Memorization and the morphology-syntax divide: A cross-linguistic investigation

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This study investigates the memorization of complex lexical items from a cross-linguistic perspective and in the context of the debate about the demarcation between morphology and syntax. For this purpose, we conducted an experimental study in which German, French and English adjective-noun/noun-adjective combinations (e.g. Jungtourist, jeune touriste, YOUNG tourist, young TOURist) were tested with respect to how well they were memorized. Using existing nouns (e.g. Architekt, architecte, architect) as a baseline, we found evidence that the German AN constructions under investigation exhibit a memorization advantage in comparison to the French AN/NA constructions. We attribute the effect to the compound status of the German constructions as well as their morphological origin, in contrast to the syntactic source of the French constructions. For the English constructions, we considered stress (YOUNG tourist vs. young TOURist) to be a determining factor, which we hypothesized to interact with semantic compositionality. This interplay was examined in a second study, which revealed that non-compositional structures with initial stress (e.g. HARD shirt) gave rise to compound-like effects in comparison to the phrase-like compositional constructions with non-initial stress (e.g. short BRUSH). In conclusion, we argue for a cognitively grounded distinction between word-formation and syntax, where memorization has turned out to be a suitable test environment.

Keywords: *compounds, phrases, memorization, mental lexicon, lexicalism*

1. Introduction

Connecting the question presented in (1) to the assumption given in (2) leads us to the central question of our paper, which is shown in (3).

(1) Following the lexicalist tradition and assuming that morphological and syntactic products differ from each other categorically (e.g. Chomsky 1970; Di Sciullo & Williams 1987; Scalise & Guevara 2005: 182-183), the question arises whether morphological constructions are better candidates for memory storage – an idea suggested in the literature (Wunderlich 1986: 209; Olsen 2000: 899).

(2) It has been observed that languages differ with respect to the use of morphological and syntactic constructions in order to express novel complex lexical concepts. Looking at adjective-noun/noun-adjective (henceforth: AN/NA) constructions, we assume that German prefers using compounds (morphological constructions) as naming units, whereas French favors phrases (syntactic constructions) (Bücking 2009; Van Goethem 2009). In English, constructions with initial stress, i.e. compound-like constructions, rather than constructions with non-initial stress, i.e. phrase-like constructions, typically fulfill naming needs (McCauley, Hestvik & Vogel 2012: 27).

(3) Combining (1) and (2), we ask whether compounds/compound-like constructions, i.e. German AN compounds and English AN compound-like constructions, show a memorization advantage in comparison to phrases/phrase-like constructions, i.e. French

AN/NA phrases and English AN phrase-like constructions. We will only investigate typical naming units in German and French, i.e. AN compounds and AN/NA phrases respectively. That means, we will ignore German phrases and French compounds in our experimental studies. In English, we decided to examine both constructions with initial stress and constructions with non-initial stress because the amount of research on stress in English AN constructions is rather small (in comparison to NN constructions). Based on the results of two experimental studies, we claim that items originating in the domain of morphology show a memorization advantage in comparison to items of syntactic provenance.

The structure of the paper unfolds as follows. In Section 2, the theoretical background of our studies will be discussed. We will define the terms compound as well as phrase and outline difficulties in clearly distinguishing between a compound and a phrase in English. Aiming at a clarification on empirical grounds, Section 3 will report on a psycholinguistic study we conducted in order to go beyond a mere structural analysis by examining the cognitive reflexes, i.e. the memorization, of non-lexicalized AN/NA constructions in the three aforementioned languages. The results obtained here will serve as the starting point for our second experiment that exclusively focused on the memorization of AN constructions in English (Section 4). Finally, Section 5 will discuss the implications of these two studies for the morphology-syntax divide and conclude our paper.

2. Theoretical background

In the literature, arguments for and against a principled distinction between morphology and syntax have been discussed for decades. While proponents of lexicalist conceptions emphasize the necessity to separate the two domains (e.g. Sadock 1985; Bisetto & Scalise 1999; Ackema & Neeleman 2004), other authors reject the idea and prefer to think in terms of a single grammatical module (e.g. Baker 1985; Lieber 1992; Kremers forthcoming). The debate on whether or not a categorical distinction between compounds and phrases needs to be assumed plays a crucial role in the present contribution and mirrors the two opposing views just mentioned. In order to find out whether compounds and phrases differ from each other, several factors have been investigated.

Inflection or, more precisely, inflectional agreement represents a typical factor discussed in the context of the separation between compounds and phrases. In German, AN compounds and AN phrases can be clearly distinguished on the basis of inflection: in a phrase, an inflectional suffix attaches to the adjective that agrees with the noun in terms of gender, number, case and definiteness; in a compound, however, an adjective's root/base is attached to the nominal head without an inflectional marker (Becker 1992: 16). The phrase *roter Barsch* (red perch) and the compound *Rotbarsch* (red_perch, 'rosefish') illustrate the contrast. In French, the same distinction is possible: while the construction *grande mère* (big mother) is a phrase because the adjective and noun agree in terms of number and gender, *grand-mère* (big-mother, 'grandmother') represents a compound due to the absence of agreement between the adjective and noun. Note, however, that some peculiarities regarding inflectional agreement between an adjective and a noun exist in French.[1] Note also that the following observations only refer to spoken language. We ignore written language here because we use auditory stimuli in our study. First, the basic form of the adjective, i.e. the

[1] Cf., e.g., Lübke (2007: 96-100).

form without an inflectional suffix, represents the masculine singular (and often also plural) form of the adjective as well (e.g. *disque dur*, disk hard, 'hard drive'). That means, we consider masculine nouns to be in agreement with the adjective and assume that a zero morpheme exists. Second, the feminine forms of a number of adjectives are also identical to the basic forms of the adjectives (e.g. *rouge*, red) and, therefore, the feminine and masculine forms of these adjectives are the same and considered to be always in agreement with a noun. Third, the singular and plural forms of an adjective normally do not differ. Combining the three aforementioned points, we can say the following.[2] Since we focus on spoken language, we can mostly not distinguish between compounds and phrases by referring to the difference between a singular and plural form (point three). Therefore, gender agreement represents the decisive factor in French. Further, we assume that an adjective can only form AN/NA phrases but not compounds if the feminine and masculine forms of an adjective are identical (point two). Moreover, since the masculine form of an adjective is identical to the basic form of the adjective (point one), French AN compounds must be, by our definition, feminine and cannot be masculine. That means *grand-père* (big-father, 'grandfather') is regarded as a phrase but *grand-mère* as a compound. While we assume that the adjective and noun agree in the former example, we do not do so in the latter. Overall, our approach is compatible with the idea that the adjective almost always agrees with the noun in French (Bouchard 2002: 70-71; Treffers-Daller 2005: 487). In other words, French almost never uses AN compounds and, instead, mostly relies on AN/NA phrases.[3] Since English relinquishes the use of adjectival inflectional affixes altogether, the criterion of inflectional agreement does not shed light on the problem here (Bell 2011: 142-143). All in all, we consider inflectional agreement to be the defining criterion of AN compounds and AN phrases. Put differently, while agreement between the adjective and noun indicates phrasal status, the lack of agreement signals compoundhood. Having a single factor that defines the constructions as either compounds or phrases is crucial in order to avoid circularity. As a consequence, we will avoid the terms AN compound and AN phrase in English. Nevertheless, although other factors such as those presented below cannot unambiguously separate compounds and phrases, they can mirror and, thus, further support the distinction between compounds and phrases. Therefore, it must be the goal to find as many features as possible that characterize compounds and demarcate them from phrases. By doing so, we might be able to underline the compound-phrase distinction in languages like German and, in addition to that, argue which English AN constructions are at least compound-*like* and which are phrase-*like*.[4]

Stress is one such factor. In German, AN compounds usually bear initial stress, whereas AN phrases typically carry non-initial stress (Motsch 2004: 379). In French, stress is not decisive in this respect and does not contribute to the compound-phrase distinction (Van Goethem 2009: 242). In English, initial stress has been considered to be an indication of compoundhood and non-initial stress, i.e. nuclear stress, a marker of syntactic constructions (Chomsky & Halle 1968: 17). Even though this observation has been criticized time and again (cf. Bauer 1998; Lieber & Štekauer 2009: 8-11 for a critical analysis of stress in English), it is generally plausible if we take the Germanic root that German and English have in common into account (Pereltsvaig 2012: 10). As just stated, German distinguishes AN

[2] Note a fourth peculiarity: Some adjectives have different roots/bases for their masculine (e.g. *beau*, nice) and feminine (e.g. *belle*, nice) forms.

