

Learning to Express Causal Events across Languages: What do Speech and Gesture Patterns Reveal?

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1. Introduction

Understanding and expressing the causal relations between entities in events are universal aspects of human cognition. Yet, different languages have different ways of distributing features of the same causal information into linguistic units. There are significant crosslinguistic differences in the way semantic elements in a causal event are mapped onto lexical and syntactic structures (Talmy, 1985). For instance, speakers of *satellite-framed* languages such as English conflate Cause with Motion in the main verb (e.g. *push* in (1)) and express the Path of the resulting event in the satellite (e.g. *down* in (1)). This lexicalization pattern allows English to express both the Cause and the Path of the resulting event in one clause. In contrast, speakers of *verb-framed* languages such as Turkish typically express Cause as an adverbial or a subordinate verb (e.g. *tekmele*-‘kick’ in (2)) and conflate Motion and Path of the resulting event in the main verb (e.g. *in-* ‘descend’ (2)). Thus Turkish speakers express the Cause and the Path of the resulting event in two clauses. Furthermore Turkish, as different from other verb framed languages such as Spanish, can encode Cause additionally with a morpheme in the main verb that conflates Motion and Path of the resulting event (e.g. *-dir* morpheme in (2)).

(1) *She kicked the barrel down.*

(2) *Fıçt-yı* *tekmele-yerek* *aşağı-ya*
barrel-Accusative kick-Connective down-Dative
in-dir-di
descend-Causative-Past
'(he/she/it) caused the barrel to descend by kicking it'

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These crosslinguistic differences raise a number of important questions in language development with regard to how this variation is learned by children speaking different languages. Previous research that has investigated the development of a similar crosslinguistic variation, that is how Manner and Path elements of a motion event are syntactically packaged in satellite- (English) versus verb-framed (Turkish and Japanese) languages, has shown that both universal and language-specific tendencies guide the development of how semantic elements are mapped onto syntactic units (Allen et al, 2003, in press). Here we extend this investigation to how children speaking typologically different languages such as Turkish and English, learn to map semantic elements such as the Cause and the Path of the resulting event following language-specific patterns.

Previous research has also shown that differences in the way semantic elements of motion events are syntactically packaged (with regard to Manner and Path) have consequences for how gestures that accompany these expressions are shaped. Co-speech gestures are spontaneous and frequent accompaniments to speech and the expressions in the two modalities have been found to be tightly integrated pragmatically, semantically, and temporally (Goldin-Meadow, 2004; Kendon, 2004; McNeill, 1985, 1992). A subset of co-speech gestures that are frequently used in event descriptions are called “iconic” gestures (McNeill, 1992) which convey meaning by their resemblance to the different aspects of the events they depict (e.g. wiggling fingers crossing space to represent someone walking). In spite of the potential for gestures to depict events in an iconic and analog fashion, speakers of typologically different languages have been found not only to talk differently about the same motion events, but also to gesture differently. That is, the gestural representations of the same events vary across languages when the events are encoded by different syntactic frames (i.e. verb-framed or satellite-framed) with regard to packaging of Manner and Path (Kita & Özyürek, 2003; Özyürek et al., 2005). Here we investigate whether gestures that encode Cause and Path of the resulting event are also used differently by speakers of Turkish and English adults. If adult patterns differ, we further ask how language-specific differences emerge in children’s gestures.

With regard to nature of causal events, we focus on “direct causation” where the causer and causee touch, rather than do not touch but influence each other indirectly, as in “indirect causation” (Wolff, 2003). Wolff (2003) has shown that English-speakers use single-clause sentences (e.g. *The blue marble moved the green marble*) more often than two-clause sentences (*The blue marble made the green marble move*) for causal chains in direct causation, while they use two-clause sentences more frequently to represent indirect causation. Turkish, on the other hand, typically encodes both types of causation using two-clause sentences. Since we are interested in exploring language acquisition in situations where there is cross-linguistic difference, we focus on the structure that is expected to yield the greatest difference in adult speech— i.e. direct causation.

