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RESEARCH ARTICLE

Caused motion events in Uyghur child language

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Abstract

In view of recent typological work revealing important intra-typological variations among verb-framed languages in motion expression, we investigated children's acquisition of caused motion events in Uyghur. Four-, 6-, 8-, and 10-year-old children and adults participated in a cartoon narration task, and analyses of data in terms of syntactic packaging, semantic density, and information focus showed that, while children's use of packaging strategies involving complex syntax (i.e., subordination) – previously found to be challenging for children speaking verb-framed languages – was adult-like from age 8, they continued to diverge from the adult patterns for measures of semantic density and information focus at age 10. We take this developmental asymmetry as emanating from different kinds of knowledge entailed in encoding motion and suggest that they may be on different developmental timelines because they demand differential amount of experience with a language.

Keywords: caused motion event; Uyghur; child language

قىسقىچە مەزمۇنى

ئەڭ يېقىنقى تىپولوگىيەلىك تەتقىقاتلارنىڭ ھەرىكەت ئىپادىلىشىدە پېئىل-تەۋە تىللار ئارىسىدىكى مۇھىم ئىچكى تىپولوگىيەلىك پەرقلىرىنى كۆرسىتىشىنى نەزەردە تۇتقان ئاساستا، بۇ تەتقىقاتتا ئۇيغۇرچىللىرىنىڭ سەۋىبلىك ھەرىكەت ۋەقەلەرنى ئىپادىلەش ئىقتىدارلىرىنىڭ ئۆگىنىشى تەكشۈرۈلدى. 4، 6، 8 ۋە 10 ياشلىق بالىلار بىلەن چوڭلار بىر قىسىم قىسقا كارتۇنفىلىمنى كۆرۈپ تەسۋىرلىگەن مەزمۇنلىرىنى سىنتاكسىلىق توپلاش ئۇسۇلى، سېمانتىكىلىق زىچلىقى ۋە ئۇچۇر مەركىزىلىكى نۇقتىلىرىدىن تەھلىل قىلىشتا، مۇشۇ قېتىمقى بىلەن باغلىنىشلىق پېئىل-تەۋە تىللاردا بالىلار ئۆچۈن قىيىن دەپ قارىلىدىغان مۇرەككەپ سىنتاكسىسقا (مەسىلەن، بەتىنىڭ تۇرىدىكى) تايىنىدىغان توپلاش ئۇسۇللىرى 8 ياشتىن باشلاپلا چوڭلارغا ئوخشىغان بولۇپ، بەلكى سېمانتىكىلىق زىچلىق ۋە ئۇچۇر مەركىزىلىكى كۆرسەتكۈچلىرى بويىچە 10 ياشقىچە چوڭلارنىڭ قوللىنىش ئۇسۇللىرىدىن پەرق كۆرۈلگەن. بىزبۇ پەرىقلىق تەرەققىياتنىڭ ئاساسى سەۋەبىنى ھەرىكەتنى ئىپادىلەشتە زۆرۈر بولغان پەرقلىنەرلىك بىلىملار بىلەن چۈشەندۈرىمىز، ۋە بۇ بىلىملار تىل بىلەن بولغان تەجرىبە مىقدارىنىڭ پەرقىگە باغلىق بولۇپ، بۇبىلىملارىنىڭ ئوخشىمىغان ۋاقىتتا تەرەققى قىلىدۇ دەپ قارايمىز.

ناچقۇچلۇق سۆزلەر: سەۋەبلىك ھەرىكەت ۋەقەلەر; ئۇيغۇر; بالىلار تىلى

1. Introduction

How children learn to encode motion events has been the focus of numerous recent cross-linguistic investigations (e.g., Bunger et al., 2021; Hendriks et al., 2022; Hickmann et al., 2018; Ji et al., 2011). This line of research is concerned with gauging the respective role of language-specific versus language-universal factors in child language acquisition, and it uses Talmy's (2000) two-way typology of satellite-framed and verb-framed languages to capture cross-linguistic diversity. Talmy's typological framework and many subsequent studies it inspired have shown that languages differ along typological lines not only in how motion event components are lexicalised and syntactically organised (Beavers et al., 2010; Croft et al., 2010), but in which event components speakers typically focus on and select for expression (e.g., Slobin, 2004; 2006; Soroli, 2024). It has also become evident, however, that cross-linguistic differences are a matter of tendency both across typological divides, i.e., inter-typological variability, and within typological groups, i.e., intra-typological variability, due to the influence of an array of factors including individual languages' contact situations (Goschler & Stefanowitsch, 2013; Michelotti et al., 2025) and language-specific properties (Beavers et al., 2010; Lewandowski, 2021). In relation to the role of language-specific factors, for example, typological work has shown that differences in constituent order within the verb-framed language type (i.e., SVO in Romance languages versus SOV in Korean and Turkic languages) give rise to significant intra-typological variation in encoding motion events (Sarvasy & Choi, 2020; Tusun & Hendriks, 2022). And while existing research has mostly addressed how inter-typological variability shapes the acquisition process, the issue of intra-typological variability remains much less well-understood, particularly regarding verb-framed languages. This study, therefore, takes as its point of departure the above-mentioned insight that differences in constituent order drive interesting intra-typological variation within the verb-framed language type and examines how children speaking Modern Uyghur – an under-represented Turkic language with an SOV constituent order – acquire caused motion expressions. As well as expanding the evidential base of current research that has mostly involved European languages such as English, German, and French (e.g., Harr, 2012; Hendriks et al., 2022; Hickmann et al., 2018), the study specifically probes the influence of intra-typological variability arising from differences in canonical constituent order within the verb-framed language type and contributes more generally to better characterising the role of language-specific properties in children's spatial language development.

2. Motion expression across languages

Motion events typically can involve a figure moving along a Path in a certain Manner, as in (1–2), or a figure Causing the displacement of an object along a Path in a certain Manner, as in (3–4). We call the former voluntary motion (VM), and the latter caused motion (CM). While the semantic components such as Manner, Path, and Cause are considered universal, languages vary as to how they are mapped onto lexical and syntactic means. And typologically (Talmy, 2000), those expressing Path in a satellite and Cause/Manner in the verb are known as satellite-framed languages (henceforth S-language, e.g., Germanic) while those expressing Path in the verb and Cause/Manner outside the verb (e.g., subordinate clauses, adjuncts) are verb-framed languages (henceforth V-language, e.g., Romance, Turkic). The syntactic implication of such lexicalisation patterns is that S-language speakers can compact all the semantic components in a syntactically simple (mono-clausal) construction, whereas V-language speakers typically have to use

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syntactically complex (bi-clausal) constructions to do the same (Allen et al., 2007; Bunger et al., 2016; Lewandowski, 2021; Özçalışkan, 2015).

(1) Mary ran (Manner) into (Path) the classroom.
(2) Marie traverse (Path) la rue en courant (Manner).
(3) Mary pushed (Cause+Manner) the present up (Path) the rooftop.
(4) Marie monte (Path) sur un toit en poussant (Cause+Manner) un cadeau.

The seemingly superficial structural differences across languages have profound implications for habitual language use in terms of how many event components speakers typically express (henceforth "semantic density") and which event components they focus on for expression (henceforth "information focus"). For example, numerous studies have shown that S-language speakers tend to produce semantically denser descriptions (e.g., Manner+Path) than V-language speakers (e.g., Path only), meaning that they typically focus on different event components for verbalisation (see Bunger et al., 2016; Ji et al., 2011; Lewandowski & Özçalışkan, 2023; Tusun & Hendriks, 2019), and relative syntactic complexity has been suggested as the underlying factor: S-language speakers have at their disposal compact structures that facilitate the joint encoding of multiple semantic components, whereas V-language speakers need to use complex structures that increase online processing load (Özçalışkan, 2015; Slobin, 2006), and unless the co-event (Manner) is at issue, V-language speakers tend to express the framing event (Path). Thus, in motion situations depicted in (1–2), while English speakers typically express both Manner and Path, French speakers tend to focus on Path only (see, e.g., Soroli, 2024). It has therefore been argued that Manner is a high-salience domain in S-languages but a low-salience domain in V-languages (Slobin, 2006; Slobin et al., 2014).

