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Bilingual language acquisition of word-formation

This study examines word-formation in German among 3- to 7-year-old bilingual children compared to length of exposure-matched monolingual peers. Using three tasks with 66 bilingual and 60 monolingual children, we found compound inversions in both groups, significantly more in bilinguals. These results suggest a developmental temporal delay behind monolinguals but no deviance in bilingual acquisition of compounding and highlight the need for further research on compounding in monolingual development.

Keywords: word-formation, compounding, bilingual language acquisition, inversions

Erwerb der Wortbildung bilingualer Kinder

Diese Studie untersucht die Wortbildung im Deutschen bei 3- bis 7-jährigen bilingualen Kindern im Vergleich zu Kontaktzeit-gematchten monolingualen Kindern. 66 bilinguale und 60 monolinguale Kinder bearbeiteten drei Aufgaben. Vertauschungen (Inversionen) von Kompositabestandteilen traten in beiden Gruppen auf, jedoch signifikant häufiger bei bilingualen Kindern. Dies deutet auf eine zeitliche Verzögerung, aber keine Abweichung im bilingualen Erwerb hin und betont den Forschungsbedarf zum Kompositaerwerb im monolingualen Spracherwerb.

Schlüsselwörter: Wortbildung, Komposita, Bilingualer Spracherwerb, Inversionen

1 Introduction

Bilingualism is becoming increasingly important in today's globalized world. In 2022, 22.4% of children under six in Germany primarily spoke a language other than German at home (Destatis 2024). According to the latest education report, one in four children is exposed to German at kindergarten for the first time around age three (Autorengruppe Bildungsberichterstattung 2024), reflecting the growing linguistic diversity of the population. A child is considered to grow up bilingual when s/he uses two or more languages in its daily life (Grosjean 1996). The acquisition is often differentiated into simultaneous and successive acquisition (Chilla 2020; however, see Paradis (2023) and Boese & Scherger (submitted) for another upcoming perspective on bilingual children devalueingthe predominant influence of age of onset (AoO) and focusing more on individual input qualities). According to classifications along the AoO, simultaneous bilingual acquisition occurs when a child is exposed to two languages from birth or before the age of two (Chilla 2020). When a second language (L2) is introduced after the first language (L1) has already been established, typically after the age of two, it is called successive acquisition. Therefore, the AoO and Length of Exposure (LoE) of the L2 are important aspects to describe acquisition contexts further. Research has shown repeatedly that languages influence each other on an individual basis (cross-linguistic influence, Müller & Hulk 2001). This includes the (temporary) delay of grammatical patterns like German case marking in Italian bilingual children (Scherger 2016), acceleration of specific grammatical patterns like V2 placement (Arnaus & Müller 2020), or transfer of typological linguistic patterns like the word order of compounds from one language to another. Cross-linguistic transfer in compound formation and comprehension has been observed across languages with differing head–modifier orders (Foroodi-Nejad & Paradis 2009; Nicoladis 2002; Kutsuki 2019). Grammatical patterns that are challenging in L1 acquisition or involve interface phenomena (e.g., compounds) are particularly sensitive to cross-linguistic influence (Müller & Hulk 2001). This leads to our research goal: the investigation of word formation in bilingual children to analyze potential cross-linguistic influence. More specifically, this study examines word-formation principles (derivation, compounding), focusing on compound patterns (headedness), in typically developing (TD) bilingual children aged three to seven, compared to LoE-matched TD monolingual peers. Given typological differences in compounding—particularly in constituent order and productivity (s. 2.2)— we expect bilingual children to use different word-formation principles when naming low-frequent objects than monolingual peers and to show order reversals in compound components (inversions) when producing and interpreting novel German compounds. To investigate this aspect, word-formation principles and patterns in German and in the languages of the bilingual participants are presented in chapter 2. In chapter 3, research on their acquisition in L1 and L2 contexts is reviewed, before chapters 4 and 5 present the research questions and methods. The article concludes with a presentation and discussion of the findings.

2 Word-formation

To examine the word-formation in monolingual and bilingual children, the three main principles and its patterns in German are summarized in this chapter, with a focus on compounding. As a first principle, derivation uses affixes, either as prefixes (e.g., “Un-mut”, ‘displeasure’) or suffixes (e.g., “mut-ig”, ‘brave’) to form new words. In contrast, conversion involves no morphological change, only a shift in grammatical category, as in German nominalizations of infinitives (e.g., “das Lesen”, ‘the reading’, from infinite “lesen”, ‘to read’; Eisenberg 2013, 201-202). As a third principle, compounding is used to form new words by means of two or more lexical items, as e.g., in “Haustür”, ‘front door’ (ibid., 217). In what follows, the main patterns of German compounding are described in more detail.

2.1 Compounding in German

Compounding is highly productive in German, allowing to name new terms spontaneously. The most common compound type in German is the endocentric compound, where one element (modifier) specifies the other (head). Unlike endocentric compounds, exocentric compounds lack a head, and their meaning cannot be derived from it. In endocentric compounds, the head determines the meaning and grammatical functions of the word, while it is described further by the modifier. German and English compounds are realized right-headed, illustrated by the example “Haustür” ‘front door’ (Eisenberg 2013, 217). In

Romance languages such as Spanish, compounds are typically realized left-headed, e.g. “sacacorchos” lit. ‘pull-corks’ for ‘corkscrew’ (Olsen 2000, cited in Müller 2015, 1568), which is an example of a synthetic compound whose head (“saca”) derives from a verb (“sacar”), as in “Zeitungsleser”, ‘newspaper reader’ (Schlücker 2012, 6), where the head is “-leser”, ‘reader’, derived from “lesen”, ‘to read’, with the main difference of left- (“sacacorchos”) versus right-headedness (“Zeitungsleser”). Contrary to synthetic compounds, for root compounds, like front door, the semantic relation of the constituents has to be interpreted situationally (ibid.). While this can cause misunderstandings due to unfamiliar words, it enables the creation of novel compounds, a key factor in the high productivity of German compounding. Additionally, the right-headedness has to be considered during the interpretation, because a change of the modifier and head can lead to a change of meaning (Orangensaft ‘orange juice’ and Saftorange ‘juice orange’).