In the present study, we investigate how adults and children express basic semantic elements of causal motion events in two typologically different languages— English and Turkish— which differ in the syntactic structures they use to express such events. Data are taken from elicited narrations of native speakers of these languages aged three, five, and nine years, as well as adults. We predict that linguistic encoding of direct causal events will vary with language in accordance with Talmy (1985). That is, we expect adult English speakers to conflate the Cause and the Path of the resulting events in one clause, and adult Turkish speakers to use two clauses. With regard to development, we expect both universal and language-specific tendencies to guide the development of causal event expressions, consistent with findings from Allen et al. (2003, in press) regarding syntactic packaging of Manner and Path in motion event descriptions. Although Allen et al. found language-specific patterns from age three, they also found that both Turkish- and English-speaking three-year-olds had a tendency to conflate Manner and Path together in one clause, even though such conflation was very rare in descriptions from Turkish adults. We also expect gestural representations of adults to differ as found in Kita and Özyürek (2003) and Özyürek et al. (2005). That is, English speakers might be more likely to represent both the Cause and the Path of the resulting event in their gestures than Turkish speakers who might focus either on the Cause or the Path of the resulting event. Finally we explore the gestural patterns of children.

2. Methods

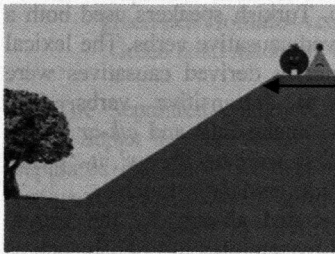
2.1. Participants

Participants in the study were 80 native Turkish speakers and 80 native English speakers. In each group, there were 20 adults, 20 three-year-olds, 20 five-year-olds and 20 nine-year-olds. The adults ranged in age from 18 to 40 and were all current or recent university students. All groups of children had similar age means. The mean age for the three-year-olds was 3;8 (both Turkish and English). The mean ages for the five-year-olds were 5;7 (Turkish) and 5;6 (English) and the mean age for the nine-year-olds was 9;4 (both Turkish and English).

2.2. Materials

Data were collected by elicitation, using two animated video clips depicting direct causation in motion events (Özyürek, Kita, & Allen, 2001, and also used in Allen et al, 2003; Allen et al., in press; Özyurek et al., 2005). Each video clip was between 6 and 15 seconds in duration, and involved a round red smiling character and a triangular-shaped green frowning character, moving in a simple landscape. Each clip depicted a causing and a resulting event. The causing event in both clips was the triangular shaped character hitting the round character. The resulting events had both a Path and a Manner component, depicted simultaneously. The resulting event in the first clip involved the round character

rolling down a hill. The resulting event of the second clip involved the same character rolling up a hill. Figure 1 depicts some stills from one of the stimulus clips.



Causing subevent
(triangle hits tomato man)



Resulting subevent
(tomato man rolls down)

Figure 1. Selected stills of the Causing and Resulting subevents taken from one of the stimulus clips

2.3. Procedure

The data were collected as part of a larger study that was a cross-linguistic developmental investigation of syntactic packaging of Path and Manner. Participants were tested individually in a quiet space at their university (adults), preschool (three- and five-year-olds), or after-school study center (nine-year-olds). All interactions were videotaped for later coding and analysis. Participants were told that they would see a series of 10 clips on a computer screen depicting the adventures of the so-called Tomato Man and Green Man, and that, after each one, they should recount the clip to an adult listener, who had not seen it. The Turkish data was collected in Istanbul, and the English data was collected in Boston. For the purposes of this study narrations of only two of these events were analyzed since they were the only ones involving direct causal events.

2.4. Speech Coding

The speech that referred to the causal event portion of the two clips was transcribed and then categorized as representing either the Causing subevent or the Resulting subevent. Note that descriptions in which the speaker mentioned only one of the two subevents but not both were excluded from the analysis since our aim was to investigate how the two subevents were expressed together (i.e. in one clause or two).

