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A CORPUS INVESTIGATION OF THE ORDERING OF SELECTED ATTRIBUTIVE ADJECTIVES IN SLOVENIAN

Abstract

The paper investigates the question of attributive adjective ordering in Slovenian against the background of the cartographic model of natural language syntax (e.g., Cinque 1994, 2010, Scott 2002, Shlonsky 2004, Laenzlinger 2005, Ramaglia 2014). Using the nearly 1.2-billion-word Gigafida 2.0 corpus, we conducted a study in which we check the frequency of attested orders of selected attributive adjectives belonging to thirteen semantic categories and determine whether we can adequately predict language use if we adopt a cartographic model as a working theoretical framework, specifically the adjective hierarchy proposed in Scott (2002). The results show that the probability of encountering an order that violates the hierarchy is in general extremely small compared to the probability of encountering an order that respects the hierarchy, which indicates that the order of adjectives attested in the Slovenian corpus is by-and-large compatible with the proposal that the order is governed by a hierarchy of adjective projections.

Key words: generative grammar, cartography, attributive adjective string, language use, corpus

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1. Introduction

It is very likely that in languages with prenominal adjectives the order of adjectives will be as in (1a) and not as in (1b).

(1) a. small green Chinese vase
b. Chinese green small vase
Sproat and Shih (1991: 565)

What is probably even more interesting or important is that preferences for one order over another apply regardless of whether these are languages with pre-or post-nominal adjectives (e.g., Martin 1969, Hetzron 1978, Dixon 1982, Sproat and Shih 1991, Shlonsky 2004, Scontras and Kachakeche 2020).[2] Preferences for one order over another are present in Slovenian too. Below, we present two proposals for adjective ordering in Slovenian, made within the traditional grammar framework. One is by Vidovič-Muha (1978) and one by Toporišič (2000). The models differ to some extent in the subclassification of adjectives, i.e., their clustering into the semantic classes. Since these two models make different predictions as to how adjectives are supposed to be ordered in language use, and they also lack a comparative, crosslinguistic aspect, we merely present them here and use them as a basis for the prediction that order restrictions exist in Slovenian too.

According to Vidovič-Muha's (1978) proposal, shown in (2), SUBJECTIVE COMMENT adjectives are placed furthest from the noun, followed by adjectives expressing MEASURE, ATMOSPHERE, COLOR, STATE, and MATERIAL. The adjectives closest to the noun are classifyingly used adjectives, i.e., adjectives denoting KINDS.

(2) **SUBJECTIVE COMMENT** (*lep* 'beautiful', *grd* 'ugly', *dober* 'good', *slab* 'bad') >**MEASURE(MENT)** (*velik* 'big', *majhen* 'small', *globok* 'deep', *plitev* 'shallow', *dolg* 'long', *kratek* 'short', *težak* 'heavy', *lahek* 'light', *mlad* 'young', *star* 'old')

[2] These are all orderings with neutral stress and intonation, i.e.,the basic orderings, without comma intonation and without special interpretations.

>**ATMOSPHERE** (*jasen* 'clear', *meglen* 'foggy', *deževen* 'rainy') >**COLOR** (*rdeč* 'red', *zelen* 'green', *bel* 'white') >**STATE** (*bolan* 'ill', *jezen* 'angry', *pečen* 'baked', *rezljan* 'carved', *zašit* 'sewed') >**MATERIAL** (*lesen* 'wooden', *železen* 'iron', *kovinski* 'metallic') >**KIND** (*ladijski* 'ship', *otroški* 'child') >**N**

According to Toporišič (2000), the hierarchy is as in (3), with the highest position occupied by adjectives for PLEASING, followed by OBJECTIVELY ATTRIBUTED PROPERTY, AGE/PERIOD, COLOR, PARTICIPLE, ORIGIN/NATIONALITY, and with adjectives denoting KINDS as the category closest to the modifying noun.

(3) **PLEASING** (*ljubek* 'cute') >**GENERAL ADJECTIVE**; **OBJECTIVELY ATTRIBUTED PROPERTY** (*divji* 'wild', *monden* 'cosmopolitan', *pameten* 'smart', *lep* 'beautiful', *grd* 'ugly', *majhen* 'small', *težek* 'heavy') >**AGE/PERIOD** (*mlad* 'young', *star* 'old', *nov* 'new', *moderen* 'modern') >**COLOR** (*zelen* 'green', *siv* 'grey', *rdeč* 'red', *lila* 'violet') >**PARTICIPLE** (*razbit* 'broken', *boleč* 'painful', *zarjavel* 'rusted', *zaželen* 'desired') >**ORIGIN/NATIONALITY** (*pariški* 'Parisian', *kitajski* 'Chinese', gozden 'forest', *cerkven* 'church', *državen* 'state') >**KIND**(*mali* 'little') >**N**

The model that has taken shape within the formal linguistic theory and has been very prominent in the field of adjective order in multiple adjective string research is the cartographic model of natural language syntax. According to this model, crosslinguistic tendencies for relatively rigid adjective ordering can be accounted for if we assume that adjectives are merged in specifiers of various dedicated adjectival functional projections merged above the noun (e.g., Cinque 1994, 2010, Scott 2002, Shlonsky 2004, Laenzlinger 2005, Ramaglia 2014). As a result, adjectives in multiple adjective strings cannot appear in just any of all possible orders but follow each other in a specific sequence dictated by the functional hierarchy. All deviations from the basic and arguably universal pre-nominal order of adjectives are considered a consequence of either adjective phrase

movement, where an adjective is moved for reasons of topic or focal marking, or different structural positions of the merge.

