectional class, etc. Finally, the LXM's semantics is included in its (S) dimension.

(14) LXM   bruch-o_n
    (F)   /brux/, °/bruʃ/
    (SX)   cat: N, gen: NEU, infl: IXth paradigm [9]
    (S)   'belly'

Quite often, as mentioned in 2.1, the stem allomorph of the LXM in question is involved exclusively in derivation or compounding, but never in inflectional operations. In the following examples, the noun-based adjective (15), and both complex nouns (16-17) are formed on the stem allomorph °/bruʃ/ which never surfaces as an independently occurring word.

(15) bruš-n-ý   'related to belly/stomach'
    belly-AZR-FLX
(16) bruš-ák   'crunch'
    belly-NZR
(17) pod-bruš-k-o   'hypogastrium'
    under-belly-NZR-FLX

Each and every LXM is provided with the correlated word-forms, [10] i.e. fully inflected units inserted in a context. Consider (18):

(18) m-á   červen-é   líc-a.
    have-3.SG.PRS   red-NEU.NOM.PL   cheek-NEU.NOM.PL
    '(He/she) has red cheeks.'

The inflectional suffix *-é* marking neuter gender, nominative case and plural number is used to produce a word-form of the adjectival LXM in (13).

2.2.2. Lexeme Formation Rules

The second important fact that has to be presented is that complex lexemes result from morphological rules, the so-called L(exeme) F(ormation) R(ules). These LFRs instantiate either derivational, e.g. (16-17) or compounding processes, e.g. (1-6).

As for compounding rules, they access to the (F), (SX) and (S) dimensions of both component lexemes. Moreover, the LFRs have an important impact on the semantics of LXM3, as we will show in more detail in 3. The application of a rule can be seen in terms of three parallel and independent operations, each imposing its fine-grained constraints on both input and output lexemes (Fradin 2003; Fradin & Kerleroux 2003).

For example, the formation of the compound MODROOKÝ 'blue-eyed' (5), and more generally, that of BsA-to-BsN combinations can be illustrated as in (19):

(19)	LXM1	LXM2	LXM3
	modr-ý	ok-o$_n$	modr-o-ok-ý$_a$
(F)	/mɔdr/	/ɔk/	/mɔdr/ ⊕ /ɔ/ ⊕ /ɔk/
(SX)	cat: A, infl: Ist	cat: N, gen: NEU, infl: IXth	cat: A, infl: Ist
(S)	'blue'	'eye'	'x such that the eyes of x are blue'

The (S) dimension of LXM3 introduces the semantics of 'x', i.e. the referent of the noun the adjective modifies when inserted in a NP context. In other words, 'x' is involved in the interpretation of the compound adjective before its mere identity is revealed by the context. As soon as the semantic properties will be identified in more detail (sect. 3), the (S) content will be formalised in a more accurate way.

We believe that the formal structure in (19), when applied to the data examined in this paper, is a good starting point for the semantic analysis we propose. This is what we are going to demonstrate in 2.4 by examining other existing formal structures. But before doing so, we present two types of AN compounds, whose semantic differences are easily representable as results of LFRs.

2.3 Two types of AN compound adjectives

Roughly speaking, one may describe all Slovak AN_A (19) as compounds formed with BsA and BsN. However, a closer look at the data leads us to notice that the set of AN_A is not homogeneous. Among the collected data from SNK, two types can be distinguished by their formal structure. We identify suffixed (2.3.1) and non-suffixed (2.3.2) AN adjectives. As we will see, the formal distinction between these compound types is equally correlated to meaning differences.

2.3.1. Suffixed AN compounds

The suffixed adjectival compounds (henceforth $AN\text{-}AZR_A$) occur systematically with an adjectivizer. In (20), the compound ends with the derivational suffix /sk/.

(20) vysok-o-hor-sk-ý   'related to high mountains'
     high-LNK-mountain-AZR-FLX

The same suffix /sk/ produces attested and well-formed denominal adjectives:

(21) hor-sk-ý   'related to mountains'
     mountain-AZR-FLX

It has to be mentioned that other productive nominalising suffixes, such as /n/ (22) or /ɔv/ (23) are also extensively found in suffixed AN compounds.

(22) a. vzduš-n-ý   'related to air'
        air-AZR-FLX
     b. tepl-o-vzduš-n-ý   'related to warm air'
        warm-LNK-air-AZR-FLX
(23) a. tlak-ov-ý   'related to pressure'
        pressure-AZR-FLX
     b. vysok-o-tlak-ov-ý   'related to high pressure'
        high-LNK-pressure-AZR-FLX

From a semantic point of view, it is very important to notice that in compound forms, cf. (20), (22b) and (23b), the adjectival suffix takes scope over both components (i.e. the sequence BsA-BsN), and not only over the BsN.

(24) vysok-o-hor-sk-á   turistik-a   'tourism in high mountains'
      high-LNK-mountain-AZR.F.SG   tourism.F-SG

The instances of the suffixed type can be interpreted following (25a-b).

(25) a. 'related to BsA-BsN'
      b. 'related to high mountains'

Note also that the second component's form of cases like (20), (22b) and (23b) is always similar to that of existing derived adjectives formed on the same BsN, cf. (21), (22a) and (23a).

Horecký *et al.* (1989: 236) and Buzássyová (2003:45) point out that the adjective-noun sequences (e.g. *vysok-é hor-y* 'high mountains'), to which the suffix is added, are lexicalised expressions having a more or less stabilised meaning. Furdík (2004: 70-71) analyses the BsA-BsN combinations as bases of suffixed syntactic phrases, where both components are formally bound by an interfix /ɔ/. However, these proposals predict also ungrammatical forms. In fact, not all lexicalised NPs exhibiting the AN structure (26-27) can be suffixed, far from it.

(26) *francúz-sk-o-bozk-ov-ý   'related to French kiss'
      French-AZR-LNK-kiss-AZR-FLX
(27) *červen-o-vín-n-y   'related to red wine'
      red-LNK-wine-AZR-FLX

We believe that only an in-depth semantic analysis enriched with constraints on the BsA and BsN selection is indispensable to predict well-formed AN-AZR$_A$ and to define the limits of the compounding LFR in question.

2.3.2. Non-suffixed AN compounds

The non-suffixed AN adjectives (i.e. AN$_A$) are the compounds we focus on in this paper. As exemplified in (28), they lack any adjectivizer (i.e. /sk/, /n/, /ɔv/).

(28) dlh-o-krk-ý   'long-necked'
      long-LNK-neck-FLX

As was already seen in (19), their interpretation appears to be different from that of AN-AZR$_A$, cf. (25).

(29) a. 'having BsN with property BsA'
     b. 'having a neck which is long'

Slovak authors consider the AN_A (28) only as a subtype of the suffixed compounds presented in 2.3.1. According to Horecký *et al.* (1989), cases like (28) express a salient feature of the HdN's referent and are used mostly in zoological and botanical nomenclatures. However, it should be pointed out that in our corpus, we gathered AN_A which have not exclusively terminological uses.

In addition, Horecký *et al.* (1989) give no further explanation about the formal differences between $AN\text{-}AZR_A$ and AN_A. Neither Furdík (2004) nor Makišová (2006) mention any distinctiveness between these two AN adjective types.

