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Early Event Understanding Predicts Later Verb Comprehension and Motion Event Lexicalization

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Before infants produce words, they can discriminate changes in motion event components such as manner (how an action is performed) and path (trajectory of an action). Individual differences in nonlinguistic event categorization are related to children's later verb comprehension (Konishi, Stahl, Golinkoff, & Hirsh-Pasek, 2016). We asked: (a) Do infants learning Turkish, a verb-framed language, attend to both manner and path changes in motion events? (b) Is early detection of path and manner related to children's later verb comprehension and (c) how they describe motion events? Thirty-two Turkish-reared children were tested at three time points. At Time 1, infants (M_{age} = 14.5months) were tested on their detection of changes in path and manner using the Preferential Looking Paradigm. At Time 2, children were tested on their receptive language skills (M_{age} = 22.07months). At Time 3, children performed 3 tasks (M_{age} = 35.05months): a verb comprehension task, an event description task depicting motion events with different path and manner combinations, and an expressive language task. The ability to detect changes in event components at Time 1 predicted verb comprehension abilities at Time 3, beyond general receptive and expressive vocabulary skills at Times 2 and 3. Infants who noticed changes in path and manner at Time 1 used fewer manner-only descriptions and more path-any descriptions (i.e., descriptions that included a path component with or without manner) in their speech at Time 3. These findings suggest that early detection of event components is associated not only with verb comprehension, but also with how children lexicalize event components in line with their native language.

Keywords: event conceptualization, verb learning, motion event lexicalization, relational words

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Verbs are the core components of sentences that represent *who is doing what to whom* and how things unfold over space and time. Learning verbs and other relational terms (e.g., prepositions) is a tough task for children (Gentner, 1982; Göksun, Aktan-Erciyes, Hirsh-Pasek, & Golinkoff, 2017; Göksun, Hirsh-Pasek, & Golinkoff, 2010; Golinkoff & Hirsh-Pasek, 2008). In a seminal article, Gentner (1982) argued that for verb learning children need to first conceptualize events and then package the relations within events for their native language. Linking event perception to verb learning, in this "natural partitions hypothesis," Gentner claims that lexicalizing events is more challenging than perceiving relations in events (see also Gentner & Boroditsky, 2001). Another view, however, suggests that language can direct cognition. In particular, children construe events as they learn language (Bowerman & Levinson, 2001; Choi & Bowerman, 1991). In their typological prevalence hypothesis, Gentner and Bowerman (2009) later suggested that some semantic categories are salient to children and can exist in prelinguistic thought whereas other categories that vary crosslinguistically and are less natural can need more language exposure to be learned.

In line with Gentner (1982) and Gentner and Bowerman (2009), we have argued that in order for children to learn verbs they must first perceive actions within events and discriminate between event components. For example, in the initial step of verb learning infants detect the act of *walking* in a continuous event and then differentiate *walking* from *running*. Later, infants categorize event components across different contexts such as learning that *running* is the same action when an *athlete runs* or when a *cat runs*. At the final step of the verb learning process, children need to package these event components based on the requirements of their native language (Göksun et al., 2010). In this longitudinal study, we ask whether Turkish-learning children's early understanding of event components predicts their later verb learning, focusing on their

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verb comprehension and lexicalization of event components in line with their native language.

Conceptualizing Events

A motion event is defined as a situation "containing movement or the maintenance of a stationary location" (Talmy, 1985, p. 85). A dynamic motion event consists of different semantic components such as *path* (the trajectory of motion with respect to the ground), *manner* (how an action is performed), *figure* (the moving entity), and *ground* (the stationary setting; Talmy, 1985, 2000). Languages vary in how they encode these components of motion events. For example, two of these components, path and manner, are encoded in different forms across world's languages. In satellite-framed languages, the manner of motion is encoded within the main verb and the path of motion in a prepositional phrase such as *climbing up*. In contrast, verb-framed languages like Turkish or Spanish include the path of motion typically in the main verb and express manner in a subordinated verb or adverbial clause such as *tırmanarak* ç*ıktı* "go up climbing" in Turkish (Talmy, 1985, 2000). This makes Turkish a path-focused language. Thus, Turkish speakers typically use two separate clauses to express manner and path in their speech and can omit manner of motion in expressions (Özçalişkan, 2016). Although there are fewer manner verbs in Turkish compared with English, it is still possible for Turkish speakers to produce sentences involving only manner of motion such as *kız koştu* "the girl ran."