Following Cinque (2010) there are two separate sources for attributive adjectives: direct modification and indirect modification or (reduced) relative clause (RC). These two sources have different interpretative properties and different merge positions; merge positions for indirect (reduced RC) modification, associated with, i.a., intersective, literal interpretation, are above the positions hosting direct modification adjectives, associated with, i.a., non-intersective, possibly idiomatic interpretation.

In the present paper, the focus is on indirect modification adjectives, i.e., adjectives interpreted intersectively. In intersective adjective-noun combinations, the adjectives are interpreted literally and maintain truth-conditional independence, unlike in the case of direct modification, where an adjective-noun combination gives rise to a non-intersective reading; compare the reading in (4a) with the one in (4b).

(4) Peter je velik jedec.
Peter is big eater.
a. Intersective: Peter is tall and an eater.
b. Non-intersective: Peter eats a lot.

That these are in fact two different structural positions is illustrated in (5), where both indirect and direct modification are instantiated simultaneously by the same adjective *velik* 'big'. The sentence is grammatical only if the adjective that is further away from the noun is interpreted intersectively ('tall and an eater'), and the adjective that is closer to the modifying noun is interpreted subsectively ('someone who eats a lot'). An attempt to interpret the adjective that is further away from the noun subsectively and the one that is closer to the noun intersectively leads to ungrammaticality.

(5) Peter je velik velik jedec.
Peter is big big eater
'Peter is a tall big eater.'

Since direct modification adjectives are merged in a separate field of the NP complex, in the part of the hierarchy that is closer to the noun than adjectives deriving from a relative clause, they are not part of the sequence that is the subject of our research.We can infer from the example in (6) that both parts of the hierarchy are arranged in a specific order, moreover, we can assume that the order is the same in both parts.

(6) a. Peter je velik star prijatelj.
Intersective: 'Peter is a friend who is tall and old.'
Non-intersective: 'Peter is a great long-time friend.'
b. Peter je star velik prijatelj.
Intersective and non-intersective: 'Peter is an old great friend.'

While (6a) is ambiguous between two interpretations, namely an intersective one 'a friend who is tall and old' and a non-intersective one 'a great long-time friend', (6b) can only have one, the interpretation in which the first adjective is interpreted intersectively and the second non-intersectively, namely 'a great friend who is old'.

The most elaborated version of adjective hierarchy proposed within the cartographic model of natural language syntax, which can explain the order of both direct and indirect modifiers, is the Universal hierarchy of adjectival functional projections proposed in Scott (2002).[3] According to Scott (2002: 114), the hierarchy of thirteen

[3] Although Scott (2002) does not at any point explicitly define that the hierarchy he proposes is about the ordering of indirect modifiers, this can be inferred, first, from the examples he excludes from the discussion, see (i) and (ii), and second, from all the data he provides in support of the proposed Universal hierarchy of adjective phrase-related functional projections.
(i) senatorial industrial investigation
(ii) industrial senatorial investigation
As far as (i) and (ii) are concerned, it is claimed that these are cases with no basic ordering, since ordering is chosen upon the intended interpretation; (i) refers to the senate's investigation of the industry, (ii) to the industry's investigation of the senate (Scott 2002: 92). As for Scott's material in support of the universal

semantic categories of adjectives relevant for our corpus research is as illustrated in (7).

(7) SIZE>LENGTH>HEIGHT>SPEED>DEPTH>WIDTH>WEIGHT> TEMPERATURE>WETNESS>AGE>SHAPE> COLOR>MATERIAL> NP

As a currently highly prominent model in the domain of complex NP research, the cartographic model has attracted a lot of criticism, ranging from the problem of innateness, origin, and functional projection proliferation to the problem of rigidity (e.g., Svenonius 2008, Truswell 2009, Scontras et al. 2017, Leivada and Westergaard 2019, Larson 2021). Given the conclusions based on large databases (cases of actual use of multiple adjective strings), the concerns of corpus studies focusing on the rigidity problem, or the so-called empirical undergeneration problem, seem particularly relevant (Wulff 2003, Truswell 2009, Kotowski and Hartl 2019, Trotzke and Wittenberg 2019). Since a rigid order is assumed as a direct output of adjectival functional hierarchy within the cartographic model, the data that do not attest to restrictions in ordering among the proposed semantic categories could be problematic for this strictly syntactic approach.

2. Motivation and Research question

There are several different motives for testing the predictions of Scott's (2002) cartographic model of adjective phrase-related functional projections. First, while it has been claimed that order restrictions apply to Slovenian complex NPs (Vidovič-Muha 1978, Toporišič 2000), there is a lack of experimental studies in the domain of adjective ordering constraints, especially studies that would verify the predictions of the cartographic model (attempts – pilot studies Plesničar 2017; forced-choice experiment, Plesničar 2018; self-paced reading experiment). Second, there is the advantage of corpus studies (compared to experiments of type e.g., forced-choice), namely, the

hierarchy, all adjectives in his examples have the properties of indirect modifiers, as defined in Cinque (2010).

feasibility of comparing a large number of adjectives within a wide range of semantic categories. And finally, although much attention has recently been paid to testing adjective order constraints with the corpus approach, no corpus study has really directly examined the predictions of the cartographic model, even though the cartographic model is currentlydominant in the domain of adjective order research, and Scott's (2002) proposal, moreover, is one of the most fine-grained of all offered so far. Generally, corpus studies test the predictions of Scott's cartographic model either indirectly, against other semantic classifications, or within a limited set of semantic categories and nouns (Wulff 2003, Truswell 2009, Scontraset al. 2017, Kotowski and Hartl 2019, Trotzke and Wittenberg 2019).