2.2 Compounding cross-linguistically

As previously explained, compounding is a highly productive word-formation principle in Germanic languages, realized strictly right-headed in **German** and **English** (Müller 2015). Other languages, for example **Spanish**, also allow left-headed structures and are not as productive as German compounds (ibid.). Building on this contrast, the following section provides an overview of the compounding patterns in the remaining participants’ L1s to explore potential cross-linguistic influences. **Arabic** compounding is strongly left-headed, as illustrated by the example “ʕaruus l-baħr-i“ (“ʕaruus” ’see’, “l-baħr-I” ‘bride’, lit. ‘Seebride’ for mermaid; Altakhaineh 2019, 5). The translation of German compounds is challenging for Arabic speakers, because of the lower productivity of compounds in Arabic (Mohamed 2011). **Turkish** compounds resemble German ones in productivity and right-headedness (Schroeder et al. 2014), illustrated by “elma ağacı” (“elma” ‘apple’, “ağacı” ‘tree’; Arcodia & Sarı 2018, 322). In **Kurdish** and **Persian**, the primary word-formation principle is derivation. For example, the word “dukandar″ ‘shop owner’ is derived from “dukan″ ‘shop’ by adding the verb stem “-dar“ (Adli 2014, 185). Compounds in Kurdish and Persian are typically limited to two elements and are right-headed, as illustrated by the example “zænpedær” ‘father in law’, lit. ‘wife father’, which can also be realized as „pedær-e zæn” ‘father of the bride’ (ibid., 187-188). Persian compounds can be realized left-headed as well (Foroodi-Nejad & Paradis 2009). In the **Albanian** language, compounding is the most productive word-formation principle (Kallulli 2014). Compounds are realized left-headed, as illustrated by the example “bojë flokësh“ ‘color hair’ for hair color (ibid., 419). **Armenian** compounds are realized right-headed, while left-headed structures are judged as ungrammatical (Dolatian 2021). In Slavic languages**,** like **Czech**, **Russian**, **Bosnian** and **Bulgarian,** compounding is uncommon compared to derivational principles (Błaszczak 2014; Gargarina 2014; Szucsich 2014). However, according to Kapatsinski and Vakareliyska (2013), the **Russian** language is influenced by Germanic languages, leading to a growing number of right-headed compound-nouns. **Czech** compounds are realized left-headed (Pala et al. 2010). There are right-headed endocentric root and synthetic compounds in **Bulgarian** (Jarema et al. 1999) and the **Bosnian** language (Szucsich 2014). For Bosnian, an example of a right-headed endocentric compound is “mravojad“ ‘anteater’ (ibid., 206). The **Hungarian** language is characterized by right-headed compounds, like in Germanic languages (Kiefer & Németh 2019).

3 Acquisition of word formation

3.1 Compounding in first language acquisition

The ability to form new words appears at a very early stage in German language acquisition. Research shows that children begin to create compounds as early as age two (Dressler et al. 2010; Schipke & Kauschke 2011; Elsen & Schlipphak 2015). In spontaneous speech analyzed by Schipke and Kauschke (2011), 10% of the observed word-formations were novel compound nouns such as “Automensch” ‘car man’ to describe a robot (p. 75). Further observational research suggests that German-speaking children tend to create novel compounds to compensate for lexical gaps (Elsen & Schlipphak, 2015). However, there are indications from observational studies, that German-speaking children disobey the right-headedness and show inversions around two years. Elsen & Schlipphak (2015) report about observed inversions produced spontaneously by a 1;9-years-old German-speaking girl referring to “Fingernägel” ‘fingernails’ as “Nagelfinger” ‘nailfinger’. Rainer (2010, cited in Elsen & Schlipphak 2015, 2123) observed a stage from three to four years, when children seem to have difficulties with the constituent order. Dressler et al. (2010) found inversions to be rare in their study and Schipke and Kauschke (2011) did not mention any inversions at all. To the best of our knowledge, no experimental studies have so far investigated German-speaking children's competencies in comprehending and producing novel compounds—an area that could offer valuable insights into their metalinguistic knowledge of word-formation processing. However, there are studies on the production and reception of novel compounds investigating English-speaking children (Clark et al. 1985; Clark et al. 1986). Reception was tested using a word-picture matching task with 60 children aged 2;0-6;0 years. Each trial showed four images: the target (e.g., mouse hat—a hat on a mouse), a modifier-only image (mouse), a head-only image (hat), and a distractor with the correct head but a different modifier (e.g., fish hat). The results were interpreted that by age two, English-speaking children already organize words taxonomically in their mental lexicon. However, it remains unclear whether children as young as 2;4 had fully grasped the modifier-head structure, as their interpretation of inverted forms (e.g., hat mouse) was not assessed (Clark et al. 1985). Regarding the production of novel compounds, Clark et al. (1986) found that three- and four-year-old children often produced inverted compounds like “puller wagon” to describe someone who pulls a wagon, while five- and six-year-olds more commonly used correct forms like “wagon puller”, indicating a developmental stage during which English-speaking children initially invert the order of compound components. In a follow-up study, Clark and Barron (1988) asked children aged three to six to judge and correct grammatical (“wagon puller”) and inverted (“puller wagon”) compounds. Older children were better at spotting errors, but many of their corrections were still incorrect, which Clark and Barron (1988) interpreted as evidence that reception develops ahead of production.

3.2 Compounding in second language acquisition

While previous studies have examined acquisition of word formation in L1 acquisition of German, little is known about how bilingual children acquire word formation in German compared to monolinguals. Differences between the L1 and German in word-formation – such as the productivity and compound-headedness - may lead to challenges in the formation of new words, for example, through compounding (Tschichold & ten Hacken 2015). Comparison studies of the formation of compounds can, therefore, lead to a better understanding of the bilingual acquisition of complex words and could reveal cross-linguistic influence, for example in the form of the transfer of morphological patterns from the L1 to German.