Nevertheless, there is a wide range of issues that need to be addressed; for instance, it is worth knowing whether suffixed and non-suffixed forms are interchangeable or not. We argue that $AN\text{-}AZR_A$ like (20), (22b) and (23b) never appear without the adjectivizer, thus (30) is ungrammatical, cf. (20).

(30) *vysok-o-hor-ý   'related to high mountains'
     high-LNK-mountain-FLX

However, one may identify compounds with the meaning glossed in (29a), occurring, at the first glance, with the derivational suffix /n/.

(31) jemn-o-zrn-(n)ý   'fine-grained'
     fine-LNK-grain-FLX

Yet, (31) has to be considered as an instance of consonant gemination due to prosodic constraints. The formal adjustment at the /n/ ⊕ /n/ phonemes boundary is governed by strictly formal reasons. Hence, (31) is not formed by means of an adjectivizer. Another case exhibiting a similar formal phenomenon is proposed in (32).

(32) ostr-o-hran-(n)ý   'sharp-edged'
     sharp-LNK-edge-FLX

In sum, we tend to disagree with the existing analyses (Horecký *et al.* 1989; Buzássyová 2003) according to which the non-suffixed AN_A (28) is a sub-type of $AN\text{-}AZR_A$ (20). Conversely, we consider that $AN\text{-}AZR_A$ and AN_A are formed by two different LFRs, both selecting BsA as first and BsN as second component. The semantic constraints on the one hand and the formal structure on the other hand represent sufficient reasons to

distinguish two different LFRs. In other words, the categorial constraints of LXMs involved are not sufficient to predict neither the output form (i.e. suffixed or not), neither the output semantics, cf. (25) vs. (29). Only an in-depth semantic analysis of LXM1-2 may lead us to a satisfying formulation of the corresponding LFR at work.

In what follows, we are concerned only with the non-suffixed compound adjectives and we focus on semantically transparent lexemes, i.e. lexemes exhibiting a compositional meaning. [11] Our corpus contains 365 AN_A, 335 of which come from SNK, and 30 from the Internet. We aim to analyse in which way BsA and BsN combine to produce an adjective, and also to study the constraints applying to these lexemes, as well as the weighing on the noun which is modified by the compound. But before this issue can be properly addressed (see sect. 3) we have to discuss some existing formal analyses.

2.4. Formal structure of Slovak non-suffixed AN_A

In this sub-section, we suggest an appropriate formal analysis of the non-suffixed AN_A, cf. (28) accounting for both their meaning and their forms, and also for the correlation between them. We first discuss some previous formal analyses (Hoeksema 1984; Oniga 1992; Crocco-Galèas 2003; Bisetto & Scalise 2005; Booij 2005; Bisetto & Melloni 2008), in order to establish their relevance for Slovak data. We then show that the Lexeme-Based treatment of AN_A offers the most convenient manner to account for their semantics.

As shown in (8), Slovak compounds cannot be analysed as formed from two independent words. It has been argued in 2.2.1 that in Slovak, which is a language with a rich allomorphy system, only lexemes, i.e. lexical units deprived of any inflectional marking, are likely to be involved in lexeme formation processes. Consider now similar compounds in English (33), German (34) and Dutch (35), which can be compared with Slovak adjectives (36).

(33) long-nos-ed

(34) dunkel-haar-ig   'dark-haired'
       dark-hair-AZR

(35) blauw-og-ig   'blue-eyed'
       blue-eye-AZR

(36) veľk-o-bruch-ý   'big-bellied'
       big-LNK-belly-FLX

As for our first hypothesis, we may apply to Slovak AN_A the structure (37a) envisaged for English compounds (33) (Marchand 1960: 208; Bisetto & Scalise 2005: 331; Adams 2001: 94).

(37) a. $[[A\text{-}N]_N \text{-}ed]_A$

Marchand (1960: 12-13) assumes that the instances of exocentric compounds [12] do not pertain to compounding but to derivation. In such cases, "[...] the underlying basis is not a fixed compound but a syntactic combination". A similar point of view is found in Bloomfield (1933/1970: 217). In (37a), *-ed* is thus considered as a suffix selecting and heading the two-elements nominal base, e.g. *long nose*. The suffix projects the adjective feature on the resulting lexeme. (37b) shows this structure applied to Slovak data:

(37) b. $[[A\text{-}N]_N \text{-}\acute{y}]_A$

Consider (37c), which results from the application of Marchand's (1960) analysis.

(37) c. *veľk-é-o-bruch-o-ý   'big-bellied'
        big-NEU.NOM.SG-LNK-belly-NEU.NOM.SG-FLX

The inacceptability of this example is due to the fact that derivation applies to a syntactic combination, that, as such, has been submitted to inflectional rules. Hoeksema (1984) rejects (37a) for Dutch examples like (35) on the basis of similar arguments. In sum, we cannot consider that a fully inflected AN sequence, i.e. *veľk-é bruch-o* 'big belly' may result in a construction such as (37c), cf. (36).

Moreover, AN combinations never result in compound forms such as those in (38), which should constitute bases, i.e. $[A\text{-}N]_N$ in the suffixation patterning (37b). [13]

(38) *veľk-o-bruch-o   'big belly'
        big-LNK-belly-FLX

Another structure proposed for English compounds is exemplified in (39a) (Crocco-Galèas 2003), which is transposed to Slovak in (39b).

(39) a. $[A [N\text{-}ed]_A]_A$
     b. $[A [N\text{-}\acute{y}]_A]_A$

Crocco-Galèas (2003) observes that English exhibits examples where *-ed* produces well-formed and attested adjectives (40), generally meaning 'possessing BsN' or 'provided by BsN' (Marchand 1960; Ljung 1970; 1976; Hudson 1975; Beard 1976). Consequently, Crocco-Galèas (2003) hypothesises that this same adjectivizer is also used in the formation of compounds like (41).

(40) beard-ed, roof-ed
(41) white-beard-ed, thatch-roof-ed

As for Dutch (35), Hoeksema (1984: 180) considers that the pattern in (39a) "[...] is intended for the synthetic composition construction only, while the normal derivation construction [...] will be interpreted by a separate, although related, rule".

A slightly different conception of synthetic compounding [14] is proposed by Booij (2005). Cases like (35) "[...] seem to be formed by the simultaneous application of compounding and derivation" (Booij 2005: 128). Dutch compounds are obtained by the unification of two simple patterns; the BsN serves as a base for a possibly non-existent but well-formed adjective, which simultaneously combines with another adjective. "This template does not introduce a new formal type of complex words, but it expresses that it is the combination of two independently motivated word formation processes that systematically and productively co-occur" (Booij 2005: 129). (42a) illustrates Booij's (2005) pattern for Dutch, cf. (35), and (42b), its parallel application to Slovak. Both patterns are transcribed in the same format as the above discussed structures (37) and (39). The symbol '+' indicates that compounding and derivation are simultaneous operations.