In addition to the fact that no corpus study goes into a detailed review of the cartographic model offered by Scott (2002), there is another significant problem with corpus studies on adjective order, namely the problem of conflicting outcomes.

On the one hand, it is argued that a bipartite division between subsective and intersective adjectives is sufficient to explain the data since there is a clear tendency for subsective adjectives to dominate intersective adjectives and no ordering preferences were found among subsective and intersective multiple adjective strings (Truswell 2009).[4] On the other hand, interestingly, a very influential recent study, Scontras et al. (2017), which examines the ordering of semantic categories that are a subset of the categories proposed by Scott (2002), using corpus research merely to validate a behavioral

[4] In Truswell (2009) the subsective interpretation is claimed to be equivalent *„to the conjunction of the property denoted by N with the property denoted by Adj related to a comparison class largely determined by N*" (Truswell 2009: 526). According to the above criteria considered by Truswell (2009), adjectives for AGE or even adjectives for COLOR can be, just like adjectives for SIZE, misconceived as subsective. Consider, for example, the adjective *turquoise*, which is very likely to be defined as something between blue and green when compared to prototypical blue and as blue when compared to red. We will take the position that the adjectives discussed in the present study are intersective, and their interpretation depends on their inherent vagueness and context-sensitivity (see e.g., Klein 1982, Partee 1995, Morzycki 2015).

measure of ordering preferences attained through a direct measure of subjectivity, reaches the same conclusion as Scott (2002). According to Scontras et al. (2017) adjectives for SIZE and LENGTH, grouped into the class of DIMENSION, are located furthest from the noun, followed by adjectives for AGE, SHAPE, COLOR, and MATERIAL, as shown in (8) below.

(8) DIMENSION (SIZE, LENGTH) >AGE>SHAPE>COLOR> MATERIAL adapted by Scontras et al. (2017)

To contribute to this ongoing debate, we conducted a corpus study in which we sought to check the frequency of attested orders of selected attributive adjectives of thirteen semantic categories and determine whether we can adequately predict language use if we adopt a cartographic model as a working theoretical framework, specifically the adjective hierarchy proposed in Scott (2002).We assume that if default adjective ordering in an NP is a result of universal hierarchically ordered NP structure, then the principles that govern the process of building complex NPs should be observed as differences in the number of occurrences between what would then boil down to syntactically adequate and syntactically anomalous complex NP structures.

3. Materials and methods

To be able to assess as accurately as possible whether the prediction of the model proposed by Scott (2002) holds for Slovenian, we decided to examine a wide range of semantic categories from Scott's hierarchy and investigate how they are ordered with respect to each other in the largest corpus of written Slovenian, i.e. the nearly 1.2-billion-word reference corpus *Gigafida 2.0*[5] (deduplicated). In (9) we list all thirteen semantic categories used in our corpus study, their corresponding

[5] Available at: http://www.gigafida.net.

adjectives, and their relative frequencies[6]; although irrelevant here, the semantic categories are listed in the order from Scott (2002).

(9) **SIZE**: *velik* 'big' (2,667,041), *majhen* 'small' (586,904), *ogromen* 'huge' (54,879), *droben* 'tiny' (53,775), **LENGTH**: *dolg* 'long' (502,666), *kratek* 'short' (384,723), **HEIGHT**: *visok* 'high' (801,128), *nizek* 'low' (275,075), **SPEED**: *hiter* 'fast' (251,343), *počasen* 'slow' (36,521), **DEPTH**: *globok* 'deep' (67,679), *plitev* 'shallow' (6,254), *plitek* 'shallow' (2,248), **WIDTH**: *širok* 'wide' (191,419), *ozek* 'narrow' (68,106), **WEIGHT**: *težek* 'heavy' (264,669), *lahek* 'light' (127,823), **TEMPERATURE**: *vroč* 'hot' (99,915), *mrzel* 'cold' (28,777), *hladen* 'cold' (75,857), **WETNESS**: *suh* 'dry' (74,922), *moker* 'wet' (21,017), **AGE**: *star* 'old' (80,209), *mlad* 'young' (711,377), **SHAPE**: *kvadraten* 'square' (67,222), *okrogel* 'round' (61,360), **COLOR**: *rumen* 'yellow' (73,551), *moder* 'blue' (100,430), **MATERIAL**: *lesen* 'wooden' (70,476), *plastičen* 'plastic' (36,920), *kovinski* 'metallic' (31,859)

The corpus was searched using the No Sketch Engine browsing tool. Not to miss any of the potentially relevant cases, we opted for the lemma search, as Slovenian lemmas can have many different word forms. Although we anticipated that this would produce some extra noise as the lemma search includes all forms of the word in the result, including comparative and superlative adjective forms, we deemed this to be outweighed by the greater number of hits and thus by the greater number of potentially relevant cases. (10) provides a template of the lemma query used.

(10) [tag="P.*" & lemma="..."] [tag="P.*" & lemma="..."]