Studies with bilingual children have revealed cross-linguistic influence of English and French (Nicoladis 2002), English and Persian (Foroodi-Nejad & Paradis 2009) and Spanish and Japanese (Kutsuki 2019) on comprehension and production of novel compound nouns with respect to the head modifier order. Because of the different compounding patterns of the compared languages, this was interpreted as cross-linguistic transfer. Nicoladis (2002) investigated 25 English monolinguals and 25 English-French bilinguals aged three to four with respect to their production and their comprehension of novel compound nouns and found no differences in comprehension between monolinguals and bilinguals, but more inverted compounds produced by bilinguals over monolinguals. Foroodi-Nejad & Paradis (2009) found structural overlap and dominance as explanatory factors for cross-linguistic transfer by applying the adapted material of Nicoladis (2002) to 19 Persian monolinguals, 16 Persian-English bilinguals and 17 English monolinguals aged three to five years. Kutsuki (2019) investigated ten Spanish-Japanese bilingual children and 32 Japanese monolingual children aged four to five years. She interpreted higher inversion rates in bilingual children as transfer from Spanish to Japanese in comprehension and production of novel compounds. The method of these three studies was applied to the German context by this research group (Scherger et al. 2024) and is part of this investigation. They investigated 16 monolingual German-speaking children and 19 bilingual German-speaking children aged 6;0 to 8;9 with seven different L1s. The results support the previous findings that bilingual children may show cross-linguistic influence in their use of left-headed structures, when producing and understanding novel compounds. Bilingual children with German as L2 inverted compound components more often than their age-matched monolingual peers in production and comprehension, bilinguals with German as L1 showed inversion rates comparable to both age- and LoE-matched monolinguals. Furthermore, bilingual children with German as L2 inverted more often than bilingual children with German as L1 in the comprehension task, but showed no differences in production and comprehension compared to LoE-matched monolinguals. Moreover, a higher inversion rate for production was also found for bilingual children compared to monolingual age-matched peers in another study by these author group (Scherger & Kliemke 2021). They asked nine monolingual and nine bilingual children with German as L2 aged seven to eight years to name low-frequent objects and analyzed their used word-formation principles. The word formation principles observed did not differ in use and extent between bilingual and monolingual children, but when producing compounds, the bilingual children inverted compound components more often than the monolingual children. The methods of both studies were applied in this study to provide a comprehensive view of the word-formation competencies of monolingual and bilingual children and to examine the order of compound constituents in both production and comprehension.

4 Research Questions and Hypotheses

This study investigates word formation in bilingual children, using methods from two prior studies by this research group (Scherger & Kliemke 2021; Scherger et al. 2024). Based on the findings that compounding emerges early in German L1 acquisition, we extended the age range of bilingual participants to three to seven years. Both experiments pursued different research questions. Experiment 1 focused on the use of various word-formation principles, while Experiment 2 examined inversions in production and comprehension of novel compounds. This is reflected in the two distinct research questions. The picture-naming task following Scherger & Kliemke (2021) is referred to as Experiment 1 and investigates the following research question:

1. Do bilingual children with German as L1 or L2 differ from LoE-matched monolingual German children in their use of word-formation principles when naming low-frequent everyday objects in German?

Contrary to previous results (Scherger & Kliemke 2021), we anticipate differences in word-formation principles due to the inclusion of younger children in this study (3;0-6;11 vs. 7;0-8;11 years). We also expect L1-specific word-formation patterns (left-headedness) to influence outcomes (s. RQ3).
Experiment 2 (Scherger et al. 2024) explores the following question:

2. Do bilingual children invert compound components more often than monolingual LoE-matched children when producing and understanding novel compounds?

In line with Scherger et al. (2024), we expect bilingual children to show higher inversion rates than monolingual peers when producing and understanding novel compounds. Contrary to previous results, we expect to find differences for bilingual children and LoE-matched monolinguals, because we extended the age range to 3;0-6;11 years and included a broader range of bilingual children with diverse L1s to examine expectable L1 influences and further influencing factors on inversion rates by addressing RQ3 and 4:

3. How do AoO, LoE, language dominance, compound headedness and productivity of the L1 influence inversion rates in Experiment 1 and 2 among bilingual children?

We hypothesize that the choice of word-formation principles and compounding patterns (inversion rates) are influenced by child-internal and -external factors. Specifically, we expect bilingual children with later AoO, shorter LoE, and non-German language dominance to show increased inversion rates. Those hypotheses are based on indications from Foroodi-Nejad & Paradis (2019), who found language dominance to be an explanatory factor for transfer.

4. How do age, gender, SES, language proficiency, and language development influence inversion rates in Experiment 1 and 2 among monolingual and bilingual children?

Across both monolingual and bilingual groups, we also anticipate higher inversion rates in younger children, like Clark et al. (1986) and Clark & Barron (1988) did.

5 Participants and Method

5.1 Data collection and participants

In total, 126 children were tested to compare the word-formation of the bilingual children (*n*=66) with those of the monolingual group (*n*=60). The bilingual children were matched according to the LoE to the monolingual children (*U*=1761.0, *Z*=-1.070, *p*=.284). Because of the average AoO of 35.4 months, the bilingual children are on average 32.9 months older than the monolingual children. In Table 1, the participant characteristics can be seen.

Tab.1: Participant characteristics

	Monolingual children ***n*= 60**	**Bilingual children** ***n*=66**
Gender	male: 28 female: 32	male: 37 female: 29
Age (months)	*M*=47.7 *SD*=13.6 range=25-71	*M*=80.6 *SD*=10.9 range=44-95
LoE	*M*=47.7 *SD*=13.6 range = 25-71	*M*=45.6 *SD*=11.6 range = 26-69
AoO	*M*=0.0 *SD*=0.0 range=0	*M*=35.4 *SD*=16.3 range=0-61

Children were recruited from kindergartens and elementary schools in North Rhine-Westphalia, Germany. Ethical approval and parental consent were obtained. Parents completed questionnaires on their child's background. Questionnaires were missing for 22 children; the remaining questionnaires were on average 83.8% complete. Children were classified as monolingual due to parents' reports if only German was spoken at home. Bilingual children aged three to seven years with two to five years of exposure to German were matched with monolinguals aged two to five years. Testing took place in two sessions: one for German language proficiency and one for experimental tasks. German proficiency of 61 bilinguals was assessed using *Linguistische Sprachstandserhebung – Deutsch als Zweitsprache* (*LiSe-DaZ*; Schulz & Tracy 2011). It was not possible to assess five bilingual children. The T-score was on average *M*=46.3 (*SD*=5.7). 40 children (65.6%) scored two or more subtests <40, indicating a need for language support. 34 monolinguals were assessed with the *Sprachentwicklungstest für 2-Jährige* (*SETK-2*; Grimm 2016) or *Sprachentwicklungstest für 3-5-jährige Kinder* (*SETK-3-5*; Grimm 2015). No child scored two subtests lower than 35, indicating typical language development and hence no need for therapy (*M*=53.8, *SD*=7.9). The remaining 26 monolinguals were assumed typically developing based on external confirmation by their parents or teachers. Language proficiency, expressed as T-scores, was assessed in German using two standardized tests, each selected to ensure the use of appropriate normative data for monolingual (*SETK*; Grimm 2015, 2016) and bilingual children (*LiSe-DaZ*; Schulz & Tracy 2011). Furthermore, parents reported the age of first words and concerns about early language development in L1. There was no significant difference between the two groups in the age of first words (Mann-Whitney *U*=707.5, *Z*=-.131, *p*=.896) and concerns about the language development (*U*=707.0, *Z*=.992, *p*=.321). Parental Socioeconomic status (SES) was measured via years of schooling. Parents of bilingual children had an average of 10.2 years of schooling (*SD*=3.1), significantly fewer than monolingual parents, who averaged 12.5 years (*SD*=1.2; *U*=211.5, *Z*=-4.532, *p*<.001). Parents of bilingual children answered questions based on the PaBiQ (Tuller 2015), providing information on their child's AoO of German and German and L1 input at home (from parents and siblings). Questionnaires were translated into the parents' L1 when needed. Language dominance was determined by calculating the input ratio of German to L1. The results were categorized in <0.8 = L1-dominant, >1.2 = German-dominant, and 0.8–1.2 = balanced. Ten children had balanced input, 7 were German-dominant, and 23 were L1-dominant. Language dominance data were missing for 26 children. In total, the bilingual children speak 13 different L1s. 13 bilingual children's AoO of German was before the age of 2, so German is regarded as their L1, the remaining bilingual children (*n* = 53) acquire German as their L2. Table 2 provides an overview of the L1s of the participating children, which are grouped by their compounding characteristics as described in chapter 2.2. The L1 of seven children is unknown.