[3] Apart from some examples, all of which contain the adjective *grand* (big) and are listed in Lang & Perez (2004: 30-31), we cannot think of any other (endocentric) AN compound in French.

[4] Su (1999) also uses the terms compound-like and phrase-like in her analysis on Chinese.

compounds from AN phrases by means of inflection. Additionally, the distinction is almost always reflected in the stress pattern. Since the factor inflection is not available in English, we cannot surely define compounds and phrases but we can find arguments why certain AN constructions are compound-like and why others are phrase-like. So, we might regard constructions with initial stress as compound-like and those with non-initial stress as phrase-like.

Let us now look at the central part of our paper, namely cognitive aspects of complex constructions. Although both compounds and phrases can become part of the lexicon (Booij 2010: 169; cf. also Schlücker 2014), the present paper is generally based on the idea that psycholinguistics might offer further insights to the compound-phrase distinction – an idea that has also been pursued in other studies. Mondini et al. (2002), for example, claim to have found empirical evidence for a fundamental distinction between AN/NA compounds and phrases in Italian. While analyzing the linguistic capacities of an aphasic individual, they detected that the patient had more difficulties in correctly inflecting the constituents of phrases compared to compounds. Mondini et al.'s (2002) examination is, however, problematic. First of all, by relying on our definition of AN compounds and AN/NA phrases outlined above, we state that inflectional agreement within a compound is impossible. Second, instead of comparing an aphasic's performance on compounds and phrases, Mondini et al. (2002) actually tested reactions to lexicalized and non-lexicalized stimuli. Lexicalization and the designation of particular concepts have been considered to be a decisive feature of compounds that distinguishes them from phrases (ten Hacken 2013: 100). However, it is a well-known fact that phrases can be subject to lexicalization as well (Bauer 1998: 67-68) and, thus, the status of lexicalization of a specific construction and its grammatical origin, i.e. morphological or syntactic, should be treated separately (Gaeta & Ricca 2009).

In another study, Kotowski et al. (2014: 195-196) concentrated on the comparison of AN compounds and AN phrases in German. They conducted a memorization experiment on three different days. On each day, participants were asked to memorize novel AN compounds and AN phrases along with a specific picture representing the object. After the memorization phase, participants were tested in a lexical-decision task and asked to decide whether a construction, i.e. a compound or phrase, accompanied the same image as in the memorization part. The authors found that subjects reacted significantly more slowly and less accurately to the compounds that had not been memorized in the preceding phase than to the non-memorized phrases. Besides, their analysis did not reveal a significant difference between memorized compounds and memorized phrases. Based on these findings, Kotowski et al. (2014: 195-196) take the view that the process of memorization is able to make initial processing difficulties of compounds disappear. According to the authors, the markedness of compounds explains why they are initially more difficult to process than phrases. Having been memorized, however, compounds are accessed as easily as phrases.

In the current paper, we aim at further pursuing the idea that compounds and phrases might cognitively deviate from each other. Instead of following a monolingual path as in Kotowski et al. (2014: 195-196), the present contribution addresses the controversial issue of the compound-phrase distinction from a cross-linguistic perspective, i.e. by contrasting German, French and English. Generally speaking, it attempts to find further empirical evidence to the conception that morphological constructions seem to be more appropriate to be memorized than syntactic constructions (Wunderlich 1986: 209; Olsen 2000: 899). Although this suggestion harmonizes with most people's intuition, psycholinguistic evidence

for this claim is still rare. The contrast between German compounds and French phrases as defined above might provide interesting insights in this respect. Note that we only investigate typical naming constructions in German and French, i.e. compounds and phrases respectively, and ignore phrases in German and compounds in French. The reason for this is that individuals usually memorize only naming units, e.g. *Blaumeise* (blue_tit), but not descriptive ones, e.g. *blaue Meise* (blue tit) (Booij 2010: 169). As mentioned earlier, AN compounds are virtually non-existent in French. In German, although phrases can have a naming function, compounds represent the typical naming units. Furthermore, the paper aims at examining the English language, where the clear structural marker of inflection is not available, by contrasting it to languages such as German, where inflection does represent the factor that clearly distinguishes compounds and phrases. Put differently, although we are not able to unambiguously define AN compounds in English and demarcate them from AN phrases, we can find arguments to call specific constructions compound-like rather than phrase-like and vice versa by comparing the cognitive reflexes across languages. Note that, in English, we believe that it is worth examining the role of stress in AN constructions more profoundly and, therefore, include both constructions with initial and those with non-initial stress.

3. Experimental study 1

3.1. General idea and goal of the study

The experimental study reported in this section investigated the memorization of German AN compounds, French AN/NA phrases, English AN constructions with initial stress, i.e. compound-like constructions, and English AN constructions with non-initial stress, i.e. phrase-like constructions. The objective of the study was to examine whether compounds/compound-like constructions show a memorization advantage in comparison to phrases/phrase-like constructions.

3.2. Method

3.2.1. Participants

We tested 35 participants, each of them belonging to one of the following four groups that only included native speakers of the respective language: A German group (nine subjects, mean age: 24.11 years), a French group (eight subjects, mean age: 20.63 years) and two English groups (nine subjects in each group, mean age of EnglishA: 21.22 years, mean age of EnglishB: 21.33 years). While the first group of English native speakers, i.e. group EnglishA, was exclusively tested on AN constructions with initial stress, the second group, i.e. EnglishB, was only tested on AN constructions with non-initial stress.

3.2.2. Material

The items were presented to the subjects in their native language. We examined two different types of items: (a) our experimental items were non-lexicalized complex constructions composed of an adjective and a noun and (b) our control items (baseline) were existing nouns. These items were to be memorized on three different days (see §3.2.3). Our filler items were other non-lexicalized complex AN/NA constructions and other existing nouns that

were not to be memorized, i.e. different filler items were used on each test day. The complex AN/NA constructions that were not memorized (e.g. *BLUE pilot*, *LONG motor*) contained the same adjectives and nouns as the experimental items, i.e. the complex AN/NA constructions that were memorized (e.g. *BLUE motor*). The items were controlled for several potentially confounding variables across the languages under investigation. The number of syllables of the constituents of the complex constructions (adjectives and nouns) and of the existing nouns was balanced across languages. The AN/NA constructions were trisyllabic, i.e. they were composed of monosyllabic adjectives and disyllabic nouns. The existing nouns were trisyllabic as well.[5] Moreover, we controlled for the frequency of the adjectives and nouns, i.e. the constituents of the AN/NA constructions, and of the existing nouns by ensuring that a word, i.e. an adjective, a noun or an existing noun, in one language was located within the same frequency range as in the other languages (see Table 1 in van Heuven et al. 2014: 1180). Also, the mean frequencies of the constituents of the AN/NA constructions, the mean frequencies of the existing nouns (control items) and the mean frequencies of the existing nouns (filler items) did not significantly differ across languages. Lemma frequencies were measured in per million words (Gries & Newman 2013: 274-275) using the corpus interface IntelliText (Hartley et al. 2011). Furthermore, we ensured that all AN/NA constructions were not lexicalized by again consulting IntelliText where we used both the concordance and the frequency function. An item was defined as non-lexicalized if either it did not appear in the corpus (frequency = zero occurrences per million words) or, if it occurred, did not represent a name of a specific and well-known concept, i.e., e.g., it was a usual descriptive structure (Bakken 2006: 106; Plag 2006: 158; Gaeta & Ricca 2009: 38). So, for instance, *young tourist* appeared in the corpus but was regarded as a non-lexicalized and descriptive construction. We checked the AN/NA constructions in different spellings, i.e. we verified three possible options for the French and English constructions (with a space, with a hyphen, without a space/hyphen between the constituents) but only two alternatives in German because AN compounds are usually not separated by a space in this language. Finally, we measured the duration in seconds of all items by using Praat (Boersma & Weenink 2012). The duration of each item, i.e. of each AN/NA construction or existing noun, in one language was rounded to three decimal places and identical to the duration of the same item in the other languages.