Causing subevents were described by either a lexical causative verb or a two-argument activity verb. Note that lexical causative verbs used to describe this part of the event encoded not only the Causing but both the Causing and

Resulting subevents in one lexical item (e.g. *roll, move*). Two-argument activity verbs (e.g. *bump, push, hit*) coded only the Causing subevent but not the Resulting subevent (Wolff, 2003). The lexical causative verbs used by English speakers were *roll, slide* and *bounce* and the two-argument activity verbs were *push, hit, knock, bump, smash, nudge, run into*. Turkish speakers used both a lexical causative verb and morphologically derived causative verbs. The lexical causative was *yuvarla-* ‘roll’. The morphologically derived causatives were formed by attaching a causative suffix to intransitive verbs. The morphologically derived causatives were *düş-ür* ‘make fall’ and *çık-ar* ‘make ascend’. The two-argument activity verbs in Turkish were *at-* ‘throw’, *it-* ‘push’, *çarp-* ‘bump’, *devir-* ‘knock’, *tosla-* ‘butt’, *koy-* ‘hit’, and *değ-* ‘touch’.

Resulting subevents (if they were not encoded already by the lexical causative verbs mentioned above) were encoded by satellites in English such as *up* or *down* and in Turkish either by path verbs such as *çık-* ‘ascend’, *in-* ‘descend’, by postpositional phrases such as *tepeye* ‘to the hill’ or *denize* ‘to the sea,’ or by spatial nouns such as *yukarı* ‘upness’ and *aşağı* ‘downness’.

Two structural patterns of packaging of the Causing and Resulting subevents were distinguished in speech: Conflated (both subevents in one clause) and Separated (each subevent in a distinct clause). Each event description was coded as containing one or more exemplars of each of these two packaging types. Note that causal event descriptions which included both types of packaging (e.g. one Conflated and one Separate) were counted in analyses as instances of both types.

The Conflated category denotes a single clause that included both the Causing and the Resulting subevents. Event descriptions coded as Conflated showed some variation across languages. English Conflated event descriptions include either a lexical causative verb with a directional particle or preposition (3a) or a two-argument activity verb with a directional particle or preposition (3b).

- (3) a. The party hat rolled the tomato down the hill. (5-year-old)
 b. Triangle pushed the tomato up the hill. (3-year-old)

Contrary to predictions based on Talmy’s typology, Turkish data also included a few Conflated event descriptions. These contained either a lexical causative verb (*yuvarla-* ‘roll’ in (4a)) which encodes both the Causing and the Resulting event, an activity verb (*it-* ‘push’) with a postpositional phrase that encodes the path of the Resulting event (*aşağı* ‘down’ as in (4b)), and or a path verb with a causative morpheme added to it (*çık-ar* ‘make ascend’ as in (4c)).

- (4) a. Domates-i uçurum-dan yuvarla-dı.
 tomato-Accusative hill-Ablative roll-Past
 ‘(he/she/it) rolled the tomato from the hill’ (5-year-old)
 b. Yeşil adam domates adam-ı it-iyor
 green man tomato man-Accusative push-Present

aşağı.
downness

'Green man pushes the tomato man down.' (Adult)

- c. Yeşil kafa domates-i tepe-ye çık-ar-dı.
green head tomato-Accusative hill-Dative ascend-Causative-Past
'Green head made the tomato ascend the hill.' (3-year-old)

The Separated category denotes two clauses about the causation event which depict the subevents separately. In English, event descriptions coded as Separated include a two-argument activity verb in the first clause and a Path verb in the second clause optionally followed by a prepositional phrase (5a,b) or a two-argument activity verb in the first clause and Manner verb in the second clause optionally followed by a prepositional phrase (5c,d).

- (5) a. The triangle hit the circle. And then it fell. (3-year-old)
b. The birthday hat pushed the apple. Then it went up up. (5-year-old)
c. The triangle hit the circle. And it went rolling rolling. (9-year-old)
d. Triangle man hits tomato man. And tomato man rolls down the hill.
(Adult)

Separated event descriptions in Turkish typically include a two-argument activity verb in the first clause and a Path verb in the second clause followed by a postpositional phrase (6a), a two-argument activity verb in the first clause and a main Path verb with a subordinated Manner verb in the second clause (6b), or a two-argument activity verb in the first clause and Manner verb in the second clause optionally followed by a postpositional phrase (6c).