Tab.2: Compounding characteristics of bilingual children's L1

L1	***n*=**	**right-headed**	**left-headed**	**productive**	**unproductive**
Albanian	*n*=3		✔	✔	
Arabic	*n*=23		✔		✔
Armenian	*n*=1	✔		✔	
Bosnian	*n*=1	✔			✔
Bulgarian	*n*=1	✔			✔
Czech	*n*=2		✔		✔
English	*n*=1	✔		✔	
Hungarian	*n*=2	✔		✔	
Kurdish	*n*=7		✔		✔
Persian	*n*=6	✔	✔		✔
Russian	*n*=3	✔			✔
Spanish	*n*=2		✔		✔
Turkish	*n*=7	✔		✔	

5.2 Experiment 1

The experimental survey took place in a quiet room, where the experimenter presented visual stimuli on a laptop.

Material & Procedure

In Experiment 1, the children were asked to name 15 images of low-frequent everyday objects or components (see Scherger & Kliemke 2021, Appendix for item list). Based on prior findings (ibid.), we assume that the items represent lexical gaps for both monolingual and bilingual children, allowing us to assess their ability to create new words rather than to name existing lexical items. Figure 1 shows the image for an item. Children were asked to produce a name. If they named or described the whole picture, the target component and instruction was indicated again. As the task did not assess lexical knowledge, unfamiliar objects were briefly explained before naming. It was not possible to keep the explanation standardized.

Fig.1: Item of Experiment 1

Analysis

The testing session was video-recorded and the children's production was transcribed and analyzed afterwards. The analysis was based on the definitions of the reaction type which are given in Table 3.

Tab.3: Definitions and examples for word-formation

Word-formation	Definition	Example (Fig. 1)
Compounds	A combination of two or more morphemes or particles.	"Kugelschreiberknopf" 'ball point pen button'
Simplizia	A word that consists of a single morpheme.	"Knopf" 'button'
Derivations	A combination of words and confixes with word-formation affixes like -er or -ung.	"Drücker" 'pusher'
Phrases	Description of the appearance or function of the item.	"Man drückt das zum Schreiben" 'You push it to write'

The average number of each produced word-formation (s. Tab. 3) for each participant was calculated to compare the word-formations across the two groups. Afterwards, we analyzed the compounds in terms of their headedness and complexity, defined by the number of components. Thereby we included combinations with verb particles, such as "on", "out", "over", etc. as compound constituents (Schlotthauer & Zifonun 2008). For example, the reaction "Tür-zu-macher" 'Door closer' was analyzed as a compound with three constituents.

5.3 Experiment 2

Material & Procedure

Experiment 2 was conducted based on studies examining compounding skills in monolingual and bilingual children (Foroodi-Nejad & Paradis 2009; Kutsuki 2019; Nicoladis 2002). The suitability of the selected items for forming novel compounds in German was tested with adults before (Scherger et al. 2024). The production and reception task included 16 test items each as well as two practice items. The novel compounds consisted of two simple nouns assumed to be familiar. For the production task an example is "Spiegelsonne" 'mirror sun', a combination of sun + mirror (s. Fig.2). "Sonnenspiegel" 'sun mirror' would have been analyzed as an inversion.

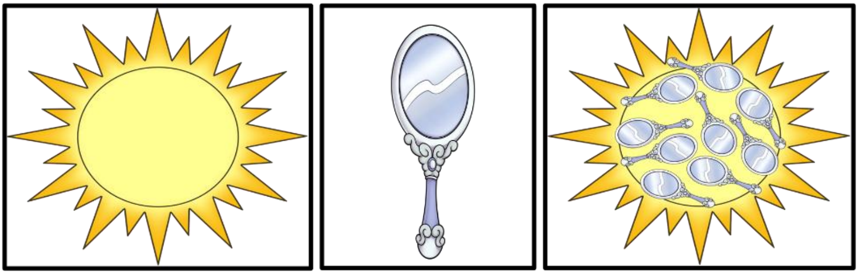

Fig.2: Example for the production task: sun + mirror = mirror sun

For both subtests, the two constituents were presented for each child in the same random order to avoid priming. Children named each in both tasks to check for lexical knowledge. If the answer was incorrect or absent, the target word was given. Afterwards, they combined the components into a novel compound. A practice item including corrections when needed ensured understanding. In the reception task, the children selected the picture matching a target compound (e.g.,"Blattkuh" 'leaf cow'), which was presented auditorily without an article to avoid priming effects, as the components have different genders (die Kuh, das Blatt). As shown in Figure 3, choices included the target ("Blattkuh" 'leaf cow'), its inversion ("Kuhblatt" 'cow leaf'), and the two components ("Kuh" 'cow', "Blatt" 'leaf') as distractors. The first two items served as practice items and the children named the components of each compound before the selection to exclude lexical gaps as well.

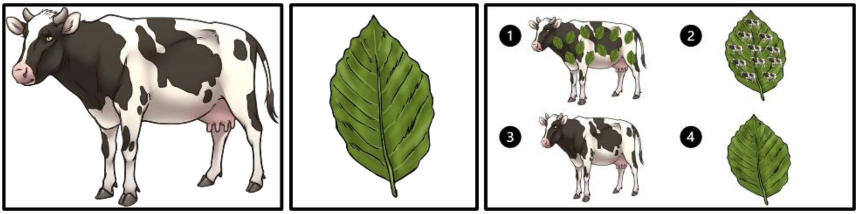

Fig.3: Example for the reception task: cow + leaf = leaf cow (1)

To make the task child-friendly, it was framed as helping a professor and assistant name and identify new inventions. The production task preceded the reception task to avoid priming effects.