All items were recorded using Praat and the voice of a 19-year-old woman. She was a native/native-like speaker of the three above-named languages. We aimed to investigate both English AN constructions with initial stress (e.g. *YOUNG tourist*) and AN constructions with non-initial stress (e.g. *young TOURist*). Having asked the speaker to stress either the first or the second syllable of the AN construction, the first author verified the correctness of the stress pattern of each sound file by listening to it and visualizing it in an oscillogram in Praat. The auditory judgment had to be in accordance with the visual one. Table 1 contains all experimental and control items, i.e. the AN/NA constructions and existing nouns that had to be memorized on the three days.

Table 1: The experimental and control items[6] [7]

[5] The first author's judgment was decisive in order to determine the number of syllables of all items.

[6] When controlling for the potentially confounding variables presented before Table 1, we took several spellings into account for the following German and English examples: *Altkaffee/Altcafé/Altcafe, gray muscle/grey muscle, catalog/catalogue, theater/theatre*.

Item type	German	French	English
Experimental items	Altkaffee	vieux café	old coffee
	Langroman	long roman	long novel
	Jungtourist	jeune touriste	young tourist
	Graumuskel	muscle gris	gray muscle
	Blaumotor	moteur bleu	blue motor
	Dünnpilot	pilote mince	thin pilot
Control items	Katalog	catalogue	catalog
	Kamera	caméra	camera
	Theater	théâtre	theater
	Architekt	architecte	architect
	Professor	professeur	professor
	Festival	festival	festival

3.2.3. Procedure

All subjects were tested individually in our language laboratory on three different days, i.e. on days one, four and eight. The experiments of the study were carried out using the computer program E-Prime (Psychology Software Tools, Inc. 2010). Items were presented to subjects through headphones, i.e. subjects did not see them. On each of the three days, the experiment consisted of two phases, namely a memorization and, immediately following, a recall phase. During the memorization phase, participants were asked to memorize both the six experimental and the six control items in their respective native language (see Table 1). A "+" preceded each of the items and appeared for 1.5 seconds on the screen. After that, subjects heard an item and were given 3.5 seconds to memorize it. In the recall phase, subjects were requested to press a button labeled "Yes"[8] if they heard an item that they had memorized in the memorization phase or a button labeled "No"[9] if they were exposed to an item they had not memorized before. During the recall phase, again, a "+" preceded each item for 1.5 seconds before participants heard an item and had to press the "Yes"- or the "No"-button. There were 24 items in the recall phase, i.e. the twelve items from Table 1, six non-memorized AN/NA constructions and six non-memorized existing nouns. In sum, everybody heard every memorized item six times, i.e. on three days in two phases per day, and every non-memorized one only once, i.e. in the recall phase of one day.

3.3. Main hypotheses

We did not expect the control items to differ across the three languages under investigation. In order to be able to compare different languages at all, we needed the control items to justify our investigation and rule out that effects found for the AN/NA constructions were due to independent reasons. We predicted, however, cross-linguistic differences among the AN/NA constructions. More specifically, we hypothesized a memorization advantage of compounds/compound-like constructions in comparison to phrases/phrase-like constructions.

[7] Note that we summarized the groups EnglishA and EnglishB in Table 1. Both groups heard the same control items. The experimental items only differed in their stress pattern in that EnglishA heard only AN constructions with initial stress and EnglishB heard only AN constructions with non-initial stress.

[8] The "Yes"-button was the STRG-button, i.e. the eighth button from the left in the lowest row on a keyboard.

[9] The "No"-button was the ALT-button, i.e. the third button from the left in the lowest row on a keyboard.

At this point, an exact definition of the term memorization advantage is still in order. In the current paper, we only discuss and consider the following two approaches. First, a memorization advantage could be mirrored in the fact that compounds/compound-like constructions are responded to faster and/or more accurately in comparison to phrases/phrase-like constructions on all three days together. Note, however, that this approach works in only one direction. That means, if phrases/phrase-like constructions are responded to faster and/or more accurately than compounds/compound-like constructions on all three days together, we cannot speak of a memorization advantage. Instead, this kind of advantage would originate in the fact that phrases/phrase-like constructions are the more usual or normal type in comparison to compounds/compound-like constructions (cf., e.g., ten Hacken 2013: 97). So, for instance, when comparing the experimental items of the two English groups, we have to keep in mind that non-initial stress is the default and unmarked pattern (Levi 1978: 41-42; Giegerich 1992: 252; Liberman & Sproat 1992: 134). It has been observed that unmarkedness goes hand in hand with higher frequency and, in turn, that a more frequent stress pattern causes faster responses (Bybee 1995: 237 referring to Greenberg 1966; Schiller et al. 2004: 237-238). Thus, a possible advantage of non-initial stress in English would not result from better memorization but rather from the frequency of the stress pattern. Therefore, we need the following, second definition of the term memorization advantage if phrases/phrase-like constructions are responded to faster and/or more accurately on all three days together or if the responses to phrases/phrase-like constructions and those to compounds/compound-like constructions do not differ on all three days together: compounds/compound-like constructions might give rise to slower and/or less accurate reactions than phrases/phrase-like constructions on the first day but not on the consecutive day(s), i.e. on the second and/or third day. The latter suggestion is based on the aforementioned idea that phrases represent the default and more frequent pattern in a language (ten Hacken 2013: 97) and, thus, should give rise to shorter response times and fewer errors at the beginning, i.e. on the first day. If, despite the phrases' initial lead, compounds and phrases do no longer differ at a later stage of learning, i.e. on day two and/or three, we can interpret the greater improvement of compounds to mirror a memorization advantage.

3.4. Results

The results were analyzed by using the statistical software Minitab (Minitab Inc. 2013). Since all subjects and all memorized items, i.e. all experimental and control items, reached an overall accuracy level of 70 percent or higher, no participants or memorized items had to be discarded from further analyses. Moreover, in the analysis of response latencies, we only included times associated with correct responses. The following analyses only refer to the response latencies of memorized items from 488 to 1416 ms.[10] All in all, 86.19 and 92.54 percent of the responses to memorized items were used to analyze the dependent variables of RESPONSE TIME and RESPONSE ACCURACY respectively.

4 x 2 x 3 repeated-measures ANOVAs by subject (F_1) and by item (F_2) were conducted for the two dependent variables RESPONSE TIME and RESPONSE ACCURACY.[11] We

[10] Outliers were excluded by means of a boxplot-analysis.

[11] Note two general procedures that we apply throughout the paper. We follow Larson-Hall (2010: 103) by providing precise *p*-values and Bühl & Zöfel (2002: 111) by considering *p*-values ≤ .05 to be significant, *p*-values ≤ .01 to be very significant and *p*-values ≤ .001 to be highly significant.

included the following three fixed independent factors: LANGUAGE as a between-subject and within-item factor, ITEM TYPE as a within-subject and between-item factor and DAY as a within-subject and within-item factor. LANGUAGE had the four levels German, French, EnglishA and EnglishB, ITEM TYPE had the two levels experimental items and control items and DAY had the three levels 1, 2 and 3. SUBJECT represented a random factor in F_1 and ITEM was a random factor in F_2.