During the process of learning verbs and relational terms, children may first become *language-generalists* who can differentiate and parse event components, even when these components will not be emphasized in their native language (Göksun et al., 2017). Thus, before children learn to talk about events, they attend to these event components that will be encoded in languages (e.g., Göksun et al., 2010, 2017; Golinkoff & Hirsh-Pasek, 2008; Mandler, 2012). Later, children can become *language-specific* interpreters of events by learning and being exposed to their native language (Göksun et al., 2017, for other views see Choi & Bowerman, 1991). The concepts that vary crosslinguistically can be learned with increasing levels of language specific experience (Gentner & Bowerman, 2009). This process is similar to infants' discrimination of phonemes in the world's languages, even when their native language does not have a different encoding for two sounds (Kuhl et al., 1997; Werker & Tees, 1984; Werker & Lalonde, 1988). After exposure to their native language, infants become less sensitive to the phonemic distinctions that are not encoded in their native language. Kuhl, Conboy, Padden, Nelson, and Pruitt (2005) showed that infants' discrimination of phonetic contrasts at 6 months of age predict their later vocabulary knowledge at 13, 16, and 24 months of age assessed by MacArthur-Bates Communication Development Inventory (see also Tsao, Liu, & Kuhl, 2006).

When we examine how infants conceptualize events, research suggests that infants are good at discriminating and categorizing the motion event components of manner, path, figure, and ground (Göksun et al., 2011; Konishi, Stahl, Golinkoff, & Hirsh-Pasek, 2016; Pruden, Göksun, Roseberry, Hirsh-Pasek, & Golinkoff, 2012, 2013; Pulverman, Golinkoff, Hirsh-Pasek, & Buresh, 2008, 2013; Song, Pruden, Golinkoff, & Hirsh-Pasek, 2016). For example, Pulverman and colleagues (2013) indicated that 7-month-old English- and Spanish-reared prelinguistic infants could detect changes of path and manner in dynamic motion events regardless of the differing ways their languages encode motion. Infants were first habituated to an animated starfish performing a specific motion such as *bending under* a ball. At test, they were presented either manner (e.g., *twisting under* the ball) or path (*bending over* the ball) changes. Regardless of the language they learn, infants dishabituated to both path and manner changes. This is important as English and Spanish belong to different language typologies in terms of how they code motion events (see also Song et al., 2016). Before 14 months of age, infants not only distinguish these event components, but also extract a common path or manner across several exemplars in the animated starfish clips such as detecting the common manner across several paths (*hopping* under, *hopping* over, *hopping* across, *hopping* past; Pruden et al., 2012, 2013; see also Konishi et al., 2016).

Similar to detecting path and manner in events, infants also perceive language specific encoding of containment (i.e., when an object is fully or partially surrounded by a container) or support (i.e., when an object appears on top of a surface) relations. In English, containment relations are typically encoded with the preposition 'in' and support relations are encoded with the preposition 'on.' Yet, in Korean, these relations are expressed by the degree of fitness between two objects: *kkita* refers to a tight-fitting relation between two objects (e.g., a gift in a cover and a ring on a finger) and *nehta* refers to a loose-fitting relation between objects (e.g., a pen in a case and a mug on a table; Choi & Bowerman, 1991). English-reared 5-month-old infants could differentiate between these tight-fitting and loose-fitting distinctions that are not emphasized in their native language (Hespos & Spelke, 2004).

In conclusion, these findings suggest that infants are good at detecting components of events and relations between objects, starting from a common base as being *language-generalists*. However, more studies are required to show whether children learning other languages that have differential encoding of path and manner components can also detect these components. The first goal of this study is to examine whether Turkish-learning children can recognize path and manner changes in naturalistic dynamic events as the first step of learning verbs. We then ask whether attending to path and manner in dynamic motion events are linked to children's verb knowledge and whether they lexicalize motion events in line with their native language, as found in the link between infants' attention to phonemic distinctions and their later language learning (Kuhl et al., 2005). Even though phonological development and its relation to later word learning seems to be parallel to infants' conceptualization of events and later verb learning, this is only an imperfect analogy (see Göksun et al., 2010 for further discussion). For our study, individual differences in attending to event components (as in the case of phonemic distinction) at an early age can be related to children's verb learning, which is similar to how individual differences in attending to phonemic distinctions can lead to different outcomes. However, the processes seem to be different in these domains. In the phonology domain, infants become less sensitive to speech sounds that are not encoded in their native language. Those infants who can achieve this process earlier would have larger vocabularies later. In the semantic domain, the process is somewhat different. Each motion event involves both path and manner components. Infants need to focus on these event components at an early age, continue to attend, and later map them in relation to their native language. That is, they would still attend and use both path and manner with different encoding styles in each language.

Mapping Verbs Onto Events

Children are good at event conceptualization; yet, learning how to map verbs onto events and lexicalizing relational terms are challenging for young children (Gentner, 1982). That is, for young children becoming language-specific interpreters of events and packaging motion event components in the ways that adult use is demanding (Gentner, 1982). Several factors help children learn verbs (Brandone, Pence, Golinkoff, & Hirsh-Pasek, 2007; Golinkoff & Hirsh-Pasek, 2008). For example, the sentential structure in which the novel verb is presented, as proposed by the syntactic bootstrapping theory, could help children to interpret the meaning of a novel verb. The number and arrangement of noun phrases in a sentence can guide children's interpretation of novel verbs (Gleitman, 1990). This theory has been tested across many languages (Brandone et al., 2007; Candan et al., 2012; Fisher, 1996; Naigles, 1996), presenting evidence for the importance of the sentential context as well as the morphosyntactic structure (Göksun, Küntay, & Naigles, 2008; Matsuo, Kita, Shinya, Wood, & Naigles, 2012) that help children identify whether a verb is transitive or intransitive. Other factors that are significant for verb learning can be related to extralinguistic cues such as saliency of actions (Brandone et al., 2007) or social cues such as eye-gaze (e.g., Nappa, Wessel, McEldoon, Gleitman, & Trueswell, 2009; Roseberry, Hirsh-Pasek, & Golinkoff, 2014; Tomasello & Farrar, 1986).