[6] Frequency and length have been shown in previous studies to be factors that can influence the adjective order in multiple adjective strings (e.g., Wulff 2003, Scontras et al. 2017, Kotowski and Hartl 2019, Trotzke and Wittenberg 2019). However, it is not entirely clear why frequency and length affect adjective order in some cases more than in others. For the present study, we tried to control for frequency and length, although this proved to be feasible only to a certain extent, both within and between semantic categories.

We tested all possible combinations of two adjectives from the list in a total of 882 queries. The total number of concordances obtained was 14.916. The obtained data were then exported to excel files, where we first edited and then cleaned them, i.e., marked the excluded data with the appropriate exclusion criterion tag. We used pre-prepared criteria for cleaning the data, all of them are presented in paragraph 3.1. After cleaning, we had 9.156 concordances left for analysis. We should note at this point that a decision to exclude a particular example from the analysis was inevitably subject to a certain degree of subjectiveness, more prominent when deciding, for example, whether an adjective is used as a classifying adjective or in a collocation, and less, or not at all in the case of incorrect tagging or when an adjective was used in a conjunction with a further adjective (e.g. *red and long*). Since some combinations yielded a very large number of hits, such as the combination *velikokrogel* 'large round' (617 hits) or *dolg lesen* 'long wooden' (300 hits), and since reviewing so many hits would be too time-consuming, we set an upper limit on the number of cases examined for each combination: when the number of concordances for the combination of two adjectives exceeds 100, the number of total relevant examples was calculated from the percentage of 100 examples examined.

3.1. Criteria for data cleaning

The exclusion criteria range from cases of classifying use, collocations, corpus tag errors, adjective modifications, comparative and superlative forms, to conjunction and proper name use. An occurrence was excluded from further analysis as soon as it met one exclusion criterion; but the vast majority of exclusions actually met two or more exclusion criteria. One such example is shown in section 3.1.5.

3.1.1. Classifying use and collocation

Our data sample contained many adjective-noun combinations with classifyingly used adjectives (e.g., *kratke hlače* 'shorts', *mlad krompir* 'new potatoes') as well as collocations (e.g.,*suharoba* 'woodenware',

okrogla obletnica 'round number anniversary'). As a classifying use, we label only clear-cut examples of the type *mlad krompir* 'new potatoes'; everything else was labeled as collocation, although it may be, by definition (e.g., Gantar 2007), closer to a set phrase (e.g.,*mrzli stric* 'first uncle', *okrogla miza* 'panel discussion') and could as such be considered as an indirect modifier, in the sense of Cinque (2010). Examples of collocation and classifying use from the corpus are given in (11) and (12).

(11) Collocation:
visokih okroglih obletnicah
high round anniversaries
'big round anniversaries'

(12) Classifying use:
majhne mlade krompirje
small young potatoes
'small new potatoes'

3.1.2. Tag error

We encountered two types of tagging errors. The first group includes incorrect tags, which could be due to an error in the original text, as in example (13), or an error that could be the result of relatively uncommonpart-of-speech sequences, such as the adjective-noun-noun sequence in (14a) or the adjective-modal-noun in (14b).In (13) the word *stari* is tagged as an adjective, but it is clear from the context and from the grammatical agreement that *stari* is actually a misspelling of the noun *stvari* 'things'.

(13) Incorrect tag, due to an error (e.g., typo) in the original text:
drobne stari
tiny old
'tiny things'

In (14a) the word *dolg* preceded by the adjective *velik* 'big' and followed by the noun *razlog* 'reason' is incorrectly tagged as an adjective (*dolg* 'long'), when it should be tagged as a noun (*dolg* 'debt').

The situation is comparable in (14b), where the context reveals that *lahko* is not used in its function of an adjective (*lahek* 'light') but in its function of a modal expression (*lahko* 'can').

(14) Wrong tag, due to uncommon sequence:

a. velik dolg razlog
big debt reason
'big debt is the reason'

b. veliko lahko veselje
great can joy
'the joy can be great'

The second group consists of tags that are not specific enough. In (15) the adjectives *velikimi* 'large' in *visoka* 'high'are not part of one and the same NP complex, but they modify two different noun phrases. *Velikimi* 'large' modifies an unpronounced but understood noun *državami* 'countries', *visoka* 'high' modifies noun *cena* 'price'.

(15) Tagging not specific enough:

cena druženja z velikimi visoka
price socializing with big high
'the price of aligning oneself with big (i.e. powerful) countries is high'

3.1.3. Adjective modification and adjectives in comparative and superlative form

We excluded from further consideration cases in which the adjective was modified, e.g., by an adverbial or quantificational phrase, or when one of the adjectives appears in the comparative or superlative form. It has been noted for Romance that in the superlative form, adjectives can appear higher than normal (e.g., Cinque 2010, Loccioni 2020)[7]. Extrapolating from these findings, we assume that Slovenian

[7] Although Cinque (2010) and Loccioni (2020) highlight only the difference between basic adjective forms and superlatives, we assume that this also applies to comparatives, as comparatives have also been argued to differ semantically from the positive/base adjective forms. According to Klein (1982), comparatives

adjectives in superlative and comparative forms are also in different structural positions than Slovenian adjectives in their positive forms. We did not, however, exclude cases where both adjectives appear in the superlative or both appear in the comparative form, assuming that in these cases, the relative ordering should be the same as between positive-form adjectives, just with different points of origin.