<u>Analysis</u>

The experimental tasks were video-recorded, and children's responses were transcribed and analyzed. In the production task, we noted whether the participants used compound nouns, simplizia (e.g., "sun") or formed phrases to describe the picture (e.g., "sun with mirrors on it"). For compounds, we examined correct compound order and inversion. Pointing responses in the reception task were also analyzed. Inversion rates were calculated for each subtest per participant, and compared. Participants who did not produced compounds or failed to respond to at least half of the production items were excluded from calculations to avoid distortion. We also compared the frequency of simplizia, phrases and zero-reactions between groups.

5.4 Data analysis

To rule out effects of the test items on the results, the test items were first compared descriptively. Since no differences were found in the use of word-formations or in the number of inversions in the two experiments, no item was excluded from subsequent analyses. Bonferroni correction was applied to control the family-wise error rate resulting in a corrected alpha level of $\alpha = 0.0125$ for each individual test. The aim of the first research question was to investigate the word-formation principles when naming low-frequent everyday objects in German among bilingual children compared to LoE-matched monolingual children with German as L1. To answer **RQ1**, we compared the percentages of the analyzed responses, with a particular focus on compounds, including their inversions and complexity. Due to unequal distribution of data across groups, we applied the Mann-Whitney-*U* test. Addressing **RQ2**, the inversion rates were compared in the production and reception task of Experiment 2 between the two groups. Since data was not normally distributed, Mann-Whitney-*U* test was applied. Regarding **RQ3**, the influences of AoO, LoE, language dominance (input ratio of German to L1) and compounding patterns (left- vs. right-headedness, unproductive vs. productive) of the L1 on inversion rates in the two experiments were analyzed calculating multiple linear regression models. As these variables are specific to bilinguals, we estimated an additional model to address **RQ4**, with predictors including gender, age (in months), language proficiency (average T-score of the applied language test), language development (age of first word), and SES (average parental years of schooling) for both, monolingual and bilingual children.

6 Results

6.1 Experiment 1

Experiment 1 was conducted with 115 children (n=61 bilingual, n=54 monolingual), because 5 bilingual and 6 monolingual children could not participate. After excluding 7 bilingual and 14 monolingual children due to zero responses on at least half of the items, data from 54 bilingual and 40 monolingual children were analyzed. Prior to exclusion, average zero-response rates were 19.2% for bilinguals and 30.4% for monolinguals, with no significant difference. As shown in Figure 4, compounding was the most frequent principle among monolingual children, while bilingual children used it significantly less often (U=589.0, Z=-2.741, p=.006). For bilingual children, simplizia were most common descriptively, slightly ahead of phrases, with no significant difference to monolingual children. However, derivations were used significantly more often by bilingual children compared to their monolingual peers (U=775.5, Z=-2.624, p=.009). Figure 5 illustrates that bilingual children inverted compound components significantly more often than the monolingual group (*U*=660.5, *Z*=-2.435, *p*=.015). Across the groups, the majority of compounds consisted of two components (bilingual: *M*=88.9%, monolingual: *M*=74.9%). Compounds consisting of three elements were produced significantly more often in the monolingual group (*U*=541.5, *Z*=-3.131, *p*=.002). More complex compositions with four or more components were rare in both groups (bilingual: *M*=1.0%, monolingual: *M*=1.1%).

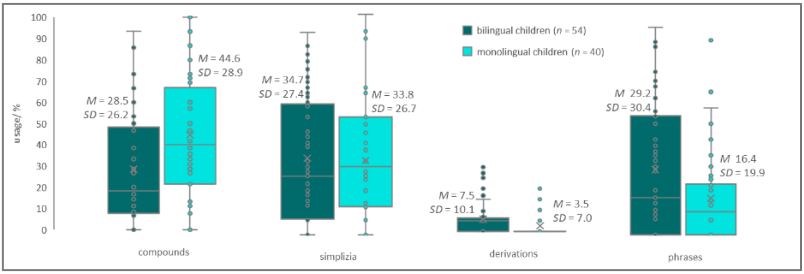

Fig.4: Percentage of reaction types observed for Experiment 1

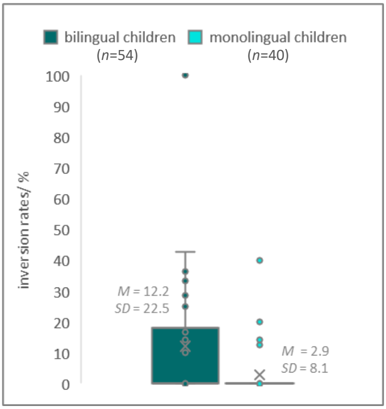

Fig.5: Inversion rates in Experiment 1

6.2 Experiment 2

<u>Production task</u>

For the production task of Experiment 2, reactions from 96 children (*n*=54 bilingual, *n*=42 monolingual) were analyzed, because we excluded 12 bilingual children and 18 monolingual children from analysis, as they produced compound nouns for fewer than half of the items. As shown in Figure 6, children from the two groups inverted when producing novel compounds, while the bilingual children inverted significantly more often than the monolingual children (*U*=776.5, *Z*=-2.647, *p*=.008).

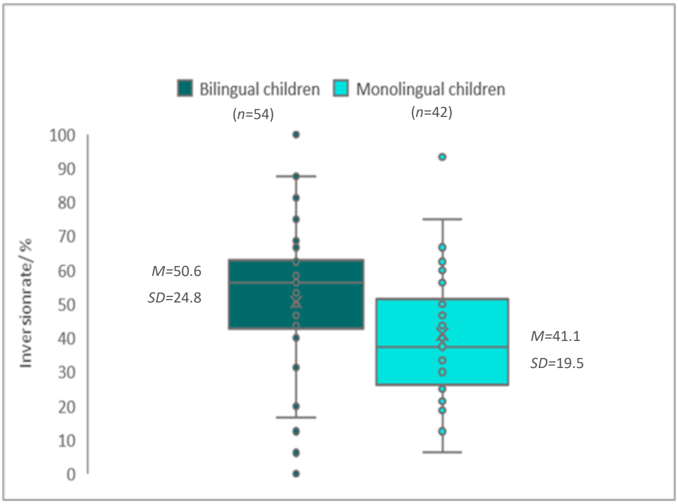

Fig.6: Inversion rates in the production task of Experiment 2

Subtest 2: Reception task

We excluded three monolingual children from analysis, due to missing reactions (*M*=85.4%) and analyzed reactions from a total of 123 children (*n*=66 bilingual, *n*=57 monolingual) for the reception task. Both groups exhibited uncertainties in identifying the target item, as reflected in the average inversion rates of 61.2% for bilingual children and 45.6% for monolingual children. This difference is statistically significant (*U*=1154.5, *Z*=-3.935, *p*=<.001).