- (6) a. Üçgen çarp-tı yine elma-ya. Yokuş-u
triangle bump-Past again apple-Dative slope-Accusative
çık-tı.
ascend-Past
'Triangle bumped into the Apple again. (he/she/it) ascended the slope.' (5-year-old)
- b. Domates adam-ı it-iyor. Yuvarlan-arak
tomato man-Accusative push-Present roll-Connective
deniz-e düş-üyor.
sea-Dative fall-Present
'(he/she/it) pushes Tomato Man. (he/she/it) falls to the sea while rolling.' (9-year-old)
- c. Yeşil adam o-nu it-ti. Yuvarlan-dı
green man he- Accusative push-Past roll-Past
yuvarlan-dı.
roll-Past
'Green Man pushed him/her/it. (he/she/it) rolled and rolled' (5-year-old)

2.5. Gesture Coding

When coding gestures we focused only on those gestures that accompanied the clauses that included the Causing subevent descriptions in speech. Note that these were a) clauses that encode only the Causing event (e.g. *he pushed him*) or b) in case of Conflated descriptions both the Causing and Resulting subevents (e.g. *he rolled him down the hill; he pushed him down* etc).

Gestures that accompanied such descriptions were classified into three categories. Only Causing Subevent gestures depicted the causing subevent exclusively (e.g. a horizontal movement of the hand to represent hitting resembling the stimulus), whereas Only Resulting Subevent gestures solely depicted the resulting subevent (e.g. a diagonal downward movement of the hand to represent descending resembling the stimulus). The third category of gestures, Both Causing and Resulting Subevents, came in two types. The first type depicted the two subevents in a single gesture (e.g. a horizontal movement fused into a diagonal downward movement with an arc-like movement of the hand representing hitting and going down). The second type expressed the subevents in a gesture string (gestures following each other with a very short pause, Goldin-Meadow, 2004) (e.g. a horizontal movement immediately followed by a diagonal downward movement of the hand representing hitting and going down).

3. Results

3.1. Speech

We determined the type of causal event representation for each group of participants and examined whether representations changed with language and/or with age. Table 1 presents the mean percentage of different types of event descriptions where both the Causing and Resulting subevents were expressed.

Table 1. Mean Percentage of Causal Event Description Type

		Causal Event Description	
		Separated (2 clauses)	Conflated (1 clause)
English	Adults	64%	36%
	9-yr-olds	68%	32%
	5-yr-olds	38%	62%
	3-yr-olds	50%	50%
Turkish	Adults	97%	3%
	9-yr-olds	100%	0%
	5-yr-olds	90%	10%
	3-yr-olds	65%	35%

Event descriptions changed with language. English-speaking adults and nine-year-olds conflated the two subevents in one clause more than their

Turkish-speaking counterparts $\chi^2(1, N=97) = 12.66, p=.000$, and $\chi^2(1, N=65) = 10.45, p=.001$, respectively. Similarly, English-speaking five-year-olds were more likely to conflate the causing and resulting subevents in their event descriptions than Turkish-speaking five-year-olds, $\chi^2(1, N=68) = 18.2, p=.000$. There were no significant differences between the three-year-olds across languages.

Event descriptions also changed with age. A chi-square analysis revealed that English-speaking five-year-olds conflated the causing and resulting subevents more than English-speaking nine-year-olds, $\chi^2(1, N=77) = 6.93, p=.008$ and adults $\chi^2(1, N=103) = 6.4, p=.011$. There was also an age difference among the Turkish-speaking participants. Turkish-speaking three-year-olds conflated causing and resulting subevents more than nine-year-olds, $\chi^2(1, N=47) = 11.1, p=.001$ and adults, $\chi^2(1, N=53) = 9.93, p=.002$. There were no other significant relations between different age groups within a language.