Even though these studies present factors that can influence how children map verbs onto events or package event components, they do not display evidence for how children may move from being language-generalists to being language-specific interpreters. Maguire and colleagues (2010) showed that children could be language-specific interpreters of events by 3 years of age. Two-and-a-half-year-old children learning English, Spanish, and Japanese mapped a novel verb to the path of the action whereas 3-year-olds displayed language-specific patterns of each language such that English-learning children were more likely to map a novel verb to manner compared with children learning Spanish or Japanese. These findings are intriguing; yet, the study did not directly test the hypothesis that there could be a direct link from event conceptualization to becoming language-specific interpreters. In a recent longitudinal study, Konishi and colleagues (2016) tested this hypothesis and found that infants' categorization of path and manner in nonlinguistic events (e.g., extracting the path 'through' from various dynamic scenes like spin *through*, hop *through*, jog *through*) at 13 to 15 months of age predicted children's overall verb comprehension at 27 and 33 months of age. This study was the first to present evidence on how individual differences in event categorization are associated with later verb knowledge. To examine how children become language-specific interpreters of events, it is critical to ask whether infants' detection of event components is also related to how children talk about motion events as expressed in their native language.

Talking About Motion Events

Another line of studies has examined how and when children express motion events in their first language (e.g., Allen et al., 2007; Gullberg, Hendriks, & Hickmann, 2008; Hickmann, 2006; Hickmann, Taranne, & Bonnet, 2009; Hohenstein, 2005; Hohenstein, Naigles, & Eisenberg, 2004; Ji, Hendriks, & Hickmann, 2011; Özçalişkan & Slobin, 1999; Papafragou, Massey, & Gleitman, 2006; Papafragou & Selimis, 2010). For example, using elicited narratives, Özçalişkan and Slobin (1999) showed that 3- to 11-year-olds and adult Turkish and Spanish speakers used path and manner verbs equally. However, English-speaking counterparts produced more manner than path verbs in accordance with the prominence of encoding manner in English.

In another study using animated and controlled motion events, Allen and colleagues (2007) investigated whether 3-year-old English-, Japanese-, and Turkish-speaking children used universal or language-specific patterns in encoding motion events compared with adults. The results showed that 3-year-old English-speaking children expressed path and manner in a single clause sentence (e.g., 'The red guy rolled down') more often than their Turkish-speaking peers who expressed path in the verb, but manner in a subordinate clause (e.g., 'The red guy went down, rolling'). This crosslinguistic difference was also observed in adults. Although Turkish- and Japanese-speaking children reflected adult-like patterns as producing information in two separate clauses, Turkish-speaking children also produced single-clause expressions significantly more than Turkish-speaking adults suggesting a universal pattern (single-clause) of encoding motion events. Similar findings were revealed when English- and French-speaking children at the same ages were tested (Hickmann et al., 2009). In particular, the combination of manner and path information was prevalent in the expressions of English-speaking children when compared with that of French-speaking children. These findings suggest that starting from 3 years of age, children become not only language-specific interpreters of their first language, but also describe motion in accordance with their native language.

The Present Study

Building on the previous work by Konishi et al. (2016), this longitudinal study investigates whether infants' ability to look longer to changes in manner and path predicts their later knowledge of verbs as well as how they describe motion events. We have three main questions: (a) Do infants learning Turkish, a verb-framed language, differentiate both manner and path changes in motion events? (b) Is early detection of event components related to children's later verb comprehension and (c) how do children lexicalize motion events in their native language?

We tested children at three time points. At Time 1, 12- to 16-month-old infants were tested using the Preferential Looking Paradigm (Golinkoff, Hirsh-Pasek, Cauley, & Gordon, 1987) to examine whether they preferred to look at path and manner changes in events. As calculated by Konishi et al. (2016), we used an average novelty score derived from path and manner test trials, including children who had scores for both test trials. This is a stringent way to derive the novelty preference score for both path and manner. We used the novelty score rather than attention to each path and manner separately, because it presents attention to each component; a requirement for being language-generalist.

Additionally, these event components are both encoded in Turkish and Turkish children need to attend to both of these event components. Parents also assessed their children's language and communicative skills by filling out the Turkish Communicative Development Inventory–I (TCDI-I; Aksu-Koç et al., 2