This inter-typological insight has also been complemented by studies revealing intra-typological variability modulated by constituent order effects within the V-language type, in that speakers of an SVO language are less likely to produce semantically dense motion descriptions compared to those speaking an SOV language (Özçalışkan & Emerson, 2016; Sarvasy & Choi, 2020; Tusun & Hendriks, 2019). In V-languages with an SVO constituent order, the verb (expressing Path) appears sentence-initially, and expressing the co-event would typically require appending a subordinate clause to a sentence whose basic structure is already established. In contrast, in V-languages with an SOV constituent order, Path is expressed sentence-finally, and speakers have greater leeway in terms of adding various motion components through subordinate structures before reaching the end of the sentence (see also Bunger et al., 2016; Ibarretxe-Antuñano, 2009). Put differently, constituent order differences in V-languages seem to affect the extent to which speakers use subordinate structures necessary for producing semantically dense motion descriptions that focus on all key components of motion.

The above observations on semantic density (and by extension, information focus) seem to hold more for VM-events than CM-events, however. Recent studies (e.g., Hickmann et al., 2018; Montero-Melis, 2021; Tusun & Hendriks, 2022) comparing speakers of an S-language (English, Swedish, German) versus a V-language (French, Spanish) have shown that V-language speakers can be on a par with S-language speakers in terms of semantic density (i.e., three components) and information focus (Cause +Manner+Path) in verbalising CM-events (cf. Bunger et al., 2016), as seen in the French example (5) or the Spanish example (6) where all key components of caused motion are expressed, which is presumably because, while Manner as a co-event is optional

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(relative to Path) for the verbal representation of VM, Cause is as central as Path in CM. Interestingly, these studies revealed a further aspect of intra-typological variability in V-languages in terms of syntactic packaging: while French and Spanish speakers tended to deviate from the predicted pattern of syntactic packaging (the framing event in main clause + co-event in subordinate clause) by either employing satellite-framed constructions (6) or loosely distributing semantic components across two or more clauses with or without subordination (5), Uyghur speakers consistently followed the predicted pattern (see more below). This has been explained in terms of the constituent order differences among these languages, and to the differences in how speakers experience and tackle what Levelt (1981) calls the "linearisation problem" (Tusun, 2023; Tusun & Hendriks, 2022). Specifically, due to the sequential nature of the speech channel, speakers must impose a linear order on the information content to be verbalised (Levelt, 2000), where more salient or activated concepts go early in speech production (Ferreira & Rehrig, 2019). In CM-events, Cause/Manner is as salient and central as Path, and consequently, if Romance and Greek speakers encode Cause/Manner in the main verb (as they have been shown to do), which comes early in the sentence, they are already half-way down the satellite-framed lane; they now have to either encode Path in a satellite (if available in the language) or express Path in a separate clause. In contrast, as will be seen in the next section, this order of linearising Cause/Manner and Path components naturally aligns with Turkic canonical constituent order: Cause/Manner are expressed in the subordinate clause that precedes the main clause wherein Path is expressed.

(5) Il a poussé (Cause+Manner) le panier et il a traverse (Path) la route.
"He pushed the basket and he crossed the road." Hickmann et al. (2018)

(6) Popi empuja (Cause+Manner) un regalo a lo alto de (Path) una duna.
"Popi pushes a present up a dune." Montero-Melis (2021)

3. Motion expression in Uyghur

Before delving into previous research on motion expressions in Uyghur, it is appropriate to say a few words about the Uyghur language and its general typological profile, especially since the language is relatively unknown in the West. Uyghur belongs to the South-Eastern branch of the Turkic language family, and alongside Uzbek, is the direct descendant of Chaghatai Turkic, the transregional literary language of Central Asia until the early 20th century. It is primarily spoken in China's Xinjiang Uyghur Autonomous Region (Xinjiang henceforth) with around 11 million native speakers (nearly half of the local population). It is an official language in Xinjiang along with Mandarin Chinese and is written in a reformed Arabic-based script. It also serves as a lingua franca of multiple ethnic groups in Xinjiang. In terms of its general typological profile, Uyghur is an agglutinative language with a rich case marking system and various valency-changing morphological devices (e.g., causatives). Its canonical constituent order is SOV, where modifiers precede their heads, and subordinate clauses precede the matrix clauses (see Ragagnin 2016 for a useful overview).

Examples (7–8) are equivalents of (1–2) in Uyghur, where Path is expressed in the main verb (with additional dimensions of Path such as Source, Goal in case markers) and Cause/Manner in the converb, which is the functional equivalent of gerunds in European languages (Johanson, 1995). That is, each sentence expresses the framing event in the

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main clause and the co-event in the subordinate clause. Note that, thanks to the so-called "verb sequences" or "multi-verb constructions" in Turkic (Aikhenvald, 2020), the same CM-event can be represented as in (9), in which this CM-construction contains two consecutive converbs (first conflating Cause with Manner, second encoding Cause only) followed by the main verb. And because of valency-changing devices such as causative affixes in the language, the same CM-event can be expressed in a single-clause construction as in (10), where both the framing event (Path) and the co-event (Cause without Manner) are expressed in the main verb locus. Several usage-based studies on motion expression in Uyghur have shown it to be a typical V-language (Tusun, 2022; Tusun & Hendriks, 2019, 2022): in VM, compared to those speaking S-languages (e.g., English), Uyghur speakers' motion descriptions are semantically less dense with VM-events, but compared to those speaking V-languages (e.g., French), their semantic density tends to be higher for VM. To illustrate, for motion situations like (1–3), Uyghur speakers have been found to be more likely to combine Manner and Path (due to the afore-mentioned facilitative role of the SOV constituent order) in comparison to French speakers, who show a greater tendency to encode Path only (Tusun & Hendriks, 2019; see also Soroli, 2024). In the CM motion domain, and like other verb-framed languages, Uyghur speakers typically focus on all essential components (Cause, Manner, Path) and therefore produce semantically dense motion descriptions as those produced by S-language speakers. However, in marked contrast to speakers of SVO verb-framed languages, whose use of syntactic packaging strategies is rather varied (Hickmann et al., 2018; Montero-Melis, 2021), as in (5–6), Uyghur speakers have been found to be highly systematic as they consistently express Path in the main clause and Cause/Manner in the subordinate clause(s) (Tusun & Hendriks, 2022), as in (7–8).

(7) Meryem sinip-qa (Path) yügür-üp (Manner) kir-ip ket-ti (Path)[1].
Mary classroom-DAT run-CONV enter-CONV go-PST.3SG

(8) Meryem soɣat-ni ittir-ip (Cause+Manner) özgi-ge (Path) čiq-ti (Path).
Mary present-ACC push-CONV rooftop-ABL ascend-PST.3SG

(9) Meryem soɣat-ni ögzi-ge (Path)
Mary present-ACC cave-DAT
ittir-ip (Cause+Manner) él-ip (Cause) čiq-ip ket-ti. (Path).
push-CONV take-CONV ascend-CONV go-PST.3SG
'Mary pushed the desk into the cave.'

(10) Meryem soɣat-ni ögzi-ge (Path) čiq-ar-di (Path+Cause).
Mary present-ACC cave-DAT ascend-CAUS-PST.3SG
'Mary made the present ascend the rooftop.'

[1]Abbreviations used in the glossing are as follows: ACC = accusative case, CAUS = causative affix, DAT = dative case, CONV = converb, PST = past tense, 3SG = third-person singular. We should note here that, although in (6), the Path verb *kirip* within the verb sequence *kirip ketti* takes a converbial form, it is nonetheless the main verb. Meanwhile, *ket* belongs to a set of grammaticalised verbs in Uyghur, and while originally meaning "to go (away)," it has come to encode aspectual information such as completion of an event (see, e.g., Johanson, 2022). There is a general consensus that such verb sequences in Turkic form one

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4. Motion expressions in child language

The last few decades have seen numerous studies on children's acquisition of motion event expressions. We mentioned earlier that semantic elements comprising motion events such as Cause, Manner, and Path are considered universal, and developmental psychologists tell us that infants are able to process, abstract, and categorise these elements at a very basic level (e.g., Mandler, 2008; Pulverman et al., 2013). We also saw that languages differ typologically in terms of how the different elements of motion events are mapped onto lexical and syntactic means (Talmy, 2000). The domain of motion has therefore provided a fertile ground for exploring the perennial question of the relative impact of language-specific versus language-universal factors in child language development (Allen et al., 2007; Bunger et al., 2012, 2016, 2021; Hickmann et al., 2018; Ji et al., 2011).