(42) a. $[A + N\text{-}ig_A]_A$
      b. $[A + N\text{-}ý_A]_A$

However, both (39b) and (42b) have to be discarded for Slovak due to the nature of the suffix *-ý*. Contrary to English *-ed* and Dutch *-ig*, Slovak *-ý* is exclusively inflectional; a denominal adjective such as in (43) is never produced.

(43) *brad-ý   'bearded'
      beard-FLX

Nonetheless, one may hypothesise that cases such as (43) result from a noun to adjective conversion process, which would make Booij's (2005) proposal applicable. Such a pattern could thus be sketched as in (44), where 'Ø' represents the zero suffix.

(44) $[A + N\text{-}Ø_A]_A$

This hypothesis is similar to that of Oniga (1992), who postulates a zero derivation in Latin compounds; the BsN is transformed into an adjective by means of a zero suffix (*ibid*: 106). [15]

(45) magn-anim-us   'magnanimous'
      great-soul-FLX

However, (44) would face a crucial problem if applied to Slovak since the conversion rule has to be productive. Yet, it is not the case; noun to adjective conversion is not an attested process (Nábělková 1993).

The last formal proposal we examine has been put forward by Bisetto & Melloni (2008), who consider that other Slavic AN_A, i.e. Russian (46) and Polish (47), are instances of parasynthetic compounding.

(46) bel-o-golov-yj   'white-headed'
      white-LNK-head-FLX
(47) siw-o-brod-y   'grey-bearded'
      grey-LNK-beard-FLX

Since neither $[A\text{-}N]_N$ nor $[N\text{-}Ø]_A$, cf. (38) and (43), form autonomous and well-formed lexemes in Slavic languages, Bisetto & Melloni (2008) analyse (46-47) as parasynthetic compounds, and thus obeying the pattern in (48). A covert suffix projecting the adjective category noted as 'Ø' in (48) has to be necessarily introduced.

(48) $[[A\text{-}N]_N\text{-}Øý]_A$

As Bisetto & Melloni point out, Russian and Polish exhibit two types of AN compound adjectives, i.e. suffixed vs. non-suffixed ones. Recall that it is also the case for Slovak, cf. 2.3.1-2.3.2. The pattern in (48) is reserved only to a sub-type of AN compounds. However, Bisetto & Melloni (2008) as well as Horecký *et al.* (1989), Kallas (1999), Buzássyová (2003), Szymanek (2009) argue that the default AN adjective type is the suffixed one (20).

Hence, non-suffixed compounds (28) are nothing but an exception to the general rule: "[…] no usual denominal suffix is used in case of adjecti-

val compounds (or premodified possessional adjectives) with a final noun which refers to an inalienably possessed, salient body-part of a human or an animal" (Szymanek 2009: 475). Whereas nouns denoting body parts normally give raise to attested and well-formed adjectives by means of derivational suffixes (15), such adjectivizer remains unspelled when the compounds into which the nouns occur exhibit a possessive meaning (36) (Štichauer 2009).

(15) bruš-n-ý   'related to belly/stomach'
   belly-AZR-FLX
(36) veľk-o-bruch-ý   'big-bellied'
   big-LNK-belly-FLX

Yet, two counter arguments can be raised against Bisetto & Melloni's (2008), Szymanek's (2009) and Štichauer's (2009) proposals.

First, the structure in (48) has two major disadvantages on a formal ground: (i) it can only be applied to parasynthetic compounding, and (ii) a c-commanding covert suffix is needed to satisfy the projection of adjective feature.

Second, even though the possessive interpretation is quite widespread among the BsN-to-HdN relations, it is not applicable to all cases. In fact, the semantic criterion of inalienability is too weak and too strong at the same time. Consider (49) on one hand. Here, the BsN does not denote a body part (e.g. term/memory). Thus, the inalienable relation is not relevant in such case.

(49) krátk-o-dob-á   pamäť   'short term memory'
   short-LNK-term.F.SG memory.F.SG

On the other hand, inalienable possession may sometimes be an insufficient constraint. For some authors, inalienability also covers kinship relations (Lynch 1992: 264; Chappell & McGregor 1996: 4). Consequently, such relations (e.g. daughter/mother) should be observed in AN$_A$-HdN sequences. Yet, this is never the case.

(50) *krásn-o-dcér-e   matk-y   'mothers with beautiful
   beautiful-LNK-daughter.F.PL mother.F.PL   daughter(s)'

In conclusion, none of patterns examined so far proves fully compatible with Slovak data. (37b) can not properly account for Slovak because either it involves fully inflected units, or relies on non-existing forms. (39b) is not fit to account for the inflectional character of /i:/. (42b) and

(44) fail because they rely on non-existing processes, i.e. conversion. And finally, (48) does not predict attested forms since is not properly fit to the semantics of Slovak AN$_A$.

We believe that not only does Lexeme-Based morphology provide a more satisfactory framework for the analysis of Slovak lexemes in general (cf. 2.1-2.3), it also offers an appropriate formal account for the data referred to in this paper. The structure that we will hypothesise is sketched in (51):

(51) [A-N]$_A$

The resulting adjective category may simply be imposed by the LFR constraining the (SX) dimension of the resulting lexeme, cf. (19). According to us, it is a more convenient and costless manner to solve all of the above-mentioned problems raised by the lack of derivational suffix and by the absence of productive noun to adjective conversion rule.

Insofar as we aim to propose an in-depth analysis of the way BsAs, BsNs and HdNs are semantically connected, we survey the semantics of attested forms in sect. 3. The identified semantic constraints between BsA, BsN and HdN will enable us to predict what new AN$_A$ lexemes are likely to mean.

3. The semantics of Slovak AN$_A$

In several analyses of AN compounds in English (Ljung 1970, 1976; Hudson 1975; Beard 1976; Tsunoda 1996) or in Slavic (Bisetto & Melloni 2008; Szymanek 2009; Štichauer 2009), the semantic link between the compound adjective and the noun it modifies is seen as an inalienable possession relation, cf. 2.4. Roughly speaking, the possessed objects denoted by BsNs are inalienably attached to their owners, referred to by HdNs.

Chappell & McGregor (1996: 4) mention more specific criteria: inalienability is characterised by inextricable, essential or unchangeable relations and the possessors exercise little choice or control over them. Frequently, kin terms are considered together with body part terms as instantiations of inalienability (Lynch 1992; Chappell & McGregor 1996).

As far as we aim to propose semantic constraints able to predict novel forms, our approach needs to rely on more accurate criteria. In what follows, we will show that the constraint at stake has to do with meronymy rather than inalienability.

Our analysis will follow from the answers we will provide to three general questions: (i) Which semantic criteria are responsible for the soundness of AN$_A$-HdN sequences? (ii) Which relations are observed between BsA and BsN? And (iii) Which semantic constraints do apply to the relation between BsN and HdN? Addressing these issues will lead us to explain the semantic difference between (52a-b) in 3.1.

(52) a. ?? man with a nose

  b. dlh-o-nos-ý   muž   'long-nosed man'
      long-LNK-nose.M.SG   man.M.SG

Sub-section 3.2 will reveal why examples such as (53a) are impossible sequences while those like (53b) are acceptable.