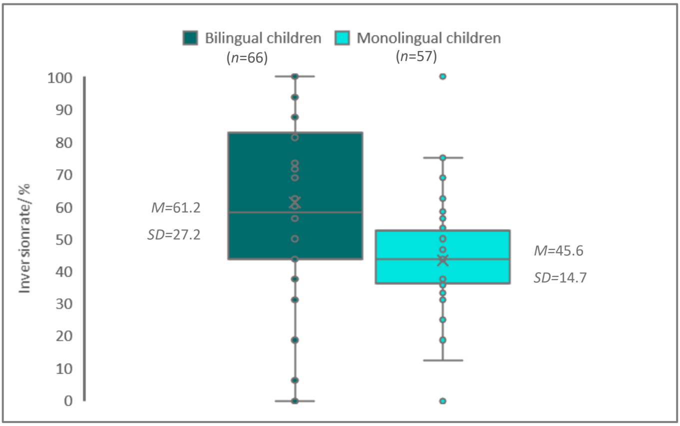

Fig.7: Inversion rates in the reception task of Experiment 2

6.3 Influencing factors

To examine the influence of bilingual predictors (AoO, LoE, L1-language dominance, and L1 compound patterns) on inversion rates in Experiments 1 and 2, three multiple linear regression models were calculated. Due to high collinearity (VIF=2.006), AoO was excluded from the final regression model. Table 4 illustrates no influence of bilingual child-internal factors on inversion rates in the three experiments.

Tab.4: Overview of predictors for inversion rates in Experiment 1 and 2 in bilingual children (RQ3)

Predictor	**Inversion rates Experiment 1**	**Inversion rates production task Experiment 2**	**Inversion rates reception task Experiment 2**
LoE	*ns*	*ns*	*ns*
Language dominance	*ns*	*ns*	*ns*
L1 Compound headedness	*ns*	*ns*	*ns*
L1 Compound productivity	*ns*	*ns*	*ns*
R^2	R^2=.203	R^2=.080	R^2=.091

LoE=Length of Exposure, ns=not significant

Three multiple linear regression models explored the effects of age, gender, SES (measured by parents' school years), language proficiency (average T-score of the language test), and language development (age of first words) on inversion rates in Experiments 1 and 2 for both, monolingual and bilingual children (see Table 5). Age of first words significantly influenced inversion rates with a strong positive effect (β=.404) in the reception task of Experiment 2, indicating a higher inversion rate for children who spoke their first words later. Age significantly influenced inversion rates with a strong positive effect (β=.441) in the reception task of Experiment 2, indicating an increase in inversion rates with age.

Tab. 5: Overview of predictors for inversion rates in Experiment 1 and 2 in bilingual and monolingual children (RQ4)

Predictor	**Inversion rates Experiment 1**	**Inversion rates production task Experiment 2**	**Inversion rates reception task Experiment 2**
Age	*ns*	*ns*	*β*=.441, *p*=.005, SE=.169
Gender	*ns*	*ns*	*ns*
SES	*ns*	*ns*	*ns*
Language proficiency	*ns*	*ns*	*ns*
Language development	*ns*	*ns*	*β*=.404, *p*=.004, SE=.729
R^2	R^2=.217	R^2=.299	R^2=.320

SES= socio economic status, ns=not significant

7 Discussion

This study examined word-formation in bilingual children aged three to seven years and compared their performance across three tasks to that of LoE-matched monolingual German-speaking peers.

For Experiment 1, we observed differences in the choice of word-formation principles when naming low-frequent objects between the two groups. Monolingual children produced mostly compounds, while bilingual children relied more on derivational principles. This differs from a previous study of this author group with older children (Scherger & Kliemke 2021), but supports our hypothesis and may reflect age-related developmental differences, indicating a temporal delay for younger bilingual children. Furthermore, we found higher inversion rates in bilingual than in monolingual children, consistent with Scherger & Kliemke (2021), who identified inversion as a developmental feature of bilinguals aged seven to eight. Additionally, inversion rates differed between LoE-matched bilingual and monolingual children, though age comparisons were not conducted in this study. Despite challenges with the component order in Experiment 1, bilingual children successfully used both compounding and derivation to label low-frequent items in Experiment 1, indicating productive word-formation competencies in German. However, bilinguals produced fewer complex compounds, suggesting potential difficulties in this typical German domain.

The higher inversion rates in Experiment 2 among bilingual children align with national (Scherger et al. 2024) and international findings (Foroodi-Nejad & Paradis 2009; Kutsuki 2019; Nicoladis 2002). Given the small L1 subgroups and no effect of L1 compound patterns, the differences between monolingual and bilingual children in Experiment 1 and 2 can be interpreted as developmental delay behind monolinguals (who showed inversion rates as well), while cross-linguistic transfer from a specific L1 remains unclear. To examine transfer effects, a larger sample with a consistent left-headed L1 and assessment of L1 compounding skills is required. The potential delay is currently investigated in a longitudinal design including monolingual and bilingual children, because high inversion rates in monolingual children also suggest a developmental phase of inversions in compound acquisition for monolingual German-speaking children with TD.

The unexpected results regarding age as a predictor of inversion rates indicate an increase in inversion among older children. This may be attributed to the fact that bilingual children, who inverted compound components more frequently than their monolingual peers in the reception task of Experiment 2, were older. Post-hoc analyses showed no significant correlation of age and inversion rates for either monolingual or bilingual children. Therefore, further research is needed to address these unresolved issues and to explore the gap in experimental studies on German-speaking monolingual children, which could inform practical language support strategies in kindergartens and schools.

In summary, our results support initial evidence of compound inversion in both production and reception among monolingual and bilingual German-speaking children. Further research should explore whether this reflects a developmental phase for monolingual and bilingual acquisition, as seen in monolingual English-speaking children aged three to four years (Clark et al. 1986; Clark & Barron 1988), cross-linguistic transfer or temporary delay. Given the higher inversion rates in bilingual children, targeted support for compound processing in bilingual school-aged children is recommended.