Research has examined the acquisition of a range of S- (e.g., English, German) and V-languages (e.g., French, Greek, Japanese, Turkish) in both VM and CM contexts and found that children are sensitive to the typological properties of their exposure language from very early on (Allen et al., 2007; Furman et al., 2014). Thus, children speaking S-languages tend to encode the framing event in a satellite and the co-event in the verb, while those speaking V-languages tend to encode the framing event in the verb and co-event (when expressed) in a subordinate structure, thereby also employing the predicted syntactic packaging strategies for the two language types (mono-clausal for S-languages and bi-clausal for V-languages). Children have also been found to be sensitive to levels of semantic density characteristic of their language in that, by and large, those speaking S-languages tend to provide semantically denser motion descriptions compared to their V-language-speaking peers. Notably, while S-language-speaking children have been reported to fully reach adult levels of semantic density at around age 8 to 10 if not earlier (see, e.g., Harr & Hickmann, 2013; Hendriks et al., 2022; Hickmann et al., 2018; Ji et al., 2011), those speaking V-languages continue to fall short of the adult levels at this age. The gradual nature of children's development in semantic density and V-language-speaking children's relative lag compared to their S-language-speaking peers have their parallels in terms of information focus as well. In the context of CM events, for instance, younger children regardless of their language tend to focus on some but not all event components (e.g., Path-only, Cause-only, or Cause+Manner, but not consistently all three), and while S-language-speaking children fully converge on adult patterns of information focus by age 8 (Bunger et al., 2016; Harr, 2012; Ji et al., 2011), V-language-speaking children do not do so even at age 10 (Harr, 2012; Hickmann et al., 2018). The gradual development shared by all children irrespective of language background has been explained in terms of children's developing cognitive abilities for language production (e.g., remembering and expressing multiple types of information in cohesive and coherent discourse, Hendriks et al., 2022; Hickmann et al., 2018) whereas the developmental delay displayed by V-language-speaking children has been attributed to the fact that expressing all event components in this language type requires the use of complex syntactic structures such as subordination that take time to develop (see also Bunger et al., 2016; Engemann, 2024).

Existing research has also uncovered some language-universal tendencies. For instance, young children speaking V-languages (aged between 3 and 5) seem to display a tendency to represent the framing event and the co-event within a syntactically simple construction (Allen et al., 2007; Furman et al., 2006). And while this may well have to do

single clause (see, e.g., Aikhenvald, 2020), which is the assumption in this paper (see more in section "Coding" below).

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with aforementioned language-specific constraints that are developmentally challenging (i.e., use of subordination), these authors maintain that young children may have a universal drive to pursue cohesion between cognitive and linguistic representations of events. Specifically, Cause/Manner and Path unfold simultaneously, and children may be mapping their cognitive representation of this simultaneity onto the linguistic structure by following some iconicity principle according to which elements that are close together in cognitive representation should be close to each other in linguistic representation. Further, there is some evidence that, irrespective of their language, younger children experience greater difficulty in encoding events that involve the crossing of a spatial boundary (e.g., "running across the road," "pushing the table into the cave") compared to those that do not (e.g., "running up the hill," "pushing the box down the hill") (Hendriks et al., 2022; Hickmann et al., 2018; Ji et al., 2011), the explanation being that boundary-crossing paths may be conceptually more complex as they denote a categorical change of location, unlike non-boundary-crossing paths, which only denote a gradual change of location.

5. The study

5.1. Aims and contribution

This study takes as its point of departure previous findings that children speaking V-languages do not fully establish adult patterns of encoding CM-events (i.e., semantic density, information focus, and syntactic packaging) even at age 10 (e.g., Hickmann et al., 2018), and aims to determine whether children acquiring Uyghur display a parallel developmental pattern or, whether they converge on the adult patterns by this age thanks to language-specific properties of Uyghur that are presumed to be advantageous. In light of recent pleas to diversify the evidential base of child language research (Kidd & Garcia, 2022), adding data from an understudied language like Uyghur is itself a contribution, but the study has something more specific to contribute. While previous developmental research on the acquisition of V-languages come mostly from French (e.g., Hickmann et al., 2009; Hickmann et al., 2018; Hendriks et al., 2022), recall that French alongside other Romance languages differ from Turkic in constituent order (SVO in Romance versus SOV in Turkic) that gives rise to intra-typological variation within the V-language type: when verbalising the same set of events, French speakers tend to offer semantically less dense motion descriptions by using more varied and variable syntactic packaging strategies compared to Uyghur speakers (Harr, 2012; Tusun & Hendriks, 2019), especially in the domain of CM (Tusun, 2023; Tusun & Hendriks, 2022). Therefore, the developmental lag reported for French children may have stemmed from the combined effects of specific properties of French (SVO constituent order) and the variability of syntactic packaging strategies in the language system and in the adult input. On the other hand, the SOV constituent order in Uyghur and its facilitative role in the production of semantically denser motion descriptions as well as in the relatively systematic use of typologically congruent syntactic packaging strategies (co-event in the subordinate clause + framing event in the main clause) in the adult input may give Uyghur children an acquisitional advantage in acquiring motion expressions such that no developmental lags will be observed.

5.2. Predictions

We made the following predictions. In line with previous typological work (Tusun & Hendriks, 2022), adult speakers were predicted to primarily encode Path in the main

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clause and Cause+Manner in the subordinate clause, thereby mostly producing semantically dense motion descriptions that focus on at least three event components. In light of previous child language research (Harr, 2012;Hendriks et al., 2022 ; Hickmann et al., 2018), we expected Uyghur children to be sensitive to the typological properties of the language from the earliest age tested, where they would encode Path in the main clause and Cause/Manner (when expressed) in the subordinate clause. However, on account of the influence of language-universal factors on syntactic packaging (Allen et al., 2007), younger children were predicted to show a greater tendency to package core components of CM-events within a single clause. And given previous findings on V-language-speaking children's difficulty with complex syntax, we predicted age effects for Uyghur children's use of syntactic packaging strategies, such that use of motion constructions that package event components across two clauses via subordination would show an age effect with older children using them more frequently than younger children. By the same token, age effects were predicted for measures of semantic density and information focus such that older children would show greater alignment with the adult patterns compared to younger children. As to the persistence of these age effects, however, two possibilities were entertained: if the intra-typological difference between Uyghur and previously studied V-languages in constituent order does confer an advantage to children's acquisition task, the hypothesised effects of age should disappear by age 10, if not earlier; if, on the other hand, intra-typological variation plays little role and Uyghur children are constrained by verb-framing typology more generally, the said effects may indeed persist at age 10, as was the case with French children (Hickmann et al., 2018). Finally, in view of earlier findings that children have difficulty encoding events that involve boundary crossing (Hendriks et al., 2022; Hickmann et al., 2018), we also predicted a developmental delay in such events compared to non-boundary-crossing events.

5.3. Participants

The study included four groups of children, respectively, aged 4 years (age range 3;11–4;7; mean age 4;6), 6 years (age range 5;9–6;6; mean age 6;5), 8 years (age range 7;9–8;4; mean age 8;4), and 10 years (age range 9;8–10;7; mean age 10;6) and one group of adults (age range 19–22), totalling 120 participants. Participants were recruited from various kindergartens, primary schools, and universities in the city of Ürümchi (China). As reflective of the societal bilingualism prevalent in Xinjiang (Ma, 2012), our participants all spoke Mandarin as their other language, but to varying degrees. The children attended kindergartens and schools in which the medium of instruction was Mandarin, whereas the adults were university students who had gone to Uyghur-medium primary and middle schools and had received some formal instruction in Mandarin from middle school onwards. The adults all reported relatively low levels of proficiency in Mandarin, and to ensure the children's proficiency in Uyghur, a sociolinguistic questionnaire was administered to their parents concerning family language practice and literacy activities alongside ratings of their children's proficiency in Uyghur on a scale from 0 (very poor) to 10 (native-like). We selected only those children who had been exposed to and used Uyghur exclusively outside school (to balance out their exposure to Mandarin in school) and whose ratings in the language were 8 or above. These eligibility criteria reduced the number of child participants to 102 from the initial 125 who had returned the questionnaires, of which 96 were included in the present study.