(53) a. *mäkk-o-matrac-á   posteľ   'soft-mattressed bed'
      soft-LNK-mattress.F.SG   bed.F.SG

  b. kriv-o-noh-á   posteľ   'bandy-legged bed'
      bandy-LNK-leg.F.SG   bed.F.SG

Finally, the constraints established in 3.3 will allow us to rule out expressions such as (54a) from well-formed NPs (54b).

(54) a. *unaven-o-noh-é   dievč-a   'girl with tired legs'
      tired-LNK-leg.NEU.SG   girl.NEU.SG

  b. štíhl-o-noh-é   dievč-a   'girl with thin legs'
      thin-LNK-leg.NEU.SG   girl.NEU.SG

We will begin by examining the general relation between the AN$_A$ and its HdN in an NP.

3.1. Semantic constraints on the AN$_A$-to-HdN relation

In what follows, our objective is to explain the semantic connexion between the compound adjective and the HdN. This will enable us to propose some semantic refinement to the corresponding rule sketched out in (19).

We will show that in all cases, the AN$_A$ cannot denote a constitutive property of a class of entities to which belongs the HdN's referent. Thus, a sequence like (55) is ungrammatical since all members of the class 'woman' have eyes.

(55) *?? woman with eyes*

As pointed out by Ljung (1976: 161): "[…] since the possessor nouns […] are known to possess by definition (inalienably) the referents of the noun-bases (*legs, buttocks, eyes, teeth* etc.), there would simply be no point in merely stating this known fact". For the sequence to become acceptable, some 'extra' semantic material has to be added. In AN_A, it is provided by the BsA (56):

(56) hned-o-ok-á   žen-a   'brown-eyed woman'
      brown-LNK-eye.F.SG   woman.F.SG

According to Tsunoda (1996: 619), expressions such as (55) rely on 'everyone'- type possession, while those such as (56) on 'not everyone'-type possession. That is, there is a class 'woman', for which the property 'having eyes' is normally shared by all of its members. As far as only a subclass of the class of entities in question has brown eyes, (56) is sound.

Similar arguments can be found in Hudson (1975); Beard (1976); Anscombre (1994); Booij (2005); Szymanek (2009). Grice (1975) also points out that typical and inherent characteristics and states-of-affairs are not expected because they are redundant. This same constraint also works for non-human animates (57) and inanimates (58). By definition, all members of the classes 'ficus' and 'butterfly' have leaves and wings respectively.

(57) škvrn-it-o-krídl-y   motýľ   'spotted butterfly'
      spot-AZR-LNK-wing.M.SG   butterfly.M.SG

(58) mal-o-list-ý   fikus   'small-leaved ficus'
      small-LNK-leaf.M.SG   ficus.M.SG

The AN_A properties, as in (56-58), are permanent in normal conditions. Therefore, we consider that these compound adjectives instantiate individual-level predicates (Carlson 1977; Kratzer 1995). (59) resumes the first semantic constraint.

(59) *Semantic constraint on the AN_A-to-HdN relation: the 'not everyone' constraint*
      AN_A denotes a property of a sub-class of the entity to which belongs the HdN's referent provided that the property instantiated by BseA-to-BsN relation is an individual-level property.

In the next sub-section, we examine the semantic relationship between the BsN and the HdN.

3.2. Semantic constraints on the BsN-to-HdN relation

We argue that the general relation between BsN and HdN is a meronymic relation: BsN denotes a constitutive and obligatory part of the HdN's referent. 335 out of 365 forms (i.e. 92%) are interpreted in this way. In marginal cases (17 of 365), i.e. 5%, the BsN-to-HdN relation is seen as functional and other interpretations are observed in 13 of 365 AN$_A$, i.e. 3%.

Meronymic AN$_A$ are examined in more detail in 3.2.1, functional AN$_A$ are presented in 3.2.2 and 3.2.3 is devoted to other BsN-to-HdN relations.

3.2.1. Meronymic AN$_A$

The meronymic relation (Winston *et al.* 1987; Vieu 1991; Chappell & McGregor 1996; Tsunoda 1996; Walsh 1996; Borillo 1997 among others) is the most widespread among the AN$_A$. The Part-Whole relation between BsN (part) and HdN (whole) is identified in 335 of 365 AN$_A$. All new coined compounds (30 of 335) found on the Internet also reflect this semantic relationship.

In almost all examples of our corpus, the BsN is an obligatory body part of a human (60) or non-human animate (61), or it refers to a constitutive part of an inanimate entity (62).

(60) ruž-ov-o-líc-e   dieť-a   'rose-cheeked child'
rose-AZR-LNK-cheek.NEU.SG   child.NEU.SG

(61) krátk-o-roh-ý   byvol   'short-horned buffalo'
short-LNK-horn.M.SG   buffalo.M.SG

(62) jemn-o-zrnn-ý   piesok   'fine-grained sand'
fine-LNK-grain.M.SG   sand.M.SG

It is worth saying that only visible and salient parts are likely to be involved in compounding. That is, BsNs never refer to internal body parts (63) or products of animates (64).

(63) *tenk-o-kostn-á   pan-i   'lady with thin bones'
thin-LNK-bone.F.SG   lady.F.SG

(64) *biel-o-vajc-á   sliepk-a   'hen producing white eggs'
white-LNK-egg.F.SG   hen.F.SG

From (60-62), it could be thought that the AN$_A$ forming rule is likely to involve nouns representing external and thus visible constitutive parts of concrete entities. One may thus hypothesise that the identification of a Part-Whole relation between BsN and HdN could be a sufficient criterion for the well-formation of meronymic AN$_A$. However, the following combinations do not confirm this presumption.

(65) *veľk-o-koles-é   aut-o   'big-wheeled car'
      big-LNK-wheel.NEU.SG   car.NEU.SG

(66) *mäkk-o-matrac-á   posteľ   'soft-mattressed bed'
      soft-LNK-mattress.F.SG   bed.F.SG

Even if the BsNs denote obligatory and constitutive parts of manufactured entities, and even if the Part-Whole relation is identified in the same way as in (60-62), the AN$_A$ in (65-66) are ill-formed. The reason of their non-acceptability may lie in the semantic type of the BsN involved; both BsNs are [-NATURAL] in (65-66). And it is worth noting that in all gathered AN$_A$ the BsNs and HdNs are [+NATURAL].

It should be noticed that some intriguing cases have been found among the 335 AN$_A$: in (67-69), the HdN has a manufactured, thus [-NATURAL] referent, and the BsN denotes its part. Note however that the Part-Whole relation, which is metaphorical in these examples, remains predictable:

(67) širok-o-zub-ý   hrebeň   'large-toothed comb'
      large-LNK-tooth.M.SG   comb.M.SG

(68) kriv-o-noh-á   posteľ   'bandy-legged bed'
      bandy-LNK-leg.F.SG   bed.F.SG

(69) tup-o-nos-ý   parník   'pug-nosed steam ship'
      pug-LNK-nose.M.SG   steam ship.M.SG

The metaphorical extensions of body part terms is a widespread phenomenon in many languages, as observed by Welsh (1996) and Aurnague & Plénat (2008).