Examples of adjectival modification are given in (16a) and (16b). In (16a) the adjective *velika* 'big' is modified by the adverbial phrase *zelo* 'very', and in (16b) the adjective *široke* 'wide' is modified by the quantificational phrase *8 cm* '8 centimeters'. Examples of adjective-adjective-noun sequences that were excluded due to one of the adjectives being in the comparative or superlative form are in (17). In (17a) the first adjective in the sequence is in the comparative and the second in the base form, and in (17b) the first adjective is in the comparative and the second in the superlative.

(16) Modification:

a. zelo velika visoka pozitivna številka
very big high positive number
'very large high positive number'

b. 8 cm široke rumene cvetove
8 centimeters wide yellow flowers
'8 centimeters wide yellow flowers'

(17) Adjective in comparative or in superlative form:

a. večja lahka kolesa
bigger light wheels
'larger light wheels'

b. višjo največjo hitrost
higher biggest speed
'higher top/maximum speed'

are complex predicates consisting of an adjective and a degree variable, and as such they are not vague, unlike their base adjective counterparts.

3.1.4. Conjunction and proper name

The use of adjectives in conjunction results in special comma intonation, which could affect anotherwise fixed order of adjectives. We therefore exclude cases of enumeration, and cases where one of two successively used adjectives is part of conjunction. (18a) presents an example of enumeration, and in (18b) the adjective *modrimi* 'blue', i.e. the second adjective in the adjective string *širokimi modrimi* 'wide blue', is a part of the conjunction phrase *modrimi in belimi* 'blue and white'.

(18) Enumeration and adjective as part of a conjunction phrase:

a. star mlad visok nizek hiter počasen drag
old young tall low fast slow expensive
poceni težek lahek
cheap heavy light

b. širokimi modrimi in belimi črtami
wide blue and white stripes
'wide blue and white stripes'

We also excluded cases in which one of the adjectives is a proper name or a constituent part of a proper name. Two such examples are presented in (19a) and (19b), respectively. In (19a) the whole adjective string is a proper name, and in (19b) only the second adjective in the adjective-adjective string is a part of the proper name.

(19) Proper name or a constituent part of a proper name:

a. Velikega Globokega
big deep
'Veliko Globoko' (the name of a settlement in south-eastern Slovenia)

b. široke Velike Pode
broad large plateau
'broad Large Plateau (Veliki Podi is the name of a plateau cunder Mount Grintovec)

3.1.5. Multiple exclusion criteria

The string *višji Velika* 'higher big' in (20) met four exclusion criteria, so it had to be excluded on multiple counts.

(20) Modification, conjunction, an adjective in comparative or in superlative form, a constituent part of a proper name:
nekoliko višji Velika in Zadnja Mojstrovka
somewhat higher big and back Mojstrovka
'slightly higher Velika (Mojstrovka) and Zadnja Mojstrovka'

The identified exclusion criteria are as follows, first, the adjective *višji* 'higher' is in comparative adjective form, second, it is modified by the adverb *nekoliko* 'somewhat', third, the adjective *Velika* 'big' is a constituent part of a proper name (*Velika Mojstrovka* peak), and fourth, it is also part of a conjunction phrase, consisting of *Velika* 'big' and *Zadnja* 'back'.

4. Results and discussion

We analyzed the cleaned data set, 9.156 examples in total. The first step was to compare the number of occurrences with expected and unexpected adjective orders in general. In Figure 1 visual presentation of the compared samples is given.

The Sapiro-Wilk test of normality shows that neither the sample of occurrences with the expected adjective-adjective order ($W = 0.30185$, $p < 0.001$) nor the sample of occurrences with the unexpected adjective-adjective order ($W = 0.44809$, $p < 0.001$) were normally distributed. Based on this outcome a non-parametric test for independent samples, the Mann-Whitney U test, was used to test the null hypothesis that, for randomly selected frequency values from the expected and unexpected order samples, the probability of the frequency of the expected order being greater than that of the unexpected one is equal to the probability of the frequency of the unexpected being greater than that of the expected one. The number of occurrences with the expected order (Min = 0.00, Max = 670.14,

Median = 2.00, Mean = 19.28) is higher than that with the unexpected order (Min = 0.00, Max = 31.00, Median = 0.00, Mean = 1.484). The test indicates that this difference is statistically significant, U ($N_{expected}$ = 411, $N_{unexpected}$ = 441) = 138255, p < 0.001.