We concentrate here on the two interactions LANGUAGE x ITEM TYPE and LANGUAGE x ITEM TYPE x DAY because they are decisive in order to find out whether a memorization advantage occurred. The results of the other interactions and main effects are listed in Appendix A and B. Looking at RESPONSE TIME, the interaction of LANGUAGE x ITEM TYPE was very significant in F_1 and highly significant in F_2 ($F_1(3, 155) = 4.98$, $p = .003$; $F_2(3, 110) = 6.39$, $p = .000$). There was no significant interaction of LANGUAGE x ITEM TYPE x DAY. The examination of RESPONSE ACCURACY showed that these two interactions were not significant. Next, we conducted Tukey multiple comparisons for the significant interaction of LANGUAGE x ITEM TYPE. The latencies of the French control items did not significantly differ from those of the German control items (Difference of means (henceforth: DM)$_1$ = -40.8, t_1 = -2.14, p_1 = .397; DM_2 = -35.6, t_2 = -1.71, p_2 = .682).[12] [13] The reaction times of both the German and French control items, however, highly (very) significantly differed from the response latencies of the control items of the two English groups (EnglishA versus German: DM_1 = -120.6, t_1 = -6.50, p_1 = .000; DM_2 = -117.5, t_2 = -5.64, p_2 = .000; EnglishB versus German: DM_1 = -118.5, t_1 = -6.39, p_1 = .000; DM_2 = -113.8, t_2 = -5.46, p_2 = .000; French versus EnglishA: DM_1 = 79.7, t_1 = 4.17, p_1 = .001; DM_2 = 81.8, t_2 = 3.93, p_2 = .004; French versus EnglishB: DM_1 = 77.6, t_1 = 4.06, p_1 = .002; DM_2 = 78.2, t_2 = 3.75, p_2 = .007).[14] The response times of the control items of the two English groups did not significantly differ (DM_1 = 2.1, t_1 = 0.12, p_1 = 1.000; DM_2 = 3.6, t_2 = 0.17, p_2 = 1.000). Since our baseline only worked for two comparisons, i.e. the German control items did not significantly differ from the French control items and the control items of EnglishA did not significantly differ from the control items of EnglishB, we focused on these two comparisons when looking at the experimental items. Latencies of the French experimental items were significantly longer than reaction times of the German experimental items in F_2 (DM_2 = 65.0, t_2 = 3.12, p_2 = .046). The difference of the response times of the control and experimental items was clearly smaller in German (DM_1 = -62.5, t_1 = -3.37, p_1 = .021; DM_2 = -52.9, t_2 = -2.54, p_2 = .191) than in the other languages (French: DM_1 = -145.9, t_1 = -7.41, p_1 = .000; DM_2 = -153.5, t_2 = -7.37, p_2 = .000; EnglishA: DM_1 = -150.5, t_1 = -8.11, p_1 = .000; DM_2 = -167.5, t_2 = -8.04, p_2 = .000; EnglishB: DM_1 = -98.0, t_1 = -5.28, p_1 = .000; DM_2 = -98.7, t_2 = -4.74, p_2 = .000). Moreover, subjects responded to the English experimental items with non-initial stress significantly faster than to the experimental items with initial stress in F_2 (DM_2 = -65.2, t_2 = -3.13, p_2 = .045). Figure 1 summarizes the results reported in this paragraph.[15]

[12] All *p*-values reported for Tukey multiple comparisons in the current paper are corrected *p*-values.

[13] Since the control items are not hypothesized to significantly differ across languages, we report these non-significant values here.

[14] Possible reasons for this effect cannot be discussed in the current paper.

[15] Looking at RESPONSE ACCURACY, the control items did not significantly differ across languages. Therefore, we contrasted the experimental items across all languages. We only found one significant result here: The experimental items of EnglishA were responded to significantly less correctly than the German experimental items in the subject analysis (DM_1 = -9.51, t_1 = -3.15, p_1 = .040).

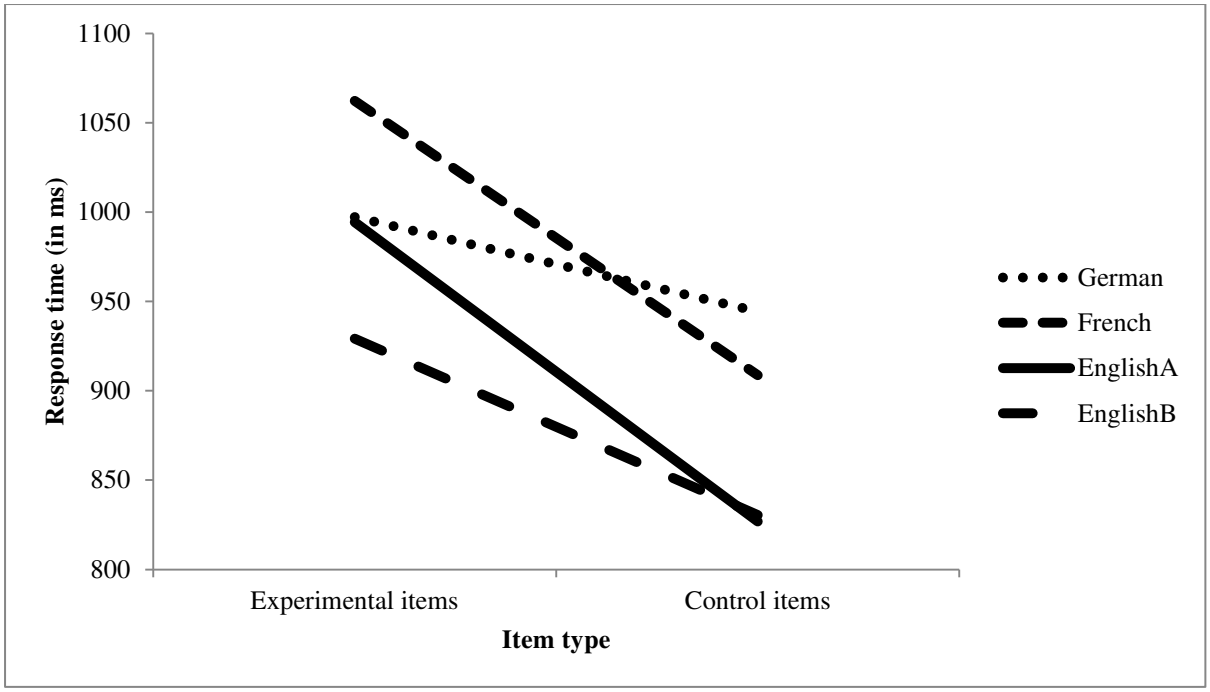

Figure 1: Interaction of LANGUAGE x ITEM TYPE (F_2)

We have already mentioned that the analysis of the results on all three days together can be problematic because, for instance, non-initial stress represents the more frequent pattern in the case of AN constructions in English. For this reason, we conducted an analysis on the individual days. In statistical terms, we carried out Tukey multiple comparisons of the interaction of LANGUAGE x ITEM TYPE x DAY but did not find a significant result, i.e. the comparison between the reaction times and accuracy rates of the experimental items with non-initial stress and those with initial stress did not show a significant difference on any of the three days.[16]

3.5. Discussion

Having ensured that our baseline worked for the comparisons between German and French as well as between the two English groups, we were able to contrast the respective AN/NA constructions, i.e. the experimental items. We interpret the finding that the German AN compounds showed significantly faster response latencies on all three days together than the French AN/NA phrases as a memorization advantage of the German compounds. Compounds seem thus to be more prone to be memorized than phrases. The results revealed for the comparisons between the two item types, i.e. between the experimental and control items, within the individual languages further support this tendency: whereas the responses to the two item types significantly differed in French as well as in the two English groups, we did not detect a significant difference in German. In our opinion, this finding mirrors the word-like character of German AN compounds because their latencies did not significantly deviate from those of the existing nouns, i.e. typical words, of the same language.

[16] There was no significant difference between the control items of EnglishB and EnglishA either.

Due to the differences in the frequencies of the two stress patterns in English AN constructions, we analyzed the data for EnglishA and EnglishB on the individual days but did not find significant differences. Thus, our analysis did not reveal a memorization advantage for one group of English AN constructions in comparison to the other group of English AN constructions.

4. Experimental study 2

4.1. General idea and goal of the study

The experimental study reported in this section examined the interplay between stress distribution and semantic compositionality in English AN constructions in the context of memorization. In particular, we asked whether semantically non-compositional constructions with initial stress, i.e. compound-like constructions, showed a memorization advantage in comparison to semantically compositional constructions with non-initial stress, i.e. phrase-like constructions.

Our first study reported above examined only one typical feature of AN compounding, i.e. initial stress. Apart from initial stress, semantic non-compositionality has been considered to be a common characteristic of compounds (Downing 1977: 820; Bücking 2009: 187). Initial stress and semantic non-compositionality are not only closely connected to morphology, i.e. specifically to compounding, but also to lexicalization (Bauer 1983: 58; Giegerich 2004; 2005). If we now rely on Wunderlich (1986: 231) in assuming that lexicalization can follow memorization, the process under investigation in our first study, the question arises whether non-compositional constructions with initial stress, i.e. constructions with typically morphological features, show a memorization advantage in comparison to constructions with typically syntactic features such as compositional semantics and non-initial stress. The impact of the interaction of stress and semantic compositionality on the process of memorization was the topic of interest in our follow-up/second study reported here. Instead of focusing on the factor of stress only, as in the first study, we included semantic compositionality as a second factor in the follow-up study. Similar to the stress criterion, semantic compositionality cannot define compounds and phrases but it can possibly support the distinction and, as in English, provide arguments to call certain AN constructions compound-like but others phrase-like. In the first study outlined above, we primarily concentrated on fully compositional items such as *young tourist*. The results of a post-hoc survey (SoSci, Leiner 2014) we conducted revealed that participants did not find it difficult to imagine a referent for the AN constructions to be memorized in the first study in almost all cases (cf. also §4.2.2 for further information on the survey). We believe that this finding indicates the compositional character of the AN constructions listed in Table 1 and used in the first study.