One may presume that even if the BsN-to-HdN relation is meronymic (65-69), the semantic type [+NATURAL] is required for BsN in each and every case (67-69). This constraint is at work even though in reality, the teeth of a comb (67), the legs of a bed (68) or the nose of a ship (69) are not natural, but manufactured. It could also explain why the wheel of a car (65) and the mattress of a bed in (66) are not good candidates, since they can never refer to a [+NATURAL] entity.

A question that arises here is whether all the subkinds of Part-Whole relation may be observed. If this is indeed the case, it may prove helpful for the identification of semantic constraints responsible for the selection of the BsN. Six classes describing the different meronymic relations (Vieu 1991: 168-170 following Winston *et al.* 1987) are proposed in Table 1.

Part-Whole Relation	Description	Examples
I Component-Integral Object	Part has a functional role with respect to the whole	$handle_{Part}$-cup_{Whole}
II Piece-Object	Part does not have a functional role with respect to the whole	$cup\ fragment_{Part}$-cup_{Whole}
III Substance-Mass	Part is an obligatory ingredient distributed in the whole	rum_{Part}-$punch_{Whole}$
IV Portion-Mass	Parts are similar to each other with respect to the whole	$slice_{Part}$-pie_{Whole}
V Member-Collection	The whole is a collection of individuals of the same type	$tree_{Part}$-$forest_{Whole}$
VI Sub-collection-Collection	All members of the part are members of the whole	$Benelux_{Part}$-$U.E_{Whole}$

Table 1. Meronymic classes (Vieu 1991 following Winston *et al.* 1987).

The most common relation is the first one, 'I Component-Integral Object' where the part (BsN) has a functional role with respect to the whole (HdN), e.g. (60-61). The 'II Piece-Object relation' is identified in cases like (62). As for the 'III Substance-Mass Relation', it is instantiated only once among 335 forms:

(70) cel-o-zrn-ná   múk-a   'whole-grained flour'
      whole-LNK-grain.F.SG   flour.F.SG

In all cases, the very existence of the HdN's referent entails the existence of the BsN's referent. The above examples provide evidence in favour of the meronymy-based constraint, and its adequacy for the description of the BsN-to-HdN interpretation, cf. class I-III in Table 1.

Note, however, that no compound is formed on the basis of the three remaining classes: 'IV Portion-Mass' (71), 'V Member-Collection' (72) and 'VI Sub-collection-Collection' (73).

(71) *tenk-o-rez-ý   koláč   'thin-sliced pie'
      thin-LNK-slice.M.SG   pie.M.SG

(72) *ihličn-at-o-strom-ý   les   'coniferous forest'
      conifer-AZR-LNK-tree.M.SG   forest.M.SG

(73) *kaz-ov-o-rezák-ý   chrup   'canine decayed teeth'
decayed-AZR-LNK-canine.M.SG   dentition.M.SG

In (74) we summarise the semantic constraint imposed to the BsN-to-HdN relation, which is applicable to the meronymic AN_A.

(74) *Semantic constraint on the BsN_{Part}-to-HdN_{Whole} relation: the* 'meronymic' constraint
The referent of the (preferably [+NATURAL]) BsN is a constitutive part of the HdN's referent; the part is entailed by the mere existence of the HdN's referent. The Part-Whole relations pertain to classes I-III.

We can now sketch the semantic representation of AN adjectival compounds more accurately. In (75), parameter 'x' refers to the expected HdN, 'y' is an instance of a class sharing both A' and N' properties, i.e. 'y' refers to a sub-class of N', having the A' property. Finally, 'x' and 'y' are in Part-Whole relation I, II or III.

(75) 'x such that A'(y) & N'(y) & part-of$_{I\text{-}III}$ (y, x)'

Consequently, the (S) dimension of the LFR forming Slovak AN_A can be refined as follows, cf. (19).

(19')

	LXM1	LXM2	LXM3
	modr-ý $_A$	ok-o$_N$	modr-o-ok-ý$_A$
(F)	/mɔdr/	/ɔk/	/mɔdr/ ⊕ /ɔ/ ⊕ /ɔk/
(SX)	cat: A, infl: Ist	cat: N, gen: NEU, infl: IXth	cat: A, infl: Ist
(S)	blue' (y)	λ x λ y eye' (y) & part-of$_I$ (y, x)	λ x λ y blue' (eye' (y)) & part-of$_I$ (y, x)

It should be mentioned that some cases identified so far do not verify (74-75). Consider (76-78); when such AN_A modify a deverbal HdN, they receive a different interpretation. The BsN does no longer refer to the constitutive part; its semantic relation with the HdN is instead close to what can be called an 'instrumental' relation.

(76) ľav-o-ruk-é   písan-ie   'left-handed writing'

     left-LNK-hand.NEU.SG   writing.NEU.SG

(77) modr-o-ok-ý   pohľad   'blue eyes look'

     blue-LNK-eye.M.SG   look.M.SG

(78) biel-o-zub-ý   úsmev   'white teeth smile'

     white-LNK-tooth.M.SG   smile.M.SG

Obviously, the BsN's referent plays an important role in the process denoted metonymically by the HdN. In such cases, the BsNs exhibit an interpretation close to that of 'instruments' involved in the predicate-argument verb structure; the action of writing necessarily activates the hands (76), that of looking obligatory involves the eyes (77), and during the action of smiling, the agent may show his/her teeth (78).

Let us now consider (79) which verifies the instrumental interpretation as well as the meronymic constraint (75).

(79) Zuzk-a   píš-e   iba   ľav-ou   ruk-ou.

     Suzie-F.NOM.SG   write   only   left   hand

                            3.SG.PRS   F.INS.SG   F.INS.SG

'Suzie is writing only (with her) left hand.'

In (79), 'hand' is interpreted as an instrument of the verb from which is derived the HdN *writing* in (76). We can consider the [+HUMAN] subject of (79), to be what is referred to by 'x', in (75). In addition to the instrumental interpretation, a 'I Component-Integral Object' relation is instantiated in the above sentence.

However, the very restricted number of cases similar to (76-78) does not allow us to formulate more general conclusions concerning the semantic restrictions involved here. As far as we have identified only a very small set of AN$_A$ (7 out of 335 meronymic AN$_A$) modifying a deverbal noun, we do not consider the BsN-to-HdN 'instrumental' relation to be a particular case. In fact, the AN$_A$ interpretation depends entirely on the HdN type: if the latter denotes a concrete [+/-NATURAL] entity, AN$_A$ in (76-78) would be interpreted as meronymic, but since the HdN refers to a deverbal action noun, an instrumental interpretation can be observed.

In the following sub-sections, we look at AN$_A$ types with the lower frequency: functional AN$_A$ (3.2.2) and other AN$_A$-HdN interpretations (3.2.3), that represent marginal but regular cases of the general rule, cf. (19').

3.2.2. Functional AN$_A$

The functional relation subsumes cases in which the BsN refers to an ability and the HdN denotes either the corresponding organ (80), or the entity possessing the ability in question (81). This semantic relationship is observed in 5% of AN$_A$.