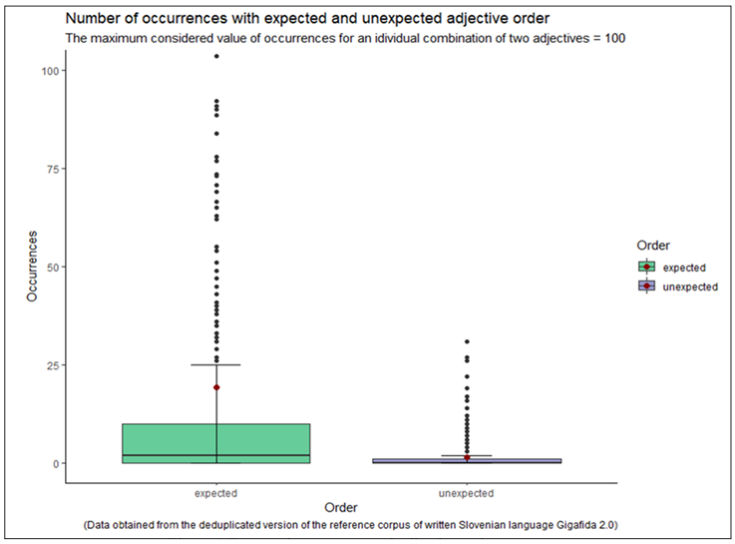

Figure 1: Expected vs. unexpected adjective order

Low medians and means indicate that in the corpus there is a large proportion of adjective-adjective combinations for which there isno data. This result is not surprising, as combinations of two adjectives arenot particularly common constructions in general, and among them, there are some that are less common or less meaningful than others, compare for example the HEIGHT-DEPTH combination, for which it is not entirely clear what real-world context it could be used to describe, with the combination SIZE-COLOR, for which applicable real-world contexts are very easy to imagine. As shown in Figure 2, the proportion of unattested adjective order is higher in the case of the unexpected order, specifically, it is twice as high when compared to the proportion in the case of the expected order. This outcome is expected assuming the adequacy of Scott's (2002) model, according to which, ideally (if speakers don't form ungrammatical constructions

and if our data cleaning successfully excluded all independently explainable reversals), we should get no concordances in the case of the unexpected adjective order.

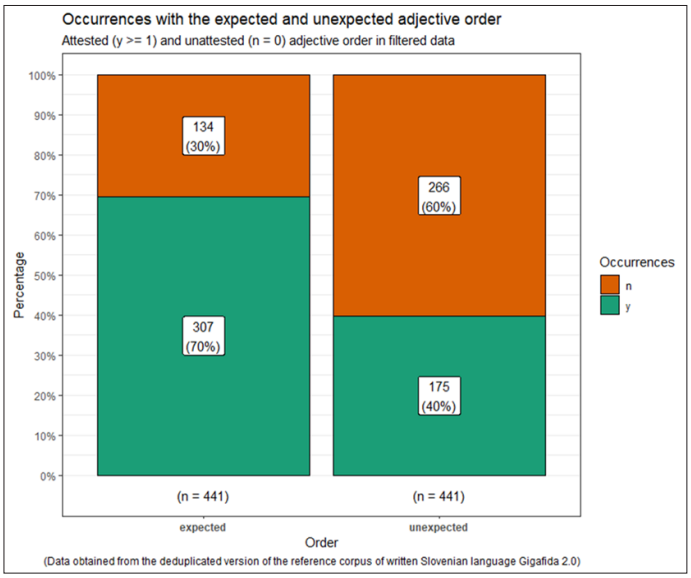

Figure 2: Attested vs. unattested adjective order with the expected and unexpected adjective order

In Figure 3 an overview of the data by individual category is given. In addition to a very clear distinction between expected and unexpected orders across all thirteen semantic categories, it also shows great variability between semantic categories according to the number of examples in the case of expected order. While the number of relevant examples is greater in the case of adjectives from the top and the bottom of the hierarchy (i.e. left and right edge in Figure 3) and there are also fewer deviations from the expected ordering in these cases, the picture is not as clear for the middle part of the hierarchy, where the number of relevant examples is considerably smaller.

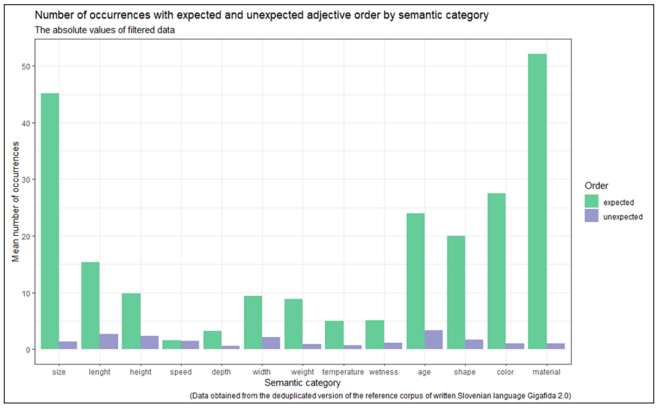

Figure 3: Expected vs. unexpected adjective order by semantic categories

A detailed review of the data reveals that some categories are more „obedient“ than others. As can be seen from the percentage values of the data presented in Table 1, in which the rows refer to the first position and the columns to the second position in the adjective-adjective-noun complex. Semantic categories AGE, WEIGHT, WIDTH, and SPEED depart the most from the expected behavior. (The greener the shade, the higher the percentage; the redder the shade, the lower the percentage.)

Table 1: The percentage values of occurrences per combination of two semantic categories

	size	length	height	speed	depth	width	weight	temperature	wetness	age	shape	color	material
size	N/A	83%	93%	46%	96%	96%	91%	88%	96%	87%	98%	100%	99%
length	17%	N/A	74%	53%	100%	79%	58%	92%	91%	54%	89%	91%	99%
height	7%	26%	N/A	N/A	67%	59%	36%	75%	86%	54%	79%	85%	99%
speed	54%	48%	100%	N/A	60%	N/A	86%	100%	100%	53%	100%	100%	100%
depth	4%	N/A	33%	40%	N/A	32%	50%	85%	67%	N/A	75%	95%	95%
width	4%	21%	41%	100%	68%	N/A	N/A	N/A	83%	41%	100%	94%	99%
weight	9%	42%	64%	14%	50%	100%	N/A	60%	63%	55%	100%	100%	100%
temperature	13%	8%	25%	N/A	15%	100%	40%	N/A	74%	83%	N/A	98%	100%
wetness	4%	9%	14%	N/A	33%	17%	38%	26%	N/A	33%	80%	100%	100%
age	13%	46%	46%	47%	100%	59%	45%	17%	67%	N/A	86%	95%	100%
shape	2%	11%	21%	N/A	25%	N/A	N/A	100%	20%	14%	N/A	68%	78%
color	0%	9%	15%	N/A	5%	6%	N/A	2%	N/A	5%	33%	N/A	87%
material	1%	1%	1%	N/A	5%	1%	N/A	N/A	N/A	0%	22%	13%	N/A