4.2. Method

4.2.1. Participants

The data of 34 native speakers of English, who completed the whole experiment, was examined in the study. They were divided into two groups (17 subjects in each group). Both groups had to memorize the same items; however, complex AN items with initial stress in the

first group carried non-initial stress in the second group and complex AN items with non-initial stress in the first group had initial stress in the second group.

4.2.2. Material

The sound files of the AN constructions to be memorized and investigated in the study were grouped into the following four conditions: (1) Semantically compositional items with non-initial stress (e.g. *short BRUSH*), (2) semantically compositional items with initial stress (e.g. *SHORT brush*), (3) semantically non-compositional items with non-initial stress (e.g. *hard SHIRT*) and (4) semantically non-compositional items with initial stress (e.g. *HARD shirt*). All items of these four conditions were to be memorized and represented our experimental items. Since we contrasted experimental items of the same language, we did not include control items. We used adjectives referring to physical properties, speed as well as dimensional adjectives and concrete/physical inanimate nouns.[17] All nouns and adjectives were monosyllabic. Since every item appeared with initial stress in one group and with non-initial stress in the other group, i.e., e.g., *short BRUSH* occurred in group one but *SHORT brush* appeared in group two, we did not have to worry about the potentially confounding variable of constituent frequency between the two levels of the factor of stress. However, we controlled for the frequency of the constituents between semantically compositional and non-compositional items. All lemma frequencies were gathered from the IntelliText interface and measured in per million words. The mean frequencies of the constituents (adjectives and nouns) contained in semantically compositional items did not significantly differ from the mean frequencies of the constituents of the non-compositional items. The decision whether an item was compositional or not was based on the authors' opinions and, importantly, consolidated in a survey (SoSci, Leiner 2014) asking English native speakers how easy/difficult it was for them to imagine that these items exist. We used the test for the following reason. Since the complex constructions were not lexicalized, i.e. they were not part of the lexicon, we assumed that subjects judged the items as easy or difficult to imagine depending on whether an adjective is "compatible" with a noun in normal usage. In the questionnaire, we gave two examples in the introduction in order to specify our idea: "[…] a "red car" is probably very easy to imagine, whereas a "deaf chair" is probably very difficult to imagine." Note that we assume that non-lexicalized constructions can be non-compositional (Härtl 2015) and reject the view that semantic non-compositionality always comes with lexicalization (Schlücker & Hüning 2009: 221).[18] Each item was rated on a scale from 1 (*very very easy*) to 6 (*very very difficult*). We considered a mean value below 3.5 to indicate compositionality and a mean value above 3.5 to signal non-compositionality. The results of our survey indeed showed this effect, i.e. the eleven compositional items had a mean lower than 3.5 but the eleven non-compositional items had a mean higher than 3.5. The total mean values were 2.10 (compositional items) and 4.32 (non-compositional items). The difference was highly significant ($t(20) = -10.00$, $p = .000$). All items were recorded using the voice of a 25-year-old male native speaker of North-American English and the computer program Praat (Boersma & Weenink 2014). Using the software, we also ensured that four sound files, i.e. one sound file of each of the four conditions mentioned at the beginning of

[17] Cf., e.g., Dixon (1982: 16); Frawley (1992: 463); Motsch (2004: 321-322); Gallmann (2009: 146).

[18] We support our view with novel German AN compounds. If you coin, for instance, the compound *Grünauto* (green_car), it will definitely not refer to any car that is green and, therefore, it will be semantically non-compositional right from the start. There is simply no need to coin a compound in order to refer to a car that is green because the phrase *grünes Auto* fulfills this job.

§4.2.2, had the same duration in seconds (see §3.2.2). No construction was lexicalized (see §3.2.2). Using the procedure described in §3.2.2, the correct stress pattern of each item was verified. Table 2 presents all experimental items of the study.[19]

Table 2: The experimental items

Semantically compositional items	Semantically non-compositional items
short brush	hard shirt
sharp nail	soft coin
vast tent	sweet fence
hot pipe	deep knife
broad hat	warm pill
dry cap	slow pen
tall truck	loud desk
cold hut	fast sock
big shelf	full lamp
thin dress	rough milk
thick rope	sour bike

The filler items were AN constructions consisting of the same adjectives and nouns as the experimental items but the adjectives and nouns were combined differently. Therefore, we automatically controlled for the variables number of syllables and frequency of the constituents. Further, we ensured that no filler item was lexicalized (see §3.2.2). Filler items had the same stress pattern as the experimental items sharing one of the two constituents in the respective group, i.e., e.g., *SHORT brush* was an experimental item in the group where *SHORT pen* was a filler item. In the other group, however, *short BRUSH*, and not *SHORT brush*, was an experimental item and *short PEN*, and not *SHORT pen*, was a filler item. The same speaker recorded all of these sound files with the same software. An item with initial stress had the same duration as the correspondent item with non-initial stress (see §3.2.2).

4.2.3. Procedure

The procedure was similar to the one described in §3.2.3. In the current study, however, two memorization phases preceded the recall phase on each of the three test days. Due to the greater number of constructions to be memorized, we decided to include an additional memorization phase in the study. Items were presented visually and auditorily in the first memorization phase but only auditorily in the second memorization and recall phase. During the first memorization phase, the visual presentation lasted for 3.5 seconds. All in all, subjects heard a total of 22 experimental items nine times, i.e. on three days in three phases per day, they read them three times, i.e. on three days in one phase per day, and they heard the filler items once, i.e. in one phase of one day. We used 22 filler items on each day.

4.3. Main hypotheses

[19] Note that the first group of subjects heard the first six compositional items and the first six non-compositional items with initial stress but the last five compositional items as well as the last five non-compositional items with non-initial stress. For the second group of subjects, it was the other way around.

Due to their higher frequency of usage and their lower degree of markedness, we expected the features non-initial stress and semantic compositionality to cause faster and more accurate reactions than initial stress and semantic non-compositionality (Liberman & Sproat 1992: 134; Giegerich 2009: 5-7). Therefore, the phrase-like constructions, i.e. the compositional constructions with non-initial stress, should trigger the fastest and most accurate responses when looking at all three days together. As opposed to that, subjects should be (significantly) slower and less accurate when responding to the compound-like constructions, i.e. to the non-compositional constructions with initial stress. Comparing the two extremes, i.e. compound-like and phrase-like constructions, on the individual days, however, we hypothesized a greater memorization advantage of the compound-like constructions compared to the phrase-like constructions in that the former should (significantly) differ from the latter at an early point during the experiment (e.g. day one) but not at a later point (e.g. day two).

4.4. Results

Again, we used Minitab to conduct the statistical analyses. None of the 34 subjects and none of the experimental items had to be excluded from further analyses since all of them reached the accuracy threshold of 70 percent. Only correct responses were included in the statistical analysis of the dependent variable of RESPONSE TIME. In the following, we focus on the analysis of responses given to the experimental items with response times from 596 to 1598 ms (RESPONSE TIME) or 596 to 1606 ms (RESPONSE ACCURACY).[20] In sum, 82.71 and 91.44 percent of responses given to the experimental items were included in the following analyses on RESPONSE TIME and RESPONSE ACCURACY respectively.

2 x 2 x 3 repeated-measures ANOVAs by subject (F_1) and by item (F_2) were conducted for the two dependent variables RESPONSE TIME and RESPONSE ACCURACY. We included the following three fixed independent factors: STRESS as a within-subject and within-item factor, SEMANTIC COMPOSITIONALITY as a within-subject and between-item factor and DAY as a within-subject and within-item factor. STRESS had the two levels initial stress and non-initial stress, SEMANTIC COMPOSITIONALITY had the two levels semantic compositionality and semantic non-compositionality and DAY had the three levels 1, 2 and 3. SUBJECT represented a random factor in F_1 and ITEM was a random factor in F_2.