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Table 1. Type of semantic components featured in experimental items

Abbreviation	Description	Features in stimuli
Cause	Cause	Causal relation between Agent and Object
A-Manner	Manner of agent's movement	Walk
O-Manner	Manner of object's movement	Roll, slide
C-Manner	Manner of agent's action causing object's movement	Pull, push
Path	Trajectory agent and object follow	Up, down, across, into

5.4. Stimuli

The elicitation stimuli, originally developed by Hickmann and colleagues (Hickmann et al., 2018), consisted of short animated cartoons depicting a human agent displacing various objects in a certain Manner (e.g., pull/push, A-Manner) along either non-boundary-crossing (up/down) or boundary-crossing (across/into) paths such that the objects moved along the same path as the agent in a certain Manner (i.e., roll/slide, O-Manner). Two additional semantic components held constant were the causal relationship between the agent and the object (Cause) and the Manner of the agent's movement (i.e., walking, A-Manner) (see Table 1 for a summary of all the semantic components featured). The crossing of these features (i.e., 2 C-Manner x 2 O-Manner x 4 Path) generated 16 configurations, and to ensure generalisability beyond a single item, each configuration was presented twice with altered ground referents (e.g., sand dune versus roof; cave versus house) and objects (e.g., wooden box versus a sack), thereby resulting in a total of 32 experimental items (See Supplementary Appendix 1 for details). Each block of four experimental items was followed by a distractor item (seven items in total and not analysed here) involving motion events in which an inanimate object causes the displacement of another object (e.g., a ball rolling into a vase and the vase breaks). The items were randomised into four test orders and were assigned to the participants on a random basis, and each participant began with a training item to gain familiarity with the procedure.

5.5. Procedure

The participants were met individually in a quiet room in their kindergartens, schools, and universities, and the stimuli were presented on a computer screen. To encourage participants to maximally rely on linguistic means (rather than on vague language or gestures) and therefore be as thorough as possible in their verbalisations, a communicative situation was created. More specifically, the 6-, 8-, 10-year-olds and adults were invited to describe the events to a fictitious character who did not have access to the cartoons but would have to reconstruct the content of the cartoons based on the participants' descriptions; the 4-year-olds were asked to describe what happened to an adult who was seated opposite to them (and thus could not see the videos) but was interested in knowing what happened.

Each session started with the training item where probes were made whenever necessary to ensure that the participants would minimally notice and were able to express

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at least the manipulated semantic components. Following the training phase, each experimental item was presented with a still where some introductory remarks were made on the setting of the scene, the figure, and the object so that the participants, especially children, would know what to expect from the cartoon (e.g., "Here is Hoppy, our main character. This is a road, and this is a basket of apples. So what happened?"). Some general questions (e.g., "What happened?," "And then?") were asked as appropriate to keep the participants' flow of speech, but specific probes were avoided.

5.6. Coding

The responses were transcribed and were then segmented into clauses, defined as a unit containing one verb and its arguments (Hickmann et al., 2018). Thus, responses like (11–13) needed no segmentation since they consisted of one clause (indicated by the letter "c" in angle brackets); responses like (14–17) and (18) were segmented into two and three clauses, respectively, depending on the number of converbial clauses they contained alongside the matrix clause; similarly, responses like (19) which presented loosely connected clauses via connective markers (e.g., *andin* "and") were segmented into two clauses. Each clause was then coded with respect to the kinds of semantic information expressed in the verb versus the satellite(s), where, following Croft et al. (2010) and Hickmann et al. (2018), satellites were taken to include all the devices other than the main verb (e.g., adverbs, converbs, ablative and dative case markers). To illustrate, in (12), the verb expressed C-Manner and Cause and the ablative case marker was coded as encoding (one dimension of) Path (i.e., source); in (13), the verb encoded Path as well as Cause (through a causative suffix), and an additional dimension of Path (i.e., ground); in (14–15), the verb expressed Path, case markers expressed extra dimensions of Path while the converbs either only expressed Cause (14) or Cause+C-Manner (15). Another dimension of coding concerned the syntactic packaging of semantic components within a response: whether the response comprised one (11–13), or more clauses (14–19), and in the latter case, whether the syntactic relation between them was one of subordination or coordination. Note here that in the case of responses containing coordination (<1%), the clause richer in semantic content was coded as the "main target response" and the other as "potential target response." Thus, c1 of (19) was coded as the "main target" because it included two semantic components (Cause+C-Manner), whereas c2 was the "potential target" because it only had one component (Path) (Hendriks et al., 2022; Hickmann et al., 2018).

(11) Bala sanduq-ni yötki-di [Cause] <c>. (4-year)
boy box-ACC move-PST.3SG
The boy moved the box.

(12) Bala čamdan-ni tay-din [Path] söri-di [Cause+C-Manner] <c>. (4-year)
boy suitcase-ACC hill-ABL drag-PST.3SG
The boy dragged the suitcase from the hill.

(13) Bala yaɣač at-ni yol-din [Path] öt-küz-di [Path+Cause] <c>. (8-year)
boy wooden horse-ACC road-ABL cross-CAU-PST.3SG
The boy made the wooden horse cross the road.

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(14) Bala somki-ni öŋkür-niŋ iči-ge [Path] (4-year)
boy bag-ACC cave-GEN inside-DAT
él-ip [Cause] <c1> kir-di [Path] <c2>
take/bring-CONV enter-PST.3SG
The boy took the bag into the (inside of the) cave.

(15) Bala čamdan-ni taɣ-din [Path] ittir-ip [Cause+C-Manner] <c1> (6-year)
boy treasure-box-ACC hill-ABL push-CONV
čüš-ti [Path] <c2>.
descend-PST.3SG
The boy descended from the hill while pushing the treasure box.

(16) Bu bala čaq-ni dumul-tup [Cause+O-Manner] <c1> (8-year)
this boy wheel-ACC roll-CONV
ambar öy-ge [Path] kir-ip ket-ti [Path] <c2>.
warehouse-DAT enter-CONV go-PST.3SG
The boy entered the warehouse while pushing a wheel.

(17) Pakinek bir čoŋ siwet miwi-ni yol-niŋ oŋ terip-i-din [Path] (10-year)
little man one big basket fruit-ACC road-GEN right side-ABL
sol terip-i-ge [Path] ittir-ip [Cause+C-Manner] <c1> maŋ-di [A-Manner] <c2>.
left side-DAT push-CONV walk-PST.3SG
The little man walked from the right of the road to the left side while pushing a big basket of fruit.

(18) Bu Bala su üzüš čembirigi-ni öy-niŋ üsti-ge [Path] (10-year)
this boy swimming ring-ACC house-GEN top-DAT
ittir-ip [Cause+C-Manner] <c1> él-ip [Cause] <c2> čiq-ti [Path] <c3>.
push-CONV take/bring-CONV ascend-PST.3SG.

(19) A bala xalti-ni asta [Manner] tart-ip [Cause+C-Manner] <c1> (4-year)
that boy bag-ACC slowly pull-CONV
andin üsti-ge [Path] čiq-ti [Path] <c2>.
then above-DAT ascend-PST.3SG
The boy pushed the bag like this and then ascended to the top.

Our analyses focused on three aspects of the coded data: 1) syntactic packaging, 2) semantic density, and 3) information focus. The measure of syntactic packaging was aimed at establishing how semantic components were syntactically organised. The coding focused on whether the semantic components were compactly encoded within a single clause or distributed across more clauses, and in the latter case, whether they contained subordination or not. Both the "main target" and "potential target" expressions were included for this measure, which gave rise to three main categories: Tight-Simple if the response was mono-clausal (11–13), Tight-Complex if the response contained two or more clauses connected via subordination (14–18), and Loose-Simple if the clauses were loosely conjoined via juxta-position (19). In terms of semantic density, the responses fell into one of the three categories: SD1 when only one component was expressed (11), SD2 if two components were expressed (12–13), and SD3/3+ if three or more semantic components were expressed (14–18). Note

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that for this measure, only semantic information from distinct categories was counted (irrespective of the specific linguistic devices). Thus, (13) was coded as SD2 (Cause+Path) even though Path was expressed twice (once in the main verb and once in a case marker); likewise, (18) was coded as SD3/3+, despite the double encoding of Cause. The measure of information focus was designed to ascertain the kind of semantic components selected for expression. Responses fell into three categories, i.e., Cause+C-Manner+Path (15/17), Cause +O-Manner+Path (16), and a residual "Other" category, which subsumed focus patterns like Cause-C-Manner+A-Manner (17) and Cause+Path (13–14), or Cause-only (11).

5.7. Statistical analyses

Our independent variables were age (five levels: four, six, eight, ten years, adults) and path type (two levels: non-boundary-crossing, boundary-crossing) while the dependent variable was the occurrence of different categories of the three aspects of the coded data: syntactic packaging (Tight-Simple, Tight-Complex, Loose-Complex), semantic density (SD1, SD2 and SD3/3+), and information focus (Cause+C-Manner+Path, Cause+O-Manner+Path, Other). All categorical variables were coded as dichotomous dummy variables (1 versus 0). Mixed-effects logistic analyses were carried out in R version 4.4.2 (R Core Team, 2024) using the glmer() function from the lme4 package (Bates et al., 2015). For each analysis, we fitted a full model that included the fixed effects of interest and compared it to a reduced model that was identical in structure except for the removal of the fixed effects in question. We assessed whether the inclusion of the fixed effects significantly improved model fit using a likelihood ratio test, implemented via the anova() function. This test compares the log-likelihoods of the two models to evaluate whether the more complex model explains significantly more variance in the data than the simpler one. For all models fitted, random intercepts were specified for Item and Subject, but random slopes were not included due to convergence failure. Post-hoc pairwise comparisons were performed with Tukey-corrected *p*-values using the glht function of the multcomp package (Hothorn et al., 2008). All the models used for the analyses and their outputs are provided in Supplementary Appendix 2.