8 Strengths and Limitations

This study provides valuable insights into language processing in bilingual and monolingual children. To address the heterogeneity among bilinguals, we collected data on language proficiency, dominance, and development, and analyzed their potential effects using multiple linear regression. First, the sample size is small, so multivariate analysis results should be interpreted with caution.

Furthermore, our bilingual sample showed considerable heterogeneity in German language proficiency, as measured by a standardized, normed language test. Notably, 65.6% of the bilingual children scored within a range indicating a need for language support, despite being enrolled in regular schools and not identified as requiring language therapy. While we cannot make clinical diagnoses based on our data, the findings suggest language difficulties may go undetected in educational and home settings. However, language proficiency did not influence inversion rates, and prior research by our group (Giesselbach & Scherger 2025) showed no differences in task performance between monolingual children with and without Developmental Language Disorders, supporting this result. Notably, age of first words, which is a predictor for (a)typical language development was a positive predictor of inversion rates in the reception task of Experiment 2. A further limitation to our study is the lack of complete parental questionnaire data, which may have provided important additional insights into the children's language background. Despite translating some questionnaires into the parents' L1, misunderstandings may have affected responses and return rate. Language dominance was assessed based only on home input, because data on language use in educational settings and L1 proficiency were unavailable. Additionally, some language proficiency data were missing for monolinguals. It should also be noted that different standardized language tests were used across groups to allow valid interpretation based on age, LoE and sample characteristics. This is due to the lack of a suitable test for both target groups.

We included bilingual children with various L1s and categorized these languages by their compounding patterns based on scientific, linguistic literature. This may have limited our results by simplifying the complex morphological patterns of the respective languages. To examine word-formation, particularly compounding, we used two experiments developed and piloted in earlier studies (Scherger & Kliemke 2021; Scherger et al. 2024). Differences in inversion rates between Experiments 1 and 2 may stem from the lack of a clear semantic relation between compound components in Experiment 2, complicating right-headedness. Furthermore, the potential influence of the non-standardized explanations in Experiment 1 and the assistance provided in addressing lexical gaps in Experiment 2 was not analyzed further. However, since the test was piloted with adult speakers who did not show any difficulties, it is nevertheless interesting to examine the developmental stage of the different child age groups. High dropout rates among two-year-old monolinguals suggest the tasks were too demanding for this age group. Observational studies suggest that children in this age group are capable of forming complex words, indicating that performance in our tasks may be confounded with higher cognitive task requirements. Further research should investigate compounding competencies and performance in spontaneous speech to identify typical developmental patterns and enable targeted language support.

9 References

Adli, A. (2014). Das Persische und das Kurdische. In M. Krifka, J. Błaszczak, A. Leßmöllmann, A. Meinunger, B. Stiebels, R. Tracy, & H. Truckenbrodt (Eds.), *Das mehrsprachige Klassenzimmer* (pp. 175–196). Berlin: Springer.

Altakhaineh, A. R. M. (2019). A cross-linguistic perspective on the Right-Hand Head Rule: the rule and the exceptions. *Linguistics Vanguard*, *5*(1).

Arcodia, G. F., & Sarı, I. (2018). Towards a typology of coordinating compounds in Turkish. *Folia Linguistica*, *52*(2), 319–349.

Arnaus Gil, L., & Müller, N. (2020). Acceleration and delay in bilingual, trilingual and multilingual German-Romance children. *Linguistic Approaches to Bilingualism*, *10*(4), 530–558.

Autorengruppe Bildungsberichterstattung (Eds.). (2024). Bildung in Deutschland 2024: Ein indikatorengestützter Bericht mit einer Analyse zu beruflicher Bildung. wbv Media GmbH & Company KG.

Błaszczak, J. (2014). Das Polnische und das Tschechische. In M. Krifka, J. Błaszczak, A. Leßmöllmann, A. Meinunger, B. Stiebels, R. Tracy, & H. Truckenbrodt (Eds.), *Das mehrsprachige Klassenzimmer* (pp. 67–92). Berlin: Springer.

Boese, J., & Scherger, A.-L. (submitted). Unraveling individual L2-acquisition in late bilingual children with and without Developmental Language Disorder: A Longitudinal Approach. In *Journal of Speech Language, and Hearing Research.*

Chilla, S. (2020). Mehrsprachige Entwicklung. In S. Sachse, A.-K. Bockmann, & A. Buschmann (Eds.), *Lehrbuch. Sprachentwicklung: Entwicklung – Diagnostik – Förderung im Kleinkind- und Vorschulalter* (pp. 109–130). Berlin, Heidelberg: Springer.

Clark, E. V., & Barron, B. J. S. (1988). A thrower-button or a button-thrower? Children's judgments of grammatical and ungrammatical compound nouns. *Linguistics*, *26*(1).

Clark, E. V., Gelman, S. A., & Lane, N. M. (1985). Compound Nouns and Category Structure in Young Children. *Child Development*, *56*(1), 84–94.

Clark, E. V., Hecht, B., & Mulford, R. C. (1986). Coining complex compounds in English: affixes and word order in acquisition. *Linguistics*, *24*(1).

Dolatian, H. (2021). The role of heads and cyclicity in bracketing paradoxes in Armenian compounds. *Morphology*, *31*(1), 1–43.

Dressler, W. U., Lettner, L. E., & Korecky-Kröll, K. (2010). First language acquisition of compounds: With special emphasis on early German child language. In S. Scalise & I. Vogel (Eds.), *Cross-Disciplinary Issues in Compounding* (pp. 323–344). John Benjamins.

Eisenberg, P. (2013). *Grundriss der deutschen Grammatik Band 1: Das Wort* Stuttgart: Metzler.

Elsen, H., & Schlipphak, K. (2015). Word-formation in first language acquisition. In P. O. Müller, I. Ohnheiser, S. Olsen, & F. Rainer (Eds.), *Word-formation: An international handbook of the languages of Europe* (pp. 2117–2136). Berlin: De Gruyter.

Foroodi-Nejad, F., & Paradis, J. (2009). Crosslinguistic transfer in the acquisition of compound words in Persian–English bilinguals. *Bilingualism: Language and Cognition*, *12*(4), 411–427.

Gargarina, N. (2014). Das Russische und das Ukrainische. In M. Krifka, J. Błaszczak, A. Leßmöllmann, A. Meinunger, B. Stiebels, R. Tracy, & H. Truckenbrodt (Eds.), *Das mehrsprachige Klassenzimmer* (pp. 219–245). Berlin: Springer.

Giesselbach, L. & Scherger, A.-L. (2025). Forming new words: compounding in children with developmental language disorders. *Frontiers in Language Sciences*, *4*, https://doi.org/10.3389/flang.2025.1622402.