(80) slab-o-zrak-é   ok-o   'weak-sighted eye'
      weak-LNK-sight.NEU.SG   eye.NEU.SG

(81) ostr-o-sluch-ý   ded-o   'sharp-hearing grandfather'
      sharp-LNK-hearing.M.SG   grandfather.M.SG

The question that arises here is whether such cases verify the constraints formulated above. Even though the BsNs, which are at the first glance verb-based nouns, [16] do not refer to a constitutive part of a whole (3.2.1), such abilities as those in (80-81) remain salient and inherent characteristics of the HdN's referent, cf. the 'not-everyone' constraint in (59). We have seen in (3.2.1) that a [+NATURAL] BsN is prefered. Here, there is no need to specify the semantic type of the BsN: all ability-denoting nouns are by definition natural.

Consider now (82):

(82) jasn-o-zvuk-ý   zvonec   'clear sound bell'
      clear-LNK-sound.M.SG   bell.M.SG

This example is comparable to (80): the bell is here interpreted as an 'organ' able to produce some sound. We may thus argue that the notion of 'organ' can be extended to artefact nouns. Note that (82) is the only one case found in the SNK where the AN$_A$-to-HdN relation is interpreted as functional and the HdN refers to an artefact.

The semantic constraint applied to the functional BsN-HdN pairs can be summarised under (83).

(83) *Semantic constraint on the BsN$_{Ability}$-to-HdN relation: the 'functional' constraint*
The referent of the BsN is an ability of the HdN's referent; the latter obligatory possesses the corresponding ability.

However, (83) is only a sketch that needs to be improved. To do so, further examples are required. In our corpus, however, examples such as (80-82) are not frequent enough to allow us to propose a more fine-grained description.

3.2.3. Other interpretations of AN_A

The last and smallest group of Slovak AN_A (3%) expresses various relations between BsN and HdN, but most of their semantic properties remain predictible. Since we have found only a very small set of AN_A in the SNK, each of them occurs with a very high frequency. Moreover, such adjectives are found almost exclusively in specialised texts, where the AN_A-HdN sequences are an instance of specialised terminologies. (84-85) illustrate physics terms and (86) that of the economics and/or finance domain. Note that the HdN is very often the same for each AN_A.

(84)	krátk-o-vln-né short-LNK-wave.NEU.SG	rádi-o radio.NEU.SG	'short wave radio'
(85)	priam-o-čiar-y direct-LNK-line.M.SG	pohyb movement.M.SG	'translation motion'
(86)	dlh-o-dob-é long-LNK-term.NEU.SG	investovan-ie investment.NEU.SG	'long-term investment'

Obviously, the BsN-to-HdN semantics is not as clear as it is for meronymic (3.2.1) and functional (3.2.2) compounds. Yet, these various relations result from the general 'not-everyone' constraint (59): BsNs are likely to express some aspect of an object- (84) or an event- (85-86) referring HdN. This aspect is crucial to describe the HdN. More specifically, the BsN in (84) indicates the characteristic property of the radio, (85) exemplifies the physics term 'translation' (vs. 'rotational motion') where the BsN refers to a kind of inherent attribute of the motion in question. As for (86), the BsN represents an obligatory element in HdN's modalities, i.e. the term of the contract.

However, the semantic heterogeneity of these relationships prevents us from identifying a unified semantic constraint that would hold for all cases. Although they clearly differ from the other AN_A in terms of BsN-to-HdN relation, they fully satisfy the rule-required semantic constraints. The next sub-section will enable us to identify the constraints on the selection of the BsA.

3.3. Semantic constraints operating on the BsA-to-BsN relation

It has been argued in 3.1 that AN_A-to-HdN combinations express individual-level properties (Carlson 1977; Kratzer 1995) of the HdN. We now examine whether the internal predicate, i.c. the one linking BsA and BsN, is constrained to instantiate this same property.

Consider (87-88), which illustrate ill-formed constructions in Slovak. They are characterised by the fact that their BsAs *wet* and *shaved* refer to stage-level properties.

(87) **mokr-o-srst-ý*   *jazvečík*   'wet-haired badger dog'
     wet-LNK-fur.M.SG   badger dog.M.SG

(88) **ohol-en-o-noh-á*   blondín-a   'blonde with shaved legs'
     shave-AZR-LNK-leg.F.SG   blonde.F.SG

In both cases, the adjectival property is extrinsic: it results from a change-of-state of the BsN. Now compare (89-90).

(89) polo-dlh-o-srst-ý   jazvečík   'medium-haired badger dog'
     medium-long-LNK-fur.M.SG   badger dog.M.SG

(90) dlh-o-noh-á   blondín-a   'long-legged blonde'
     long-LNK-leg.F.SG   blonde.F.SG

Here, the BsAs denote individual-level properties of the entites referred to by the BsNs. The role played by the innate character of the property in the AN_A well-formedness can be explained within the prototype theory (Smith *et al.* 1988; Connolly *et al.* 2007 among others). Within this theory, concepts are characterised by their prototype structure which contains several inherited feature dimensions endowed with a range of possible values (Connolly *et al.* 2007:6-7).

A similar proposal is found in the so-called conceptual combination approach proposed by Wisniewski (1996) for the analysis of English nominal compounding. Nouns are represented as frames with slots and fillers: [17] "A frame is a knowledge structure that represents a concept of a stereotypical situation or object […]. Slots and fillers are dimensions of the situation or object along with their typical values." (Wisniewski 1996: 435). For instance, the frame of 'elephant' may be represented by slots like [COLOUR], [SIZE], [LOCATION] bearing typical values like *grey, large* and *zoo*.

In our analysis, the term 'definition features' coincides with Wisniewski's 'slots' except for one difference; for us, 'definition features' reflect individual-level, i.e. intrinsic and stable properties, and not extrinsic, i.e. stage-level properties (Carlson 1977; Kratzer 1995). For instance, Wisniewski suggests a slot [LOCATION] for 'elephant'. We however reject this slot since it instantiates a stage-level property, so that the corresponding values *zoo* or *nature* are not able to subclassify, cf. 3.1.

We base our observations on the fact that every single entity expressed by BsNs may be characterised by a set of 'definition features', which can be defined as prototypical characteristics of an entity whose aspects are realised by corresponding qualities or possible values. Consequently, the BsA is seen as a realisation of one possible aspect of the relevant definition feature.

Consider, for instance, the BsN *noha* 'leg', which occurs in 5% of compounds. The entity to which it refers may be characterised by definition features such as [LENGTH], cf. (90), [FORM], [COLOUR], [SIZE], [PILOSITY], etc. A definition feature is realised by an adjective instantiating an individual-level property. Our claim is that this condition is mandatory: the BsA may modify the BsN in the compound form only if the BsA expresses a possible value of the relevant definition feature:

(91) zelen-o-noh-á   sliepk-a   'green-legged hen'
     green-LNK-leg.F.SG   hen.F.SG

(92) chlp-at-o-noh-ý   motýľ   'hairy-legged butterfly'
     hair-AZR-LNK-leg.M.SG butterfly.M.SG

As expected, the BsA in (91) instantiates one of the possible and available values of definition feature [COLOUR] and the one in (92) that of [PILOSITY]. That is, the BsAs fulfill the BsN' definition feature by taking any available value of the definition feature in question.