The analysis of both RESPONSE TIME and RESPONSE ACCURACY revealed that the interactions of STRESS x SEMANTIC COMPOSITIONALITY as well as STRESS x SEMANTIC COMPOSITIONALITY x DAY did not reach significance (for the results of the other interactions and main effects, cf. Appendix C and D). We then directly compared the two poles of the interaction of STRESS x SEMANTIC COMPOSITIONALITY, i.e. the phrase-like constructions characterized by non-initial stress and compositional semantics and the compound-like constructions characterized by initial stress and non-compositional semantics, by using Tukey multiple comparisons. Our analysis of RESPONSE TIME revealed a highly significant difference in both F_1 and F_2 ($DM_1 = -68.8$, $t_1 = -5.52$, $p_1 = .000$; $DM_2 = -61.3$, $t_2 = -4.40$, $p_2 = .000$). The difference in F_1 is represented in Figure 2. The analysis of RESPONSE ACCURACY yielded a significant result only in F_1 ($DM_1 = 5.69$, $t_1 = 3.05$, $p_1 = .012$). However, as mentioned in §4.3, we do not interpret this trend to represent a memorization advantage. Instead, we can simply explain the difference by referring to the lower level of markedness of the phrase-like constructions.

[20] Outliers were discarded using boxplots.

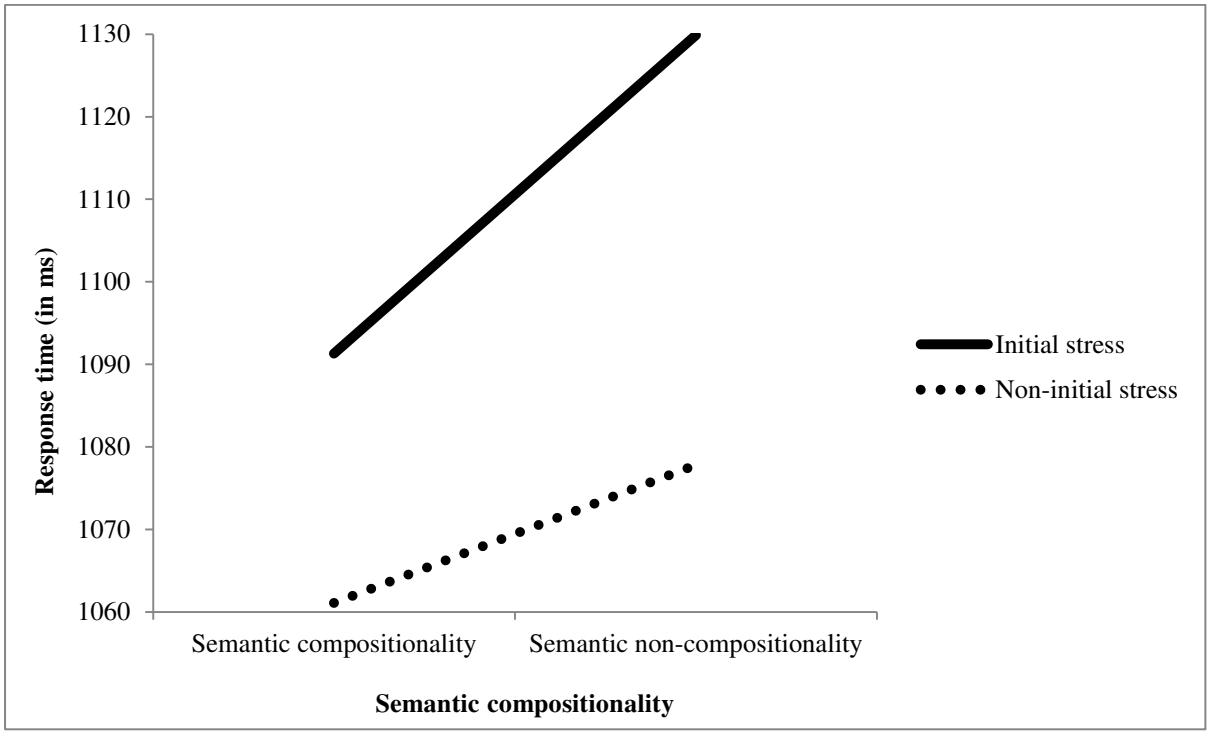

Figure 2: Interaction of STRESS x SEMANTIC COMPOSITIONALITY (F_1)

In the next step, we were particularly interested in the comparison between the phrase-like and compound-like constructions on the three individual days. The data of RESPONSE TIME showed a (highly) significant difference between the two groups on day one (DM_1 = -107.1, t_1 = -4.96, p_1 = .000; DM_2 = -81.1, t_2 = -3.36, p_2 = .048) but not on day two (DM_1 = -46.9, t_1 = -2.17, p_1 = .569; DM_2 = -50.3, t_2 = -2.09, p_2 = .633) and three (DM_1 = -52.2, t_1 = -2.42, p_1 = .393; DM_2 = -52.4, t_2 = -2.17, p_2 = .571).[21] Figure 3 visualizes the comparisons in F_1.

[21] In terms of response accuracy, the two kinds of constructions did not significantly differ on any of the three days.

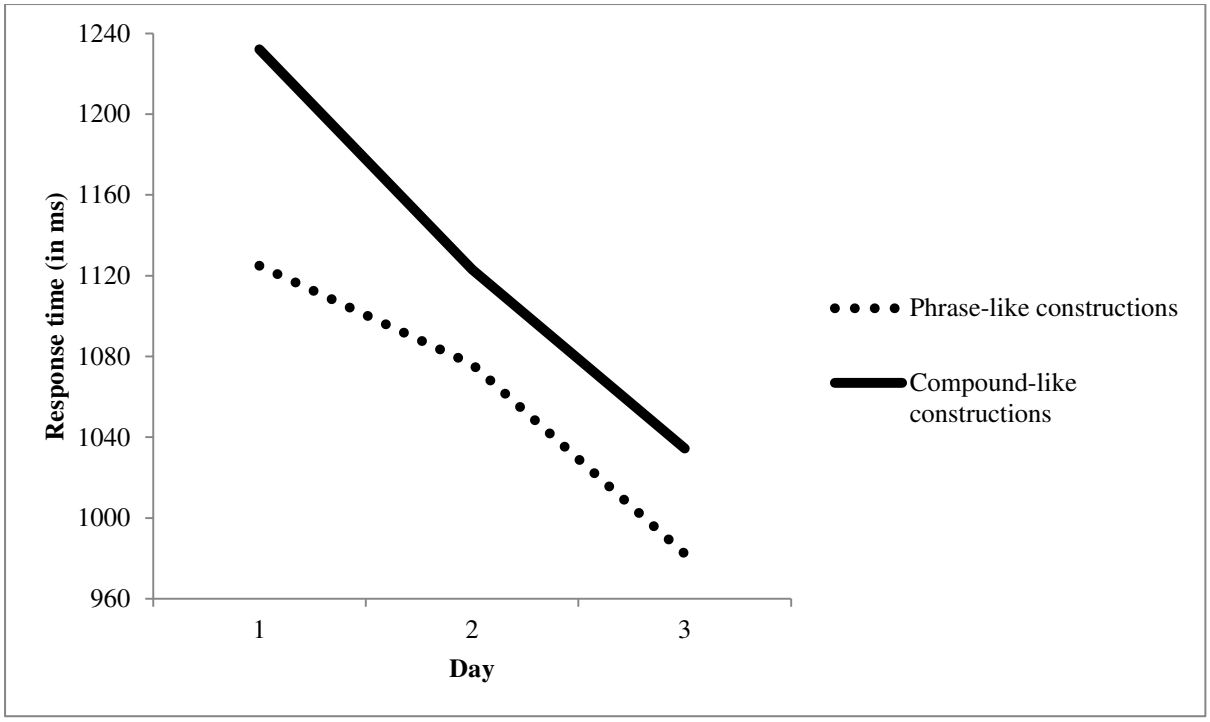

Figure 3: Phrase-like constructions versus compound-like constructions on the three test days (F_1)

4.5. Discussion

In our first study, we contrasted the memorization of English AN constructions with initial stress to those with non-initial stress but did not find that any of the two kinds of constructions were memorized better. Since almost all items were fully compositional in their semantics in the first study, we decided to investigate the interaction of stress and semantic compositionality in our second study and revealed a greater improvement of semantically non-compositional constructions with initial stress compared to semantically compositional constructions bearing non-initial stress. At this point, we see a clear similarity between English and German: not only did German AN compounds, which are typically semantically non-compositional and have initial stress, show a memorization advantage in comparison to phrases (Kotowski et al. 2014: 195-196), which are known for non-initial stress and their semantic compositionality, but also English AN compound-like constructions showed a memorization advantage over English AN phrase-like constructions. Initial stress, semantic non-compositionality and memorization affinity can be regarded as typically morphological characteristics.