6. Results

6.1. Syntactic packaging

Figure 1 shows the different syntactic packaging strategies used as a function of age group across the two path types. We can see that across age groups and path types, the most dominant is the Tight-complex strategy, followed by the much less frequent Tight-simple strategy, whereas the Loose-simple strategy featured rather rarely. The figure also suggests that age impacts the use of different syntactic packaging strategies, which is supported by the results of a two-way syntactic packaging (Tight-complex, Tight-simple, Loose-simple) x age group (4 yr, 6 yr, 8 yr, 10 yr, adult) analysis on both non-boundary-crossing ($\chi^2(8) = 322.73$ $p < .001$) and boundary-crossing ($\chi^2(8) = 169.57$, $p < .001$) events. Further analyses within the two path types identified age effects for Tight-simple (non-boundary-crossing events: $\chi^2(4) = 36.551$, $p < .001$; boundary-crossing events: $\chi^2(4) = 24.29$, $p < .001$) and Tight-complex (non-boundary-crossing events: $\chi^2(4) = 45.773$, $p < .001$; boundary-crossing events: $\chi^2(4) = 24.24$, $p < .001$) strategies but not for the Loose-simple strategy (non-boundary-crossing events: $\chi^2(4) = 0.878$, $p = 0.927$; boundary-crossing events: $\chi^2(4) = 0.959$, $p = 0.916$). Results of post-hoc pairwise comparisons, presented in Table 2,

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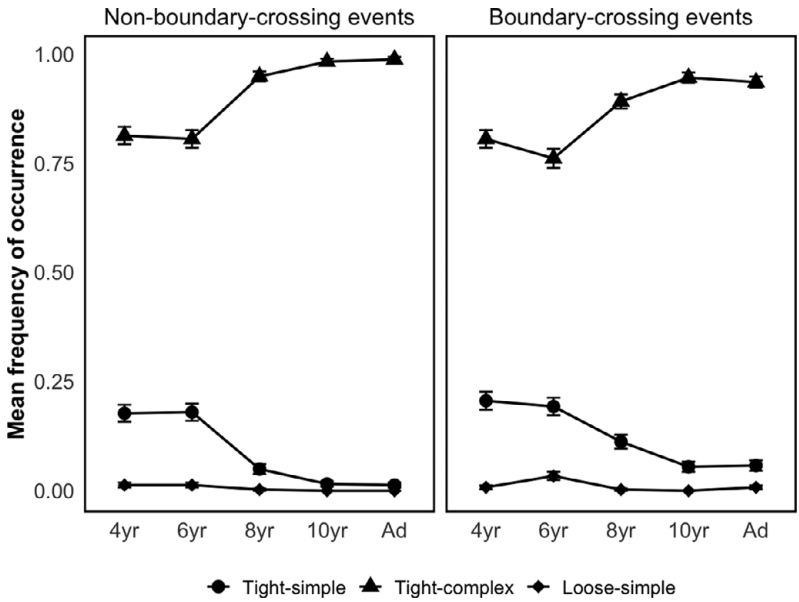

Figure 1. Syntactic packaging by age group and path type.

Table 2. Pairwise comparisons between age groups for Tight-simple and Tight-complex syntactic packaging strategies by path type

		Tight-simple				Tight-complex			
	Contrast	Estimate	SE	Z	*p*-value	Estimate	SE	Z	*p*-value
NBC	4-year versus 6-year	−0.801	1.212	0.661	0.964	−0.654	0.994	−0.658	0.965
	6-year versus 8-year	−4.113	1.410	−2.917	<.05*	3.517	1.155	3.044	< .05*
	8-year versus 10-year	−3.026	1.533	−1.974	0.277	2.485	1.250	1.988	0.270
	4-year versus adults	−5.290	1.327	−3.986	< .001***	4.846	1.172	4.136	< .001***
	6-year versus adults	−6.090	1.359	−4.480	< .001***	5.500	1.195	4.603	< .001***
	8-year versus adults	−1.977	1.343	−1.473	0.578	1.984	1.188	1.669	0.451
	10-year versus adults	1.049	1.546	0.679	0.961	−0.502	1.295	−0.387	0.995
BC	4-year versus 6-year	−0.168	1.032	−0.163	0.910	−1.324	0.790	−1.768	0.446
	6-year versus 8-year	−2.210	1.127	−2.041	0.245	2.179	0.817	2.667	0.059
	8-year versus 10-year	−2.545	1.242	−2.049	0.241	1.851	0.924	2.003	0.263
	4-year versus adults	−3.508	1.153	−3.042	< .05*	1.287	0.831	1.549	0.529
	6-year versus adults	−3.340	1.152	−2.899	< .05*	2.611	0.814	3.206	0.012*
	8-year versus adults	−1.041	1.182	−0.880	0.241	0.433	0.849	0.509	0.548
	10-year versus adults	1.504	1.250	1.204	0.748	−1.418	0.933	−1.520	0.548

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show the following: 1) 4-year-olds and 6-year-olds used the Tight-simple strategy significantly more frequently than the adults for both path types; 2) while both these groups used the Tight-complex strategy significantly less frequently than Uyghur adults for non-boundary-crossing events, only 6-year-olds used it less frequently than adults for boundary-crossing events. Taken together, the results show that Uyghur children fully follow adult patterns of syntactic packaging by age 8.

6.2. Semantic density

Figure 2 visualises the semantic density of speakers' motion descriptions as a function of age across the two path types. We can see that children and adults alike provided SD3/3+ descriptions more frequently than SD2 descriptions, while SD1 descriptions were extremely rare. We also see a general increase of SD3/3+ descriptions and a related decrease of SD2 descriptions over time, a picture supported by the results of a two-way density (SD1, SD2, SD3/3+) x age (4 yr, 6 yr, 8 yr, 10 yr, adults) analysis on both non-boundary-crossing ($\chi^2(8) = 503.4$, $p < .001$) and boundary-crossing ($\chi^2(8) = 413.17$, $p < .001$) events. Further analyses identified age effects for SD2 (non-boundary-crossing events: $\chi^2(4) = 51.254$, $p < .001$; boundary-crossing events: $\chi^2(4) = 29.44$, $p < .001$) and SD3/3+ (non-boundary-crossing events: $\chi^2(4) = 47.87$, $p < .001$; boundary-crossing events: $\chi^2(4) = 25.22$, $p < .001$) descriptions but not for SD1 descriptions (non-boundary-crossing events: $\chi^2(4) = 3.926$, $p = 0.416$; boundary-crossing events: $\chi^2(4) = 5.888$, $p = 0.208$). Results of post-hoc pairwise comparisons, summarised in Table 3, show that 1) with non-boundary-crossing events, all child groups produced SD2 descriptions significantly more frequently and SD3/3+ descriptions significantly less frequently in

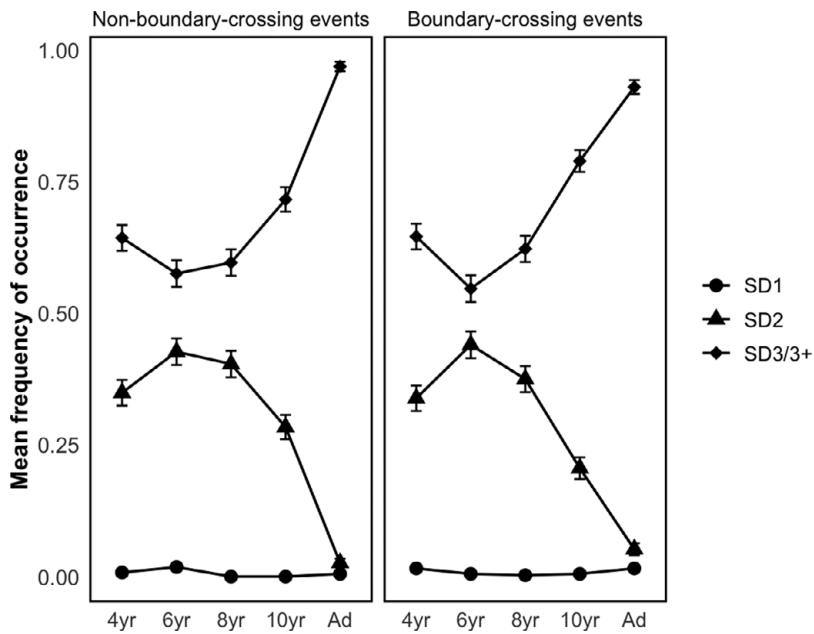

Figure 2. Semantic density across age groups by path type.