Grimm, H. (2015). *Sprachentwicklungstest für drei- bis fünf-jährige Kinder: Diagnose von Sprachverarbeitungsfähigkeiten und auditiven Gedächtnisleistungen* (3., überarbeitete und neu normierte Auflage). Göttingen: Hogrefe.

Grimm, H. (2016). *Sprachentwicklungstest für 2-jährige Kinder: Diagnose rezeptiver und produktiver Sprachverarbeitungsfähigkeiten* (2., überarbeitete und neu normierte Auflage). Hogrefe.

Grosjean, F. (1996). Bilingualismus und Bikulturalismus: Versuch einer Definition. In H. Schneider & J. Hollenweger (Hrsg.), *Mehrsprachigkeit und Fremdsprachigkeit: Arbeit für die Sonderpädagogik?* (pp. 161–184). Luzern: Edition SZH.

Jarema, G., et al. (1999). Processing Compounds: A Cross-Linguistic Study. *Brain and Language 68*, 362–369

Kallulli, D. (2014). Das Albanische. In M. Krifka, J. Błaszczak, A. Leßmöllmann, A. Meinunger, B. Stiebels, R. Tracy, & H. Truckenbrodt (Eds.), *Das mehrsprachige Klassenzimmer* (pp. 405–426). Berlin: Springer.

Kapatsinski, V., & Vakareliyska, C. (2013). [N[N]] compounds in Russian: A growing familiy of constructions. *Constructions and Frames*, *5*(1), 69–87.

Kiefer, F., & Németh, B. (2019). Compounds and multi-word expressions in Hungarian. In B. Schlücker (Ed.), *Complex Lexical Units* (pp. 337–358). De Gruyter.

Kutsuki, A. (2019). The combination of words in compound nouns by Spanish-Japanese bilingual children: Transfers in unambiguous structure. *International Journal of Bilingualism*, *23*(1), 256–274.

Mohamed, N. E. (2011). Deutsche Nominalkomposita und ihre Übersetzungsproblematik ins Arabische. *Lebende Sprache*. (1), 65–76.

Müller, P.O. (2015). Foreign word-formation in German In: P.O. Müller, I. Ohnheiser, S. Olsen, & F. Rainer (Eds.) *Word-formation: An international handbook of the languages of Europe*. (pp. 1615 – 1637). Berlin: De Gruyter.

Müller, N. & Hulk, A. (2001). Crosslinguistic influence in bilingual language acquisition: Italian and French as recipient languages. *Bilingualism: Language and cognition*, *4*(1), 1-21.

Nicoladis, E. (2002). What's the difference between ‘toilet paper’ and ‘paper toilet’? French-English bilingual children's crosslinguistic transfer in compound nouns. *Journal of Child Language*, *29*(4), 843–863.

Pala, K., Fellbaum, C., & Bosch, S. (Eds.) (2010). *Lexical Resources for Noun Compounds in Czech, English and Zulu.*

Paradis, J. (2023). Sources of individual differences in the dual language development of heritage bilinguals. *Journal of Child Language*, *50*(4), 793–817.

Scherger, A.-L. (2016). Kasuserwerb bilingual deutsch-italienischer Kinder: vorübergehend verzögernder Spracheneinfluss. *Linguistische Berichte* (246), 197-241.

Scherger, A.-L., Dietrich, F., Giesselbach, L., and Neitzel, I. (2024). Spracherwerb bilingualer Schulkinder: Verständnis und Produktion von Komposita. *Praxis Sprache 69*, 6–15.

Scherger, A.-L., and Kliemke, L. (2021). Monolingualer und bilingualer Erwerb von Wortbildungsstrategien im Deutschen. *Zeitschrift Wortbildung 5*, 4–34.

Schipke, C. S. & Kauschke, C. (2011). Early word formation in German language acquisition: A study on word formation growth during the second and third years. *First Language*, *31*(1), 67–82.

Schlotthauer, S. & Zifonun, G. (2008). *Zwischen Wortbildung und Syntax: Die" Wortigkeit" von Partikelverben/Präverbfügungen in sprachvergleichender Perspektive*. Retrieved from chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://ids-pub.bsz-bw.de/frontdoor/deliver/index/docId/4077/file/schlotthauer_zifonun_zwischen_wortbildung_und_syntax_2008.pdf [letzter Aufruf: 21.11.2025].

Schlücker, B. (2012). Die deutsche Kompositionsfreudigkeit: Übersicht und Einführung. In L. Gaeta & B. Schlücker (Eds.), *Linguistik--Impulse & Tendenzen: Vol. 46. Das Deutsche als kompositionsfreudige Sprache: Strukturelle Eigenschaften und systembezogene Aspekte* (pp. 1–27). Berlin: De Gruyter.

Schroeder, Christoph, S¸ims¸ek, Yazgül (2014). Das Türkische. In M. Krifka, J. Błaszczak, A. Leßmöllmann, A. Meinunger, B. Stiebels, R. Tracy, & H. Truckenbrodt (Eds.), *Das mehrsprachige Klassenzimmer* (pp. 115–134). Berlin: Springer.

Schulz, P. & Tracy, R. (2011). *LiSe-DaZ: Linguistische Strachstandserhebung - Deutsch als Zweitsprache*. Göttingen: Hogrefe.

Statistisches Bundesamt (2024). Bevölkerung mit Migrationshintergrund - Ergebnisse des Mikrozensus 2024. Retrieved from https://www.destatis.de/DE/Themen/Gesellschaft-Umwelt/Bevoelkerung/Migration-Integration/Publikationen/Downloads-Migration/statistischer-bericht-migrationshintergrund-erst-2010220247005.html. [letzter Aufruf: 21.11.2025].

Szucsich, L. (2014). Das Bosnische/ Kroatische/ Serbische/ und das Bulgarische. In M. Krifka, J. Błaszczak, A. Leßmöllmann, A. Meinunger, B. Stiebels, R. Tracy, & H. Truckenbrodt (Eds.), *Das mehrsprachige Klassenzimmer* (pp. 197–218). Berlin: Springer.

Tschichold, C. & ten Hacken, P. (2015). Word-formation in second language acquisition. In P. O. Müller, I. Ohnheiser, S. Olsen, & F. Rainer (Eds.), *Word-formation: An international handbook of the languages of Europe* (2137-2153). Berlin: De Gruyter.

Tuller, L. (2015). 11. Clinical use of parental questionnaires in multilingual contexts. Assessing multilingual children: Disentangling bilingualism from language impairment, 13, 301.

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