5. General discussion and conclusion

The current investigation contributes to the ongoing debate about the demarcation between morphological and syntactic structure building. While the structural factor of inflection can be used to unambiguously distinguish a compound from a phrase in German and French, this factor cannot be used to do so in English. Our paper aimed both at further investigating the cognitive nature of morphological and syntactic constructions from a cross-linguistic

perspective and at transferring tendencies from a language like German, where a clear structural distinction between compounds and phrases is possible, to English, where a clear structural separation is not possible. In general, German functioned as the starting point of the current contribution. Since the German AN constructions that were part of our first study can be unequivocally considered to figure as compounds on structural grounds and showed a memorization advantage in a previous study, we aimed at comparing the cognitive nature, specifically the affinity to be memorized, of these German compounds to that of AN/NA constructions in French and English in order to find further support for a grammatical distinction between compounds and phrases or, in the case of English, at least between compound-like and phrase-like constructions.

The results of our first study clearly point to a memorization advantage of compounds, i.e. the German AN constructions, in comparison to phrases, i.e. the French AN/NA constructions. The memorization advantage was expressed in the overall significantly faster reactions to the German compounds compared to the French phrases. Note that responses to memorized existing nouns of these languages (e.g. *Architekt/architecte*) did not significantly differ. The contrast of the English AN constructions with initial stress to those with non-initial stress required the second definition of the notion of memorization advantage. Since we interpreted the overall significantly faster performance on all three days taken together on structures with non-initial stress to be due to the higher frequency of usage of this pattern, we separately analyzed responses given on individual days. While this analysis did not reveal significant results as long as the focus was on semantically compositional constructions, our second study showed interesting findings concerning the interaction of stress and semantic compositionality. Even though compound-like constructions, i.e. semantically non-compositional constructions with initial stress, were responded to significantly more slowly than phrase-like constructions, i.e. semantically compositional constructions with non-initial stress, on the first day, the response times of these two item types did no longer significantly differ on the two following test days. We interpret this effect to reflect a memorization advantage of compound-like constructions in comparison to phrase-like constructions.

In sum, we have found further empirical evidence for a cognitive distinction of compounds and phrases by comparing the memorization of German AN compounds to French AN/NA phrases. Although we cannot establish a structural distinction between AN compounds and AN phrases in English, our analysis has revealed that compound-like constructions in English show similar cognitive reflexes as German AN compounds, i.e. they show a memorization advantage in comparison to phrase-like constructions.

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Abbreviations

AN – Adjective-noun
DM – Difference of means
NA – Noun-adjective

Appendix

Appendix A: Remaining main effects and interactions of the first experimental study (response time)

Interaction of LANGUAGE x DAY: significant only in F_1 ($F_1(6, 155) = 2.32$, $p = .036$); interaction of ITEM TYPE x DAY: not significant; main effect of LANGUAGE: highly significant only in F_2 ($F_2(3, 110) = 22.87$, $p = .000$); main effect of ITEM TYPE: highly significant ($F_1(1, 155) = 147.06$, $p = .000$; $F_2(1, 110) = 34.38$, $p = .000$); main effect of DAY: highly significant ($F_1(2, 155) = 14.86$, $p = .000$; $F_2(2, 110) = 15.20$, $p = .000$).

Appendix B: Remaining main effects and interactions of the first experimental study (response accuracy)

Interaction of LANGUAGE x DAY: significant only in F_1 ($F_1(6, 155) = 2.28$, $p = .039$); interaction of ITEM TYPE x DAY: not significant; main effect of LANGUAGE: not significant; main effect of ITEM TYPE: not significant; main effect of DAY: significant ($F_1(2, 155) = 3.70$, $p = .027$; $F_2(2, 110) = 3.54$, $p = .032$).

Appendix C: Remaining main effects and interactions of the second experimental study (response time)

Interaction of STRESS x DAY: not significant; interaction of SEMANTIC COMPOSITIONALITY x DAY: not significant; main effect of STRESS: highly significant ($F_1(1, 363) = 21.77$, $p = .000$; $F_2(1, 100) = 14.20$, $p = .000$); main effect of SEMANTIC COMPOSITIONALITY: very significant only in F_1 ($F_1(1, 363) = 9.83$, $p = .002$); main effect of DAY: highly significant ($F_1(2, 363) = 121.66$, $p = .000$; $F_2 (2, 100) = 100.99$, $p = .000$).

Appendix D: Remaining main effects and interactions of the second experimental study (response accuracy)

Interaction of STRESS x DAY: not significant; interaction of SEMANTIC COMPOSITIONALITY x DAY: not significant; main effect of STRESS: not significant; main effect of SEMANTIC COMPOSITIONALITY: very significant only in F_1 ($F_1(1, 363) = 10.10$, $p = .002$); main effect of DAY: highly significant ($F_1(2, 363) = 25.48$, $p = .000$; $F_2 (2, 100) = 21.56$, $p = .000$).

References

Ackema, Peter & Neeleman, Ad. 2004. *Beyond morphology: Interface conditions on word formation.* Oxford: Oxford University Press.

Baker, Mark. 1985. The mirror principle and morphosyntactic explanation. *Linguistic Inquiry* 16(3). 373-415.

Bakken, Kristin. 2006. Lexicalization. In Brown, K., Anderson, A. H., Bauer, L., Berns, M., Hirst, G. & Miller, J. (eds.), *Encyclopedia of language and linguistics*, 106-108. 2nd edn. Oxford: Elsevier.

Bauer, Laurie. 1983. *English word-formation*. Cambridge: Cambridge University Press.

Bauer, Laurie. 1998. When is a sequence of two nouns a compound in English? *English Language and Linguistics* 2(1). 65-86.

Becker, Thomas. 1992. Compounding in German. *Rivista di Linguistica* 4(1). 5-36.

Bell, Melanie J. 2011. At the boundary of morphology and syntax: Noun noun constructions in English. In Galani, A., Hicks, G. & Tsoulas, G. (eds.), *Morphology and its interfaces*, 137-167. Amsterdam & Philadelphia, PI: John Benjamins.

Bisetto, Antonietta & Scalise, Sergio. 1999. Compounding: Morphology and/or syntax? In Mereu, L. (ed.), *Boundaries of morphology and syntax*, 31-48. Amsterdam & Philadelphia, PI: John Benjamins.

Boersma, Paul & Weenink, David. 2012. *Praat: Doing phonetics by computer* [Computer program]. Version 5.3.13. http://www.praat.org/ (Access on April 19, 2012).

Boersma, Paul & Weenink, David. 2014. *Praat: Doing phonetics by computer* [Computer program]. Version 5.4.02. http://www.praat.org/ (Access on December 18, 2014).

Booij, Geert. 2010. *Construction morphology*. Oxford: Oxford University Press.

Bouchard, Denis. 2002. *Adjectives, number and interfaces: Why languages vary*. Bingley: Emerald.

Bücking, Sebastian. 2009. How do phrasal and lexical modification differ? Contrasting adjective-noun combinations in German. *Word Structure* 2(2). 184-204.

Bühl, Achim & Zöfel, Peter. 2002. *SPSS 11: Einführung in die moderne Datenanalyse unter Windows*. 8th revised and extended edn. München: Pearson Studium.

Bybee, Joan. 1995. Diachronic and typological properties of morphology and their implications for representation. In Feldman, L. B. (ed.), *Morphological aspects of language processing*, 225-246. Hillsdale, NJ: Lawrence Erlbaum Associates.

Chomsky, Noam. 1970. Remarks on nominalization. In Jacobs, R. A. & Rosenbaum, P. S. (eds.), *Readings in English transformational grammar*, 184-221. Waltham, MA: Ginn and Company.