The morphological complexity of the BsA is irrelevant provided that both criteria are satisfied. That is, noun-based BsAs (93-94) are extensively found in AN$_A$ because (i) they realise individual-level properties, and (ii) they fulfill one of the relevant definition features. Adjective-based BsA are also likely to be selected, cf. (89).

(93) dúh-ov-o-vlas-ý   Denis Rodman   'rainbow haired Denis
     rainbow-AZR-LNK-hair.M.SG [D.R.].M.SG   Rodman'

(94) nožnic-ov-o-ruk-ý   Edward   'Edward Scissorhands'
     scissors-AZR-LNK-hand.M.SG [E.].M.SG

To sum up, the semantic constraint bearing on the relation between BsA and BsN is proposed in (95):

(95) *Semantic constraint on the BsA-to-BsN relation: the 'individual-level' constraint*
     BsA instantiates an individual-level property of the BsN's referent and realises one of its possible definition features.

(95) is also valid for the so-called functional compounds (3.2.2); abstract BsNs, cf. (80-82) can be characterised by the definition feature [PERFOR-MANCE]. This is also the case for the compounds realising other relations (3.2.3). For instance, the possible definition feature of the referents of BsNs in (84-85) is [LENGTH].

The next step is to check whether the set of semantic constraints we have identified in sect. 3 allows us to predict new forms.

4. Application of semantic constraints on new AN$_A$-HdN pairs

The aim of this last section is to test the semantic constraints on new and unattested but possible AN$_A$. As it was mentioned several times, the semantic constraints imposed by a rule should be not only able to contribute to the correct interpretation of the existing AN$_A$-HdN pairs, but also to predict new compounds. As a matter of fact, our conclusions concerning the semantic relations examined so far will be justified if our rule is able to predict unattested but possible AN$_A$.

Recall the 'not-everyone' constraint (59). It requires that the AN$_A$ denote an individual-level property of the HdN's referent and that the BsNs refer to its inherent characteristic. The 'meronymic' constraint established in (74) states that BsN have to denote an obligatory (and preferably natural) part of the HdN's referent. In (83), we have seen that BsNs refer to an ability and the HdN corresponds to the entity posses-sing it (i.e. 'functional constraint'). Finally, we found out (95): only BsAs realising an individual-level property, and fulfilling one of the definition features of the enitity referred to by the BsN, are possible.

In 4.1 we explore the data found on the Internet. 4.2 describes the way a survey has been designed and conducted among 35 Slovak native speakers. The purpose of this survey was to judge the ill- vs. well-formed-ness of a series of invented AN$_A$. Its results constitute a validation of the constraints we identified.

4.1. Confirmation from the Internet

All new coined AN$_A$ found on the Internet instantiate a Part-Whole relation (3.2.1). Moreover, each and every case respects the constraints imposed to the compound adjective and to the noun the compound adjective modifies. (96-98) illustrate three of 30 sequences found on the Internet [18] which do not occur in the SNK.

(96)	mal-o-prs-á	hereček-a	'small-breasted actress'
	small-LNK-breast.F.SG	actress.F.SG	
(97)	umel-o-zub-á	moderátork-a	'TV presenter with
	artificial-LNK-tooth.F.SG	TV-presenter.F.SG	artificial teeth'
(98)	dlh-o-chlp-ý	plyš	'long hair plush'
	long-LNK-hair.M.SG	plush.M.SG	

These compounds refer to an individual-level property of the HdN's referent and satisfy the 'not-everyone' constraint since a subclass of entities is pointed at. The BsN in (96-97) refers to natural body part of [+HUMAN] animate. As foreseen by our constraints, the [+NATURAL] BsN in (98) metaphorically denotes a constitutive and obligatory part of an arte-fact. The 'I Component-Integral Object' relation (cf. Table 1) is operating here. Example (98) instantiates the 'II Piece-Object' relation. As expected, the BsA-to-BsN internal predicate belongs to the individual-level type in all cases.

Conversely, following ill-formed compounds, which have been invented by ourselves return no indexed pages from the Internet.

(99)	*červen-o-paprik-ý	'with red pepper'
	red-LNK-pepper-FLX	
(100)	*otvor-en-o-dver-ý	'with open door'
	open-AZR-LNK-door-FLX	

In what follows, we describe a survey in which we have submitted 60 invented AN$_A$ to Slovak native speakers, so as to evaluate their plausibility.

4.2. Survey on plausibility judgments of non-existing AN$_A$

To supplement our study, we have conducted a survey with 35 Slovak native speakers, so as to assess their judgment of acceptability towards 60 unattested AN$_A$. The experimental method is explained in 4.2.1 and the results are presented in 4.2.2.

4.2.1. Experimental method
The 35 surveyed subjects (21 women, 14 men) were all Slovak native speakers aged from 25 to 45 years. 20 subjects were postgraduate per-sons; among them, 11 had a degree in Language sciences (i.e. linguistics, traductology, foreign language didactics, etc.).

We used the following method: first, we invented a list of 60 compound adjectives. 30 of them were coined in such a way that they satisfy the rule-required semantic constraints (GROUP1). The remaining 30 phonologically sound AN$_A$ were deliberately created to violate at least one of the semantic constraints (GROUP2).

More precisely, we have put into the GROUP1 meronymic (3.2.1) or functional adjectives (3.2.2) satisfying each and every constraint, i.e. 'not-everyone' constraint (59), meronymic/functional constraint (74)/(83) and 'individual-level property' constraint (95), e.g. (101-102).

(101) svaln-at-o-noh-ý   'with muscular legs'
       muscle-AZR-LNK-leg-FLX

(102) slab-o-hlas-ý   'with weak voice'
       weak-LNK-voice-FLX

Within GROUP2, 10 ill-formed adjectives out of 30 do not verify neither the 'meronymic', neither the 'functional' constraint: e.g. (103). In 10 other cases, the BsN did not refer to a [+NATURAL] entity, e.g. (104), and the third sub-group of GROUP2 contained forms in which the BsA-to-BsN relation does not follow from the 'individual-level' constraint; it instantiates a stage-level property, e.g. (105).

(103) *tepl-o-vod-ý   'with warm water'
       warm-LNK-water-FLX

(104) *biel-o-okn-ý   'with white window'
       white-LNK-window-FLX

(105) *namaľov-an-o-ok-ý   'with made-up eyes'
       make-up-AZR-LNK-eye-FLX

The elements of GROUP1 and GROUP2 have been mixed randomly into a questionnaire that has been submitted to the surveyed participants who were asked to accomplish two tasks:
(1) "For each adjective, indicate YES if it seems natural to you, and NO if you reject it categorically".
(2) "If you accept it, propose a noun that can be modified by the adjective you judge sound".
The answering time span was unrestricted.

4.2.2. Results
Our aim was to obtain judgments of acceptability for 100% of forms from GROUP1, and rejection of 100% of compounds from GROUP2 per

each questionnaire. Even when 100% was not obtained, each subject judged at least 24 of 30 cases similar to (101-102) as well-formed. Similarly, at least 24 of 30 invented compounds like (103-105) were rejected.