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Table 3. Pairwise comparisons between age groups for SD2 and SD3/3+ motion descriptions by path type

		SD2				SD3/3+			
	Contrast	Estimate	SE	Z	*p*-value	Estimate	SE	Z	*p*-value
NBC	4-year versus 6-year	0.598	0.583	1.025	0.842	−0.555	0.567	−0.980	0.863
	6-year versus 8-year	−0.325	0.587	−0.553	0.981	0.328	0.571	0.574	0.979
	8-year versus 10-year	−0.742	0.594	−1.250	0.719	0.744	0.578	1.286	0.698
	4-year versus adults	−4.005	0.720	−5.564	< .001***	3.708	0.679	5.462	< .001***
	6-year versus adults	−4.602	0.727	−6.332	< .001***	4.263	0.685	6.222	< .001***
	8-year versus adults	−4.277	0.724	−5.909	< .001***	3.936	0.684	5.758	< .001***
	10-year versus adults	−3.535	0.724	−4.884	< .001***	3.192	0.684	4.669	< .001***
BC	4-year versus 6-year	0.956	0.667	1.434	0.605	−0.897	0.639	−1.404	0.625
	6-year versus 8-year	−0.728	0.672	−1.084	0.814	0.765	0.645	1.186	0.759
	8-year versus 10-year	−1.332	0.700	−1.902	0.315	1.180	0.666	1.773	0.389
	4-year versus adults	−2.752	0.732	−3.761	.001**	2.335	0.683	3.420	.005**
	6-year versus adults	−3.708	0.733	−5.060	< .001***	3.232	0.682	4.741	<.001***
	8-year versus adults	−2.980	0.738	−4.038	< .001***	2.468	0.689	3.580	.003**
	10-year versus adults	−1.648	0.748	−2.203	0.178	1.288	0.697	1.849	0.344

comparison to adults; 2) with boundary-crossing events, only 4-, 6-, and 8-year-olds produced SD2 descriptions significantly more frequently and SD3/3+ descriptions significantly less frequently than adults. Uyghur children continued to diverge from the adult patterns for semantic density at age 10 with non-boundary-crossing events, but converged on the adult patterns at age 10 with boundary-crossing events.

6.3. Information focus

Figure 3 below illustrates the kind of semantic components simultaneously expressed within a motion description as a function of speakers' age. A first inspection shows that speakers across age groups predominantly focused on Path and Cause combined with C-Manner (e.g., "pull," "push"), and while the adults' second most frequent pattern is Cause combined with O-Manner (e.g., "roll"), that of all child groups was the "Other" pattern. Meanwhile, there is a general progression towards the adult rates in terms of an increase of Cause+C-Manner+Path and Cause+O-Manner+Path and a decrease of the "Other" pattern. A two-way focus (Cause+C-Manner+Path, Cause+O-Manner+Path, Other) x age (4 yr, 6 yr, 8 yr, 10 yr, adults) analysis revealed a significant interaction ($\chi^2(8) = 733.19$, $p < .001$), suggesting that information focus varied as a function of speakers' age. Further analyses established age effects for Cause+O-Manner+Path ($\chi^2(4) = 73.37$, $p < .001$) and Other ($\chi^2(4) = 38.45$, $p < .001$), but not for Cause+C-Manner+Path ($\chi^2(4) = 9.32$, $p = 0.054$). Results of post-hoc pairwise comparisons, presented in Table 4, demonstrate that while the gradual development across child groups was not significant, all child groups fell short of the adult rate for both Cause+O-

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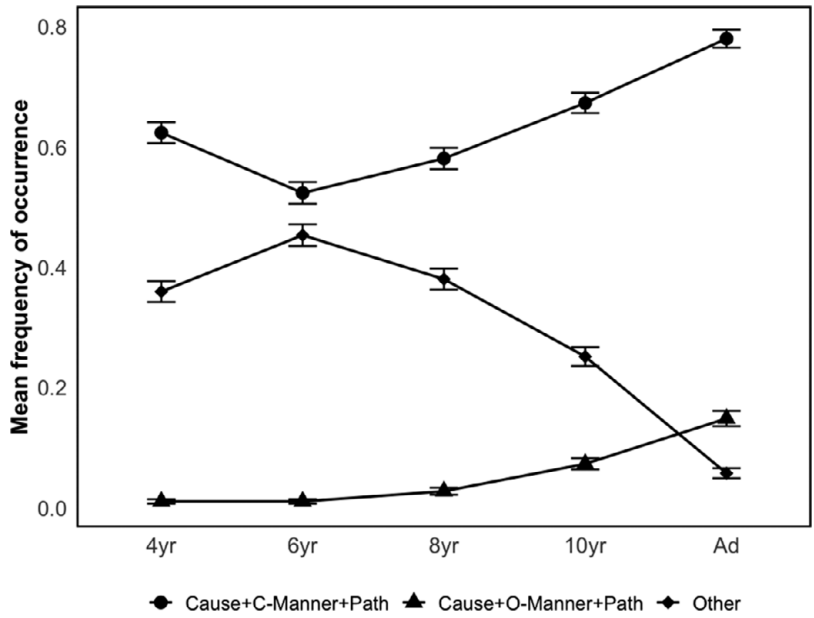

Figure 3. Information focus across age groups.

Table 4. Pairwise comparisons between age groups for Cause+O-Manner+Path and Other focus patterns by path type

		Estimate	SE	Z	*p*-value
Cause+ O-Manner+ Path	4-year versus 6-year	−0.080	0.822	−0.097	1.000
	6-year versus 8-year	1.361	0.753	1.806	0.365
	8-year versus 10-year	1.637	0.615	2.660	0.059
	4-year versus adults	4.652	0.730	6.373	< .001***
	6-year versus adults	4.732	0.742	6.378	< .001***
	8-year versus adults	3.371	0.618	5.458	< .001***
	10-year versus adults	1.735	0.542	3.201	< .05*
Other	4-year versus 6-year	0.717	0.523	1.372	0.646
	6-year versus 8-year	−0.630	0.526	−1.198	0.753
	8-year versus 10-year	−0.692	0.529	−1.309	0.685
	4-year versus adults	−2.685	0.553	−4.856	< .001***
	6-year versus adults	−3.402	0.554	−6.141	< .001***
	8-year versus adults	−2.773	0.556	−4.987	< .001***
	10-year versus adults	−2.080	0.555	−3.742	< .05**

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Manner+Path and Other patterns. Overall, Uyghur children fully followed adults in the predominant Cause+C-Manner+Path from age 4, but continued to diverge from the adult patterns for the remaining two patterns even at age 10.

7. Discussion

In this study, we set out to investigate Uyghur children's acquisition of CM-event expressions. Building on previous findings that children speaking verb-framed languages like French (often considered representative of the V-language type) do not fully develop adult patterns of encoding CM-events even at age 10 (Harr, 2012; Hendriks et al., 2022; Hickmann et al., 2018), and on insights from typological research that Uyghur is a more systematically verb-framed language than French (and indeed Spanish) in the domain of CM (Tusun, 2023; Tusun & Hendriks, 2022) – an intra-typological difference argued to have emanated, at least partly, from differences in constituent order between Romance (SVO) and Turkic (SOV) – we set out to explore whether the SOV constituent order of Uyghur, and its systematicity in the CM domain would have a facilitative effect on acquisition such that children do manage to establish adult patterns by age 10, if not earlier. We were additionally interested in discerning whether Uyghur children would exhibit some of the language-universal tendencies identified in the literature. Specifically, we invited 4-, 6-, 8-, and 10-year-old children and adults to describe a set of CM-events to a naïve listener (real in the case of 4-year-olds but imagined for older children and adults) and analysed their production data in terms of how they syntactically organised the different event components (syntactic packaging), how many event components were simultaneously expressed (semantic density), and which event components were focused on (information focus).