Except for the semantic categoryAGE, these are at the same time the categories for which the corpus exhibits only a few relevant cases (for example, for the category WETNESS there are only 5 occurrences in combination with the category WIDTH, 2 in combination with the category DEPTH and only 1 in combination with the category SPEED). If we look at the absolute values of the data presented in Table 2 (in which colorshading reflects numbers of occurrences, not numbers of occurrences correctly predicted), this is a broader problem present throughout the middle part of the hierarchy, spanning roughly the categories from SPEED to WETNESS.

Table 2: The number of occurrences per combination of two semantic categories

	size	length	height	speed	depth	width	weight	temperature	wetness	age	shape	color	material
size	N/A	35	42	13	106	73	52	42	68	456	832	1071	2087
length	7	N/A	26	42	8	155	21	122	42	13	8	105	315
height	3	9	N/A	N/A	2	41	4	3	32	49	44	28	302
speed	15	38	17	N/A	3	N/A	6	4	1	9	1	5	5
depth	4	N/A	1	2	N/A	9	2	11	2	N/A	33	60	38
width	3	42	29	3	19	N/A	N/A	N/A	5	14	39	51	156
weight	5	15	7	1	2	3	N/A	3	10	16	6	13	379
temperature	6	10	1	N/A	2	1	2	N/A	86	19	N/A	59	73
wetness	3	4	5	N/A	1	1	6	31	N/A	6	4	5	33
age	70,5	11	42	8	3	20	13	4	12	N/A	18	60	733
shape	13	1	12	N/A	11	N/A	N/A	1	1	3	N/A	27	146
color	4	11	5	N/A	3	3	N/A	1	N/A	3	13	N/A	113
material	15	4	4	N/A	2	1	N/A	N/A	N/A	3	42	17	N/A

By and large, the results of our corpus investigation thus align with the prediction that the order of adjectives is governed by the hierarchy of adjective phrase-related functional projections, since the overall probability that we will encounter an order that violates the hierarchy, compared to the probability that we will encounter an order that respects the hierarchy, is extremely small. As expected, the proportion of combinations with no occurrences or a lower number of occurrences is higher in the case of counter-hierarchy adjective orders. If we consider the percentage values from Table 1 above, the categories that are almost invariably ordered according to expectations are SIZE, LENGTH, HEIGHT, DEPTH, TEMPERATURE,

WETNESS, SHAPE, COLOR, and MATERIAL. Due to the low number of occurrences for combinations of adjectives from the middle part of the hierarchy – SPEED, DEPTH, WIDTH, WEIGHT, TEMPERATURE, WETNESS – firm conclusions about the order of these semantic categories are harder to draw.

Conclusion

The results of this study provide partial evidence in support of the claim that the order of adjectives is governed by the hierarchy of adjective phrase-related functional projections (Cinque 1994, 2010, Scott 2002, Shlonsky 2004, Laenzlinger 2005, Ramaglia 2014). Analyzing adjective-adjective combinations of thirteen semantic categories in the Gigafida 2.0 corpus of written Slovenian we can predict with great certainty the relative orders in the case of six semantic categories, namely SIZE, LENGTH, HEIGHT, SHAPE, COLOR, MATERIAL. The semantic categories DEPTH, TEMPERATURE, and WETNESS could potentially also be included in this list; however, the scarcity of relevant examples proves to be a problem in this case. The orderings are inconsistent with the predictions of the adjectival hierarchy in the case of four semantic categories, namely SPEED, WEIGHT, AGE, and WIDTH. Finally, if we look critically at the database used, we see that for certain aspects of the adjective-adjective-noun complex, the Gigafida 2.0 corpus proves insufficient despite its relatively large size of nearly 1.2 billion words, as the lack of data for certain domains of the proposed adjectival hierarchy complex in the corpus simply makes it impossible to evaluate Scott's (2002) hierarchy as a whole. To fill the gap, future research will need to find alternative ways to zoom in on the categories of the central part of the hierarchy.

References

Cinque, G. (1994). On the evidence for partial N-movement in the Romance DP. In: *Paths towards Universal Grammar: Studies in Honor of R. S. Kayne*(G.Cinque et al., eds.), Washington, DC: Georgetown UP, 85–110.

Cinque, G. (2010). *The syntax of adjectives. A comparative study*. MIT Press.

Dixon, R. M. W. (1982). *Where have all the adjectives gone? and other essays in semantics and syntax*. Berlin, Germany: Mouton.

Gantar, P. (2007). *Stalnebesednezveze v slovenščini: korpusnipristop*. Ljubljana: Založba ZRC, ZRC SAZU.

Hetzron, R. (1978). On the relative order of adjectives. In:*Language Universals* (H. Seiler ed.), Tübingen: Narr, 165–184.