Almost all surveyed subjects have considered (101) as a well-formed lexeme, and have proposed a possible HdN, e.g. *bodybuilder, football player*, etc. As for (102), nouns like *child, old lady'* etc. have been proposed. Conversely, 4 participants have judged the ill-formed example in (105) acceptable. They have precised that they would never use it, but can imagine it in informal discussions.

Thus, the constraints we proposed have been mostly confirmed. In sum, the results were satisfactory and in accordance with our predictions.

Even though the sample of participants was not significant to prove the statistical validity of this survey on the one hand and on the other hand, the method has not been sufficiently formalised, we believe that the results represent important evidence in favour of the semantic constraints put forward in this paper.

5. Conclusion

The aim of this paper was to analyse Slovak AN_A following the Lexeme-Based approach in order to identify the semantic constraints imposed by the compounding rule. Examining a large corpus of 365 AN_A and their HdNs, we attempted to describe three relation types between the elements involved: (i) AN_A-HdN, (ii) BsN-HdN and (iii) BsA-BsN. This corpus-based study allowed us to sketch out the limits and possibilities of BsA, BsN and HdN selection in order to understand better the AN compounding rule in Slovak.

The choice of the Lexeme-Based approach was justified in three main respects; by applying three independent and parallel operations (i.e. formal, categorial and semantic), this framework gives a satisfying account of the (i) final /iː/ inflectional suffix, (ii) resulting category, and (iii) semantics of BsA, BsN and HdN. Assuming that compound lexemes result from Lexeme-Formation rules imposing a set of constraints on both inputs and output, we have carefully analysed the semantic dimension of Slovak AN_A compounds.

Examining Slovak AN_A in their contexts (SNK, Internet), we have argued that the semantic relation in force is a Part-Whole relation, which has been observed in 335 out of 365 forms. Functional interpretation has been identified in 17 compounds and other semantic relations in 13 AN_A. It has been shown that in all AN_A, a [+NATURAL] BsN is selected. The BsA has to denote an individual-level property. In addition, the BsA instanti-

ates an available value of one of the corresponding definition features of the BsN's referent.

All new coined AN_A (30 of 365) from the Internet respect our conclusions that have been tested by a small survey. Its purpose was namely to assess the validity of our constraints through Slovak native speakers, judgments of acceptability, concerning well- or ill-formedness of a list of invented AN_A. This survey has proved our conclusions to be sound in most cases. In particular, the subjects tend to accept non-existing but plausible AN_A, and to rule out AN_A that do not respect at least one of the semantic constraints we have identified.

In conclusion, we believe that by using the rule-required semantic constraints defined and tested in this paper, we have got great chances to correctly predict AN_A neologisms, as well as the conditions of their use. It has been shown that the semantic constraints at work are applicable to the whole set of the explored data. However, only a scrupulous observation of new-coined compounds will fully validate our analysis. This issue, which is another question for further research, requires a large amount of textual data to be gathered and furthermore examined.

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Notes

[1] The typographic convention we adopt is similar to that of Matthews (1974): lexemes are given in small capitals and word-forms in italics.
[2] SNK is developed by Linguistics Department of Slovak Academy of Science (Jazykovedný Ústav Ľudovíta Štúra, SAV) on the model of British National Corpus. SNK is a large database of contemporary texts, 60,6% of which are journalistic texts, 17,5% fiction, 11,6% specialised texts (e.g. technics, law etc.) and 10,3% are other, non specified texts.
[3] Following abbreviations are used in our glosses: LNK=link (Bauer 2001), FLX=inflectional affix, AZR='adjectivizer', i.e. adjective forming derivational affix, NZR='nominalizer', i.e. noun forming derivational affix (Fradin 2008).
[4] Since only native compounding has been focused on, the so-called learned compounds were excluded. We ruled out all compounds in which at least one of the components originates from Greek or Latin and does not function as an autonomous word in Slovak (e.g. *makr-o-biot-ick-ý* 'macrobiotic').
[5] Note that inflectional suffix *-ý* / *-í* /iː/ exhibits formal variations, such as a short *-y* or *-i* /i/. The difference between these forms comes mostly from orthographic and prosodic reasons.

[6]   The dichotomy between morphological vs. syntactic compounds is not that clear-cut as it could seem and the question still remains open.

[7]   AdvV$_A$ compounds are also possible, e.g. *dlh-o-hraj-úc-i* long-LNK-play-PRSP-FLX 'long playing'. The verb components are likely to occur with the present participle (PRSP) suffix, cf. Szymanek (2009). Some cases of word-internal inflection are discussed by Štichauer (2009).

[8]   Mistrík (1988: 51-54) identifies three declensional adjective paradigms (i.e. I *pekn-ý,* II *cudz-í,* III *páv-í*) which are distinguished according to (i) formal properties of the stem: presence of a hard (e.g. /n/, /v/) vs. soft (e.g. /ʤ/) consonant and (ii) prosodic constraints, i.e. syllable length.

[9]   The declensional noun paradigms rely on three criteria: (i) gender (i.e. M, F, NEU), (ii) vowel vs. consonant final, (iii) hard vs. soft consonant. Along these lines, the traditional Slovak grammar distinguishes twelve inflectional noun paradigms, i.e. M: I *chlap,* II *hrdin-a,* III *dub,* IV *stroj;* F: V *žen-a,* VI *ulic-a,* VII *dlaň,* VIII *kosť;* NEU: IX *mest-o,* X *srdc-e,* XI *vysvedčen-ie,* XII *dievč-a* (Mistrík 1988).

[10]   The inflectional system of adjectives in Slovak relies on three features: (i) number: SG (singular), PL(ural), (ii) gender: M(asculine), F(eminine), NEU(ter) and (iii) case: NOM(inative), GEN(itive), DAT(ive), ACC(usative), LOC(ative), INS(trumental). Thus, the complete inflectional paradigm of Slovak adjectives contains 36 word-forms.

[11]   We excluded from our study the AN$_A$ whose meaning is a trope, i.e. a rhetorical figure consisting in using an expression with a non literal meaning. Consequently, AN$_A$ exhibiting a lexicalised (vs. compositional) meaning have not been included, e.g. *tvrd-o-hlav-ý* interpreted as 'obstinate' and not 'lit. whose head is hard'.

[12]   Cf. Bloomfield (1933/1970); Lieber (1992); Fabb (2001); Scalise & Guevara (2006) among others for the dichotomy between endocentric and exocentric compounds.

[13]   Note that Slovak exhibits well-formed AN compound nouns, e.g. *rýchl-o-vlak* fast-LNK-train 'express train', *veľk-o-mest-O* big-LNK-town-FLX 'big town'. However, we consider that semantically, the selection of BsA and BsN at work in the AN nominal compounding rule is not appropriate for cases similar to (38).

[14]   Cf. Hoeksema (1984); Lieber (1992); Fabb (2001); Bisetto & Melloni (2008) among others.

[15]   Oniga does not specify whether these adjectives are well-formed and autonomous words.

[16]   There are no available verb bases corresponding semantically to these nouns in the present state of the language.

[17]   Cf. *Variable R Condition* of Allen (1978: 93). The author thanks one of IJL's anonymous reviewers for mentioning the fact that Allen (1978) was the first to come up with the idea of slots and fillers.

[18]   Google, November 10 2009.

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