These results reveal language-specific differences in the representation of direct causation in the adult languages. As predicted, English-speaking adults used more event descriptions with the subevents conflated than Turkish-speaking adults. Furthermore, developmental differences revealed both universal and language-specific patterns in children's speech. Younger speakers of both languages (three- and five-year-olds) had a tendency to represent the subevents as conflated more than their adult counterparts. Language-specific differences emerged at age five. That is, from age five on, English speakers produced many more conflated event descriptions than their Turkish counterparts whereas they were similar at age three.

3.2. Gesture

We examined the different types of gestures produced by each group that accompanied speech that included descriptions of Causing subevent, investigating whether they changed with language and/or with age. Table 2 presents the mean percentage of different types of gestures for each age and language group.

Gestural encoding of direct causation changed with language. English-speaking adults used Both Causing and Resulting Subevents gestures more often than Turkish-speaking adults $\chi^2(1, N=97) = 19.89, p=.000$. None of the other relations proved significant in any of the three categories of gesture types, suggesting that language-specific differences emerge after age nine.

Gestural representations of direct causation did not change with age in English speakers. That is, English speakers of all ages had similar numbers of the three types of gestures. In contrast, gestural representations changed with age in Turkish speakers. Turkish-speaking three-year-olds encoded Only Causing Subevent gestures less often than five-year-olds $\chi^2(1, N=49) = 7.22, p=.027$, nine-year-olds $\chi^2(1, N=47) = 5.93, p=.051$, and adults $\chi^2(1, N=53) = 13.48, p=.001$. Further, Turkish-speaking five-year-olds produced more Both

Causing and Resulting Subevents gestures than adults $\chi^2(1, N=62) = 6.06$, $p=.048$.

Table 2. Mean Percentage of Different Gesture Types Accompanying Speech that Included Depictions of Causing Subevent

		Gesture Type		
		Only Causing Subevent	Only Resulting Subevent	Both Causing and Resulting Subevents
English	Adults	45%	10%	44%
	9-yr-olds	51%	14%	35%
	5-yr-olds	40%	21%	40%
	3-yr-olds	32%	32%	36%
Turkish	Adults	76%	0%	24%
	9-yr-olds	56%	7%	37%
	5-yr-olds	48%	7%	45%
	3-yr-olds	45%	35%	20%

The fact that English-speaking adults had gestural representations that included both the Causing and the Resulting subevents more than Turkish speakers fit with the expectation that differences in linguistic packaging would have an effect on gestures. This can be attributed to the fact that English speakers had more Conflated event descriptions which encoded both subevents in one clause compared to Turkish speakers. In contrast, Turkish speakers encoded the Causing subevent in a separate clause and without encoding the resulting event. As a result, they had fewer gestures that encoded both subevents. The child results also go hand in hand with the development of linguistic encoding, especially evident in Turkish. Younger Turkish children were not similar to their adult counterparts in that they used more gestures that encoded both the Causing and the Resulting subevents, probably due to the fact that their speech also included more Conflated descriptions than their adult counterparts, as found in the speech analysis. That is, Turkish children had a tendency to express both subevents in their speech and gesture in a more compact way than their adult counterparts.

4. Discussion

This study investigated how speech and gestures encoded relations between Causing and Resulting subevents in direct causation. We focused on two specific questions. First, do English and Turkish speakers differ with regard to their linguistic/gestural coding of direct causation in motion events? Second, are there developmental differences in the linguistic/gestural coding of causation in motion events within and across languages?

We found that causal event descriptions in adult speech show cross-linguistic variation. English speakers typically both conflated (in one clause) and separated (in two clauses) the Causing and Resulting subevents. In contrast, Turkish speakers used only separate depictions of the Causing and Resulting subevents. Our results reveal that the linguistic encoding of direct causation differs across languages in speech, in accordance with Talmy (1985).