7.1. Children's use of complex syntax involved in encoding CM events is fully adult-like by age 8

Based on earlier typological work (Tusun & Hendriks, 2022), we predicted Uyghur adults to follow syntactic packaging expected for V-languages and predominantly encode Path in the main clause and Cause+Manner in the subordinate clause (categorised as "Tight-complex" as it involves subordination). This prediction was born out as adults used the Tight-complex strategy most frequently, although very occasionally they also packaged event components either within a single clause (Tight-simple) or across two loosely conjoined clauses (Loose-simple). Our prediction that children would be sensitive to the typological properties of Uyghur as a V-language from the earliest age tested was also confirmed: irrespective of whether the event involved boundary crossing, children from age 4 used the three packaging strategies that adults used, and like adult speakers, they predominantly used the Tight-complex strategy, followed in relative frequency by Tight-simple and Loose-simple, respectively. Notably, children's frequency of use of the Tight-Complex strategy fully matched adult rates from age 8 onwards, which contrasts with previous research on children acquiring French – considered a typical V-language – who failed to establish the adult rate for using similar constructions even at age 10 (Harr, 2012; Hickmann et al., 2018). Recall that the acquisition challenge confronted by French children was at least partly attributed to the variability of syntactic packaging observed in French adult speakers who used an array of packaging strategies and showed significant divergences from the patterns predicted for V-languages (Hendriks et al., 2009;

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Hickmann et al., 2018) and partly to the effects of SVO constituent order on motion expression in French (Tusun, 2023; Tusun & Hendriks, 2019, 2022). In view of previous work showing that Uyghur adults strictly employ the typologically congruent syntactic packaging strategy, possibly due to the effect of Turkic SOV constituent order (Tusun & Hendriks, 2022), we predicted that this may facilitate Uyghur children's acquisition of complex syntactic structures for expressing CM. Our finding that children's use of various syntactic packaging strategies fully matched that of adult speakers at age 8, combined with previous findings mentioned above that French children failed to do so at age 10 (Hickmann et al., 2018), suggest that intra-typological differences characteristic of Uyghur (in relation to Romance languages like French) in terms of syntactic packaging and of constituent order did have a facilitative effect on children's acquisition of complex syntax required encoding CM-events (see also Tusun, 2024).

7.2. Children's syntactic packaging shows the influence of language-universal factors until age 6

Despite Uyghur children's early sensitivity to the different syntactic packaging strategies and that they fully converged on the adult patterns by age 8, they also showed an early preference for the Tight-simple strategy by using it significantly more frequently compared to adults until age 6, and whether the events entailed boundary crossing or not did not have an effect. A qualitative look at such descriptions revealed that speakers almost exclusively used CM constructions exemplified in (13), where the framing event Path is expressed in the verb and the co-event Cause is expressed in a causative suffix. While this could be interpreted as younger children's attempt at targeting syntactic structures that are relatively less complex, it is unclear why they do so even though they could, and as discussed above, do productively use the syntactically more complex construction of distributing the two event components across two clauses via subordination. Given that the same tendency has been previously documented for the acquisition of other V-languages (Turkish, Japanese), both for VM- and CM-events (see, e.g., Allen et al., 2007; Furman et al., 2006), younger Uyghur children's use of Tight-Simple constructions may point to the influence of some language-universal factors. It has been suggested, for example, that children may have a universal drive to pursue some sort of homology between cognitive and linguistic representations of an event. Put another way, semantic components of a CM such as Cause/Manner and Path unfold simultaneously, and young children may operate under an iconicity principle which says that whatever appears close together in cognitive representation should be close to each other in the corresponding linguistic representation (see Allen et al., 2007, p.43).

7.3. Adult-like use of complex syntax does not guarantee adult-like semantic density and information focus

Did Uyghur children's adult-like use of the typologically congruent Tight-Complex packaging strategy from age 8 enable them to be adult-like in terms of semantic density and information focus? This was what we had predicted but not exactly what we found. Starting with semantic density, we found that, across the two path types, there was a general (non-significant) increase of SD3/3+ descriptions (including at least three event components), and a corresponding (non-significant) decrease of SD2 descriptions (including at least two core event components). This general developmental trend has

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its parallels in children acquiring both S- and V-languages (Hendriks et al., 2022; Hickmann et al., 2018; Ji et al., 2011) and may be linked to the development of children's general cognitive abilities including working memory and discourse organisation skills (Hickmann, 2001). Interestingly, we found that children of all ages produced SD2 descriptions more frequently but the SD3/3+ descriptions less frequently when describing non-boundary-crossing events, but with boundary-crossing events, their semantic density eventually aligned with the adult rates at age 10. We shall reflect on why children converged on adult patterns for boundary-crossing events shortly, but the fact that their semantic density did reach adult levels at least for some events whereas children speaking other V-languages from the Romance language family were not able to do so at age 10 (Hickmann et al., 2018; see also Bunger et al., 2016) lends further support to our hypothesis that intra-typological differences in constituent order and its implications for the relative systematicity in syntactic packaging confer a developmental advantage to children speaking V-languages with an SOV constituent order like Uyghur (see Sarvasy & Choi, 2020). Nevertheless, that Uyghur children converged on the adult level of semantic density only partially, even though their use of complex syntactic structures that allow them to produce semantically dense motion descriptions is completely adult-like by age 8, indicates that V-language-speaking children's developmental delay in comparison to their age-matched peers speaking S-languages is not only related to the possibility that they have not acquired complex syntactic structures for expressing motion events, as suggested by previous studies (Hickmann et al., 2018; Engemann, 2024). But before probing what other factors may be at play, let us turn to the measure of information focus.

Given the multiple semantic components featured in our stimuli, the measure of information focus was devised to capture which components speakers would typically focus on in their verbalisations, as well as whether and at what age children fully develop the adult pattern. Based on earlier research, we predicted that older children would show greater alignment with adult speakers than younger children, and that Uyghur children might eventually converge on adult patterns thanks to the facilitative effect of SOV constituent order for encoding motion events (Özçalışkan & Emerson, 2016; Sarvasy & Choi, 2020), unlike their French-speaking peers who did not (Harr, 2012; Hickmann et al., 2018). Our analyses identified three focus patterns: Cause+C-Manner+Path, Cause+O-Manner+Path, and a residual category "Other" that included descriptions either profiling only Cause (see Example 11), Path and Cause (see Examples 12–13), or Cause+C-Manner plus A-Manner (see Example 17). We found that children across age groups display a (non-significant) increase of Cause+C-Manner+Path and Cause+O-Manner+Path patterns and a (non-significant) decrease of the "Other" pattern, thereby clearly progressing towards the target system with age. Our statistical analyses showed Uyghur children's use of the Cause+C-Manner+Path was already adult-like from age 4, although they continued to diverge from adult speakers in producing Cause+O-Manner+Path descriptions less frequently but "Other" descriptions more frequent than adults. Again, that Uyghur children already converged on the adult pattern for Cause+C-Manner+Path descriptions at age 4 and the lack of such a convergence in French children at age 10 (Harr, 2012; Hickmann et al., 2018) supports our prediction that the SOV constituent order and the relative systematicity of Uyghur in the domain of CM expression give Uyghur children an acquisitional advantage. However, the fact that they continued to deviate from the adult patterns for the Cause+O-Manner+Path and "Other" descriptions even at age 10 suggest that the presumed facilitative effect is only partial and that Uyghur children are subject to constraints common to children acquiring V-languages more generally. We will delve

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into what these constraints might be after addressing the role of boundary crossing in children's expression of CM-events.

7.4. The role of boundary crossing in Uyghur children's expression of CM-events

In light of previous findings that children experience greater difficulty in expressing motion events involving boundary crossing because this type of events denote a categorical change of location which is deemed conceptually more complex and hence entails a more complex process of form-meaning mapping (Hendriks et al., 2022; Hickmann et al., 2018; Tusun, 2024), we hypothesised that Uyghur children would experience a developmental delay for boundary-crossing events, which is not supported by our quantitative analyses. On the contrary, our semantic density analyses revealed that, while children continued to stop short of the adult level of semantic density at age 10 for non-boundary-crossing events, they eventually converged on the adult rates for boundary-crossing events. Further, our syntactic packaging analyses showed that children converged on the adult rates for the Tight-complex strategy earlier with boundary-crossing events (at age 6) than non-boundary-crossing events (at age 8). What explains these unexpected findings? There is crosslinguistic evidence that speakers are more likely to focus on Manner of motion in boundary-crossing events compared to non-boundary-crossing ones (e.g., Engemann, 2022; Soroli, 2024), and indeed, data on French child language (e.g., Harr, 2012) show that children are more likely to encode Manner information with events involving boundary crossing. The fact that Uyghur children eventually reached the adult level of semantic density (i.e., expressing Path, Cause conflated with Manner in SD3/3+ descriptions rather than expressing only Path and Cause in SD2 descriptions; see Examples 13–14) and converged on the adult use of complex syntax for this type of event earlier may have resulted from the combined influence of the general preference for Manner information for boundary-crossing events and of its SOV constituent order that promotes the simultaneous encoding of multiple event components. Nonetheless, boundary crossing does seem to underlie some qualitative deviations from the adult pattern younger children exhibit: when encoding boundary-crossing events, they occasionally use the deictic verb *ketmek* "to go away" in place of the Path verb *ötmek* "to cross" while using case marking to provide information on the source and goal of motion (e.g., "from this side of the road to that side"). In other words, younger children's motion descriptions are sometimes under-informative because the notion of boundary crossing is implied rather than explicitly encoded (see Ji et al., 2011; Ji, 2019 for similar patterns in Chinese children).