Klein, E. (1982). The interpretation of adjectival comparatives. *Journal of Linguistics* 18: 1, 113–136.

Kotowski, S. and H. Hartl. (2019). How real are adjective order constraints? Multiple prenominal adjectives at grammatical interfaces. *Linguistics* 57. 395–427.

Laenzlinger, C. (2005). French adjective ordering: perspective on DP-internal movement types. *Lingua* 115, 645–689.

Larson, R. K. (2021). Rethinking cartography. *Language* 97:2, 245–268.

Leivada, E. and M. Westergaard. (2019). Universal linguistic hierarchies are not innately wired. Evidence from multiple adjectives. *PeerJ* 7: e7438.

Loccioni, N. (2020). The syntax of superlative phrases in Romance. In: *Romance Languages and Linguistic Theory 16: Selected papers from the 47th Linguistic Symposium on Romance languages (LSRL)* (I. Vogel, ed.), Newark, Delaware, 172–186.

Martin, J. E. (1969). Semantic determinants of preferred adjective order. *Journal of Verbal Learning and Verbal Behavior* 8, 697–704.

Morzycki, M. (2015). *Modification. Key Topics in Semantics and Pragmatics*. Cambridge University Press.

Partee, B. H. (1995). Lexical semantics and compositionality. In *Language: An invitation to cognitive science*, (Gleitman, L. R. and M. Liberman eds.), The MIT Press, 311–360.

Plesničar, V. (2017). Adjective order restrictions of attributive adjectives in Slovenian. In *12th Slavic Linguistic Society Annual Meeting: A book of abstracts* (Repanšek, L. and M. Šekli eds), Ljubljana: Založba ZRC, ZRC SAZU, 159–160.

Plesničar, V. (2018). Order Restrictions of Attributive Adjectives in Slovenian: A Self-Paced Reading Study. In *Psycholinguistics in Flanders: A book of Abstracts*, Ghent: Ghent University, 58.

Ramaglia, F. (2014). The syntax and semantics of attributive adjectives in Romance. *Lingue e Linguaggio* 2, 131–158.

Scontras et al. (2017). Subjectivity predicts adjective ordering preferences. *Open Mind: Discoveries in Cognitive Science* 1: 1, 53–65.

Scontras, G. and Z. Kachakeche. (2020). Adjective ordering in Arabic: Post-nominal structure and subjectivity-based preferences. *Proceedings of the Linguistic Society of America* 5: 1, 419–430.

Scott, G.-J. (2002). Stacked adjectival modification and the structure of nominal phrases. In: *The cartography of syntactic structures* 1, (G. Cinque ed.), 91–120.

Shlonsky, U. (2004). The forms of Semitic noun phrases. *Lingua* 144: 12, 1465–1526.

Sproat, R. and C. Shih. (1991). The cross-linguistic distribution of adjective ordering restrictions. In: *Interdisciplinary approaches to language. Essays in honnor of S. Y. Kuroda* (C. Georgopolous and R. Ishihara eds.), Dordrecht: Kluwer Academic Publishers, 565–593.

Svenonius, P. (2008). The position of adjectives and other phrasal modifiers in the decomposition of DP. In: *Adjectives and adverbs: Syntax, Semantics and Discourse* (L. McNally and C. Kennedy eds.), New York: Oxford University Press, 16–42.

Toporišič, J. (2000). *Slovenskaslovnica* [SlovenianGrammar]. 4th edition. Maribor: Obzorja.

Trotzke, A. and E. Wittenberg. (2019). Long-standing issues in adjective order and corpus evidence for a multifactorial approach. *Linguistics* 57. 273–282.

Truswell, R. (2009). Attributive adjectives and nominal templates. *Linguistic Inquiry* 40: 3, 525–533.

Vidovič-Muha, A. (1978). Merila pomenske delitvene za imenske pridevniške besede [...]. *Slavistična revija* 26: 3, 253-276.

Wulff, S. (2003). A multifactorial corpus analysis of adjective order in English. *International Journal of Corpus Linguistics* 8. 245–282.

Vesna Plesničar

A CORPUS INVESTIGATION OF THE ORDERING OF SELECTED ATTRIBUTIVE ADJECTIVES IN SLOVENIAN

Summary

The paper presents the results of corpus study conducted to test the predictions of the most fine-grained version of the, arguably, universal hierarchy of adjective phrase-related functional projections (Scott 2002), which arose within the cartographic framework, currently dominant in the field of adjective order restriction research(e.g., Cinque 1994, 2010, Scott 2002, Shlonsky 2004, Laenzlinger 2005, Ramaglia 2014). Although often criticized for being too rigid and detailed, Scott's model has never been subjected to a detailed examination, i.e., the validity of the predictions this model makesabout language use has never been tested in any detail (Wulff 2003, Truswell 2009, Scontras et al. 2017, Kotowski and Hartl 2019, Trotzke and Wittenberg 2019). The present study thus makes an important contribution to the ongoing debate,particularly in this direction.Using the nearly 1.2-billion-word Gigafida corpus we check the frequency of attested orders of selected attributive adjectives of thirteen semantic categories andthe results indicate that the order of adjectives attested in our Slovenian corpus is overall compatible with the proposal that the order is governed by a hierarchy of adjective projections.There are some obscurities in the case of individual categories, which we believe are associated with the low number of examples obtained, a problem that should be addressed in future research.

Key words: generative grammar, cartography, attributive adjective string, language use, corpus