Children showed both universal and language-specific tendencies in speech. Universal tendencies were evident in children's language at younger ages. We found an early bias to conflate the subevents of a direct causation event in both English- and Turkish-speaking three- and five-year-olds. This result contrasts with Bowerman's (1982) suggestion that children have an initial strategy of isolation or differentiation of semantic elements such as expressing overtly the covert Cause, using periphrastic expressions such as 'he made the ball roll down'. In our study, children show the opposite strategy and combined semantic elements even in lexical causative verbs (e.g., *Domatesi uçurumdan yuvarladı* 'he rolled the tomato from the hill'). In fact, none of the children (or the adults) used such periphrastic structures although both English and Turkish allow them grammatically. This tendency might be attributable to Wolff's (2003) finding that the use of periphrastic causatives is reserved for indirect causal chains. The animations we used in this study depicted direct causation and the use of periphrastic structures may have been incompatible with this type of causation.

Alternatively, the combination of semantic elements by younger children may be part of a larger pattern found in child speech. Allen et al. (in press) has also found evidence contradicting Bowerman's findings; they provide evidence that child speakers of three typologically different languages (English, Japanese and Turkish) show a strong tendency to package Manner and Path tightly in speech, that is within one verbal clause rather than two, when representing events in which Manner and Path occur simultaneously.

Language-specific differences in children's speech emerged at age five. That is, in addition to universal patterns, five-year-olds displayed robust language-specific differences in their speech. English-speaking five-year-olds tended to conflate the subevents whereas their Turkish-speaking counterparts predominantly separated them. This pattern was also repeated in the event descriptions of the nine-year-olds. These patterns show that by age five, children are almost fully attuned to their language-specific patterns of talking about causation in motion events. Language-specific event depictions that involve causation might develop later than those that require packaging of Manner and Path, which had emerged by age three in Turkish-, English- and Japanese-speaking children (Allen et al., in press).

Gestural descriptions of direct causation also showed cross-linguistic variation in adults, paralleling differences in linguistic encoding. English speakers represented the causing and resulting subevents in one gesture or gestural string more than Turkish speakers. Our results confirm that the gestural encoding of causation in motion events varies with language, in accordance with previous research (Kita & Özyürek, 2003; Özyürek et al., 2005).

In contrast to adults' gestures, children's gestures show both language-specific and universal representations. English-speaking children's gestures are adult-like at age three. That is, they conflate the causing and resulting subevents in one gesture or gestural string as often as their adult counterparts. In contrast, Turkish-speaking children's gestures become more adult-like after age five. Specifically, younger Turkish-speaking children display a tendency to represent both subevents in one gesture/gesture string like their English-speaking peers. This tendency is replaced by the adult pattern of separating the subevents in gesture after age five, paralleling the development of speech.

In addition to these language-specific differences, three-year-olds in both groups show a universal tendency to represent only the resulting subevent in gesture as in Table 2 (a nonsignificant but distinct trend in our data). We surmise that this tendency could reflect an early cognitive bias in event conceptualization. Children are more likely to linguistically encode goal paths than source paths in their motion event descriptions (Lakusta & Landau, 2005). In the animations we used in our study, the goal path in the motion events corresponded to the Resulting subevent which the children had a tendency to encode in gesture, unlike the adults.

In sum, we have investigated how adult and child speakers of two typologically different languages encode Cause and Result in motion events in speech and gesture and have shown that the acquisition of adult patterns of speech and gesture do not occur until quite late in development. We cannot pinpoint the precise age of complete acquisition of adult patterns, as the five-year-olds differed from adults in some ways and the nine-year-olds never did. Thus, we suggest that adult patterns of the linguistic and gestural expression of causation in motion events are acquired fully sometime between the ages of five and nine. Interestingly, in a language like Turkish that typically expresses the subevents in separate clauses, children use non-adult-like strategies in speech and gesture possibly to be able to depict the caused motion event holistically. Thus, the development of language-specific representations of Cause and Result in speech and gesture is faster for English speakers compared to Turkish speakers, possibly highlighting the tensions between the universal and language-specific tendencies that Turkish-speaking children might have. Further research is necessary to reveal whether this early holistic bias in causal event depiction reflects differences in the conceptualization of causal events in children and adults.

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