7.5. Syntactic versus pragmatic knowledge required for encoding motion may be on different developmental timelines

So why did 10-year-old children still fall short of the adult patterns for aspects of semantic density and information focus, even though their use of the syntactic constructions that would allow them to do otherwise was completely adult-like from age 8? Recent discussions initiated by von Stutterheim and colleagues (Gerwien & von Stutterheim, 2022; Lambert et al., 2022; von Stutterheim et al., 2021) about making finer differentiations in the types of knowledge involved in motion language use may shed light on this question. To give an adequate description of a motion event, speakers must have the necessary linguistic devices (e.g., Path verbs, Manner verbs, causative verbs, subordinate structures),

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but they also need to consider specific features of the external situation including the properties of a given event (e.g., the kind and number of semantic components present, their various configurations) as well as properties of the addressee (e.g., what information is shared and can thus be omitted, what must be specified). Put differently, encoding motion requires both linguistic knowledge (of language-specific devices) and pragmatic knowledge (of principles involved in event description in relation to context), and to become a competent user of a language is to have control over both knowledge components simultaneously (Gerwien & von Stutterheim, 2022).

While acknowledging the importance of pragmatic factors in spatial language is not new (Papafragou & Grigoroglou, 2019), von Stutterheim and colleagues more explicitly embed their discussions within the usage-based theories of language and cognition (Schmid, 2012; 2020) and expound on what this pragmatic knowledge consists in and how speakers come to acquire and use it. Specifically, they argue that language experience shapes certain canonical ways of encoding events (i.e., event frames, or "pragmatic associations" in Schmid's (2020) terminology), as reflected in their relative frequency of use within a language community. To illustrate, when confronted with the kind of CM-events presented in this study, English and German speakers predominantly encode Path and Cause conflated with either the C-Manner ("pull/push") or much less frequently with O-Manner ("roll"), thereby profiling three semantic components (Hickmann et al., 2018); Chinese speakers frequently add another semantic element, i.e., A-Manner "walk" (Ji, 2019), rendering their event descriptions semantically even denser; and although Uyghur speakers can potentially do what Chinese speakers do in terms of adding A-Manner, thanks to the availability of "verb sequences" in Turkic, they rarely do so (Tusun & Hendriks, 2022). In fact, given that Manner is a low-salience domain in V-languages, Uyghur and French speakers sometimes encode Cause and Path while omitting Manner (Hendriks et al., 2009; Tusun & Hendriks, 2022). According to von Stutterheim and colleagues (Gerwien & von Stutterheim, 2022; Lambert et al., 2022), that speakers belonging to a language community produce largely uniform descriptions for types of events, both in terms of linguistic devices used and of which semantic components are selected for expression and how frequently, reflects the existence of conventionalised ways of speaking in context or event frames that are shared among members of the language community and that reside in the knowledge base of the individual (see Schmid, 2015 for a model of how all these may come together). It is this knowledge that is said to drive the allocation of attention during event apprehension and extraction of linguistic forms (e.g., Manner verbs, Path verbs, subordination) during speech production (Gerwien & von Stutterheim, 2022; Schmid, 2020). Ontogenetically, this pragmatic knowledge emerges through continued exposure to and use of a given language in specific contexts; the repeated processing and use of this knowledge leads to its further entrenchment in the speaker's mind and its reactivation for similar communicative situations (Schmid, 2020; Verspoor & Schmid, 2024).

It seems then that it is this pragmatic knowledge that is not fully in place in our 10-year-olds, not the linguistic knowledge of complex syntax, as was suggested in previous research (e.g., Hickmann et al., 2018). Recall that our participants were placed in a communicative situation where they had to describe the events either to an imagined addressee (for older speakers) or an actual addressee (for 4-year-olds) who did not have visual access to the cartoons but was interested to know what happened. In this context, adult speakers deemed it appropriate to predominantly express Path, Cause combined with C-Manner and much less frequently Path, Cause conflated with O-Manner (suggestive of the event frames shared in the Uyghur community and their relative

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frequencies in language use). And while children converged on the adult pattern for the Cause+C-Manner+Path pattern from early on, they did not select O-Manner as frequently as adults, but rather tended to focus only on Cause and Path, which is also why they fell short of the adult level of semantic density even at age 10.

The finding that children sometimes only encoded Cause and Path of motion without Manner, thereby producing low-density SD2 descriptions, may be attributed to Manner being a low-salience domain in V-languages (Slobin, 2006; Slobin et al., 2014) – a typological constraint common to children learning V-languages more generally (Hendriks et al., 2022; Tusun, 2024). But the result that they converged on adult patterns for only some aspects of semantic density and information focus implies that Uyghur children were not able to consistently put the linguistic devices (i.e., Tight-complex constructions) they had acquired to contextually adequate use. To be specific, when children produced Cause+C-Manner+Path, Cause+O-Manner+Path, and Cause+Path descriptions, they were qualitatively identical to adult speakers; their difference was more quantitative in that they used certain patterns either more frequently or less frequently than adults. This seems to show that children have developed the pragmatic knowledge (i.e., the event frames) specific to the Uyghur community in encoding CM-events, but the quantitative nature of their divergence from the adult speakers indicates that their knowledge is not entrenched and therefore could not be reactivated for subsequent use to the same degree as that of the adults. This finding further underlines the possibility that the acquisition of linguistic versus pragmatic knowledge in the motion domain is not on the same developmental timeline, with the former being in place from early on and the latter taking much longer. Indeed, this developmental asymmetry can be observed across S- and V-languages (Hendriks et al., 2022; Hickmann et al., 2018) and acquisition contexts (e.g., see Tusun, 2023 for child bilingualism; von Stutterheim et al., 2021 for adult L2 acquisition) and reinforces the notion, in keeping with usage-based accounts of language and cognition (Schmid, 2020; Gerwien & von Stutterheim, 2022), that the acquisition of pragmatic knowledge for motion expression demands more extensive situated language use.

8. Conclusion

In this study, we drew on previous work on child language and language typology and investigated the implications of intra-typological variability within V-languages for Uyghur children's acquisition of caused motion expressions. We found that Uyghur children use adult patterns of syntactic packaging strategies from age 8 and converge on adult patterns for some aspects of information focus at age 10, a finding that contrasts with previous findings on children speaking French (often considered representative of V-languages, Hickmann et al., 2018) and supports the hypothesised facilitative role of language-specific properties of Uyghur including its SOV constituent order (Sarvasy & Choi, 2020) and its relative systematicity in the caused motion domain (Tusun, 2024). Nonetheless, even 10-year-olds fell short of the adult patterns in measures of semantic density and aspects of information focus (paralleling their French peers), indicating that Uyghur children are constrained by challenges that confront those acquiring V-languages more generally (e.g., Manner as a low-salience domain, Slobin, 2006; Slobin et al., 2014). Our findings clearly demonstrate that the acquisitional challenge faced by children learning verb-framed languages is not simply due to their difficulty in acquiring complex syntactic structures required for expressing caused motion events, as previously assumed. Rather, their

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challenge lies in the ability to put knowledge of complex syntax to contextually appropriate use in terms of how many event components to express (semantic density) and which event components to express (information focus) – two dimensions that are highly pragmatic in nature. At least in the case of Uyghur, children's adult-like knowledge of language-specific devices (i.e., subordination) did not map directly unto the pragmatic aspects of motion expression, a significant finding that underscores the fact that linguistic versus pragmatic aspects of knowledge required for encoding motion events are not on the same developmental timelines, likely because they require differential amount of experience with language in a community (Schmid, 2020; Gerwien & von Stutterheim, 2022).

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