Chomsky, Noam & Halle, Morris. 1968. *The sound pattern of English*. New York, NY: Harper & Row.

Di Sciullo, Anna-Maria & Williams, Edwin. 1987. *On the definition of word*. Cambridge, MA: The MIT Press.

Dixon, Robert Malcom Ward. 1982. *Where have all the adjectives gone? And other essays in semantics and syntax*. Berlin: Mouton de Gruyter.

Downing, Pamela. 1977. On the creation and use of English compound nouns. *Language* 53(4). 810-842.

Frawley, William. 1992. *Linguistic semantics*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Gaeta, Livio & Ricca, Davide. 2009. Composita solvantur: Compounds as lexical units or morphological objects? *Rivista di Linguistica* 21(1). 35-70.

Gallmann, Peter. 2009. Die flektierbaren Wortarten: Das Substantiv (Nomen). In Dudenredaktion (eds.), *Duden: Die Grammatik: Unentbehrlich für richtiges Deutsch*, 145-248. 8th, revised edn. Mannheim: Dudenverlag.

Giegerich, Heinz J. 1992. *English phonology: An introduction*. Cambridge: Cambridge University Press.

Giegerich, Heinz J. 2004. Compound or phrase? English noun-plus-noun constructions and the stress criterion. *English Language and Linguistics* 8(1). 1-24.

Giegerich, Heinz J. 2005. Associative adjectives in English and the lexicon-syntax interface. *Journal of Linguistics* 41(3). 571-591.

Giegerich, Heinz J. 2009. The English compound stress myth. *Word Structure* 2(1). 1-17.

Greenberg, Joseph. 1966. *Language universals*. The Hague: Mouton.

Gries, Stefan Th. & Newman, John. 2013. Creating and using corpora. In Podesva, R. J. & Sharma, D. (eds.), *Research methods in linguistics*, 257-287. Cambridge: Cambridge University Press.

Härtl, Holden. 2015. Semantic non-transparency in the mental lexicon: On the relation between word-formation and naming. In Brinker-von der Heyde, C., Kalwa, N., Klug, N.-M. & Reszke, P. (eds.), *Eigentlichkeit: Zum Verhältnis von Sprache, Sprechern und Welt*, 395-416. Berlin: Mouton de Gruyter.

Hartley, Tony, Sharoff, Serge, Stephenson, Paul, Wilson, James, Babych, Bogdan & Thomas, Martin. 2011. *IntelliText* [Computer program]. http://corpus.leeds.ac.uk/itweb/htdocs/ Query.html# (Access from April 14, 2014 through March 16, 2015).

Kotowski, Sven & Böer, Katja & Härtl, Holden. 2014. Compounds vs. phrases: The cognitive status of morphological products. In Rainer, F., Gardani, F., Luschützky, H. C. & Dressler, W. U. (eds.), *Morphology and meaning: Selected papers from the 15th International Morphology Meeting, Vienna, February 2012*, 191-203. Amsterdam & Philadelphia, PI: John Benjamins.

Kremers, Joost. Forthcoming. Morphology is in the eye of the beholder. *Linguistische Berichte*.

Lang, Margaret & Perez, Isabelle. 2004. *Modern French grammar: A practical guide*. 2nd edn. London: Routledge.

Larson-Hall, Jenifer. 2010. *A guide to doing statistics in second language research using SPSS*. New York, NY: Routledge/Taylor & Francis.

Leiner, Dominik. 2014. *SoSci survey* [Computer program]. Version 2.6.00-i. https://www.soscisurvey.de (Access from February 25, 2015 through March 23, 2015).

Levi, Judith N. 1978. *The syntax and semantics of complex nominals*. New York, NY: Academic Press.

Liberman, Mark & Sproat, Richard. 1992. The stress and structure of modified noun phrases in English. In Sag, I. A. & Szabolcsi, A. (eds.), *Lexical matters*, 131-181. Leland Stanford Junior University: Center for the Study of Language and Information.

Lieber, Rochelle. 1992. *Deconstructing morphology: Word formation in syntactic theory*. Chicago, IL: The University of Chicago Press.

Lieber, Rochelle & Štekauer, Pavol. 2009. Introduction: Status and definition of compounding. In Lieber, R. & Štekauer, P. (eds.), *The Oxford handbook of compounding*, 3-18. Oxford: Oxford University Press.

Lübke, Regina. 2007. *Französische Grammatik*. München: Bassermann.

McCauley, Stewart M., Hestvik, Arild & Vogel, Irene. 2012. Perception and bias in the processing of compound versus phrasal stress: Evidence from event-related brain potentials. *Language and Speech* 56(1). 23-44.

Minitab Inc. 2013. *Minitab ® 17* [Computer program]. http://www.minitab.com/de-de & http://www.onthehub.com/minitab/ (Kivuto Solutions Inc.) (Access on July 22 and 28, 2014).

Mondini, Sara, Jarema, Gonia, Luzzatti, Claudio, Burani, Cristina & Semenza, Carlo. 2002. Why is "Red Cross" different from "yellow cross"?: A neuropsychological study of noun-adjective agreement within Italian compounds. *Brain and Language* 81. 621-634.

Motsch, Wolfgang. 2004. *Deutsche Wortbildung in Grundzügen* (Schriften des Instituts für Deutsche Sprache 8). 2nd revised edn. Berlin: Walter de Gruyter.

Olsen, Susan. 2000. Composition. In Booij, G., Lehmann, C. & Mugdan, J. (eds.), *Morphologie: Ein internationales Handbuch zur Flexion und Wortbildung/Morphology: An international handbook on inflection and word-formation*, 897-916. Berlin: Walter der Gruyter.

Pereltsvaig, Asya. 2012. *Languages of the world: An introduction*. Cambridge: Cambridge University Press.

Plag, Ingo. 2003. *Word-formation in English*. Cambridge: Cambridge University Press.

Plag, Ingo. 2006. The variability of compound stress in English: Structural, semantic, and analogical factors. *English Language and Linguistics* 10(1). 143-172.

Psychology Software Tools, Inc. 2010. *E-Prime 2 Professional* [Computer program]. Sharpsburg, PA.

Sadock, Jerrold M. 1985. Autolexical syntax: A proposal for the treatment of noun incorporation and similar phenomena. *Natural Language and Linguistic Theory* 3. 379-439.

Scalise, Sergio & Guevara, Emiliano. 2005. The lexicalist approach to word-formation and the notion of the lexicon. In Štekauer, P. & Lieber, R. (eds.), *Handbook of word-formation*, 147-187. Dordrecht: Springer.

Schiller, Niels O., Fikkert, Paula & Levelt, Clara C. 2004. Stress priming in picture naming: An SOA study. *Brain and Language* 90. 231-240.

Schlücker, Barbara. 2014. *Grammatik im Lexikon: Adjektiv-Nomen-Verbindungen im Deutschen und Niederländischen*. Berlin: De Gruyter.

Schlücker, Barbara & Hüning, Matthias. 2009. Compounds and phrases: A functional comparison between German A + N compounds and corresponding phrases. *Rivista di Linguistica* 21(1). 209-234.

Su, Yi-ching. 1999. The representation of compounds and phrases in the mental lexicon: Evidence from Chinese. *WJMLL: The Web Journal of Modern Language Linguistics* 4-5.

ten Hacken, Pius. 2013. Compounds in English, in French, in Polish, and in general. *SKASE Journal of Theoretical Linguistics* 10(1). 97-113.

Treffers-Daller, Jeanine. 2005. Evidence for insertional codemixing: Mixed compounds and French nominal groups in Brussels Dutch. *International Journal of Bilingualism* 9(3–4). 477-508.

van Goethem, Kristel. 2009. Choosing between A + N compounds and lexicalized A + N phrases: The position of French in comparison to Germanic languages. *Word Structure* 2(2). 241-253.

van Heuven, Walter J. B., Mandera, Pawel, Keuleers, Emmanuel & Brysbaert, Marc. 2014. SUBTLEX-UK: A new and improved word frequency database for British English. *The Quarterly Journal of Experimental Psychology* 67(6). 1176-1190.

Wunderlich, Dieter. 1986. Probleme der Wortstruktur. *Zeitschrift für Sprachwissenschaft* 5(2). 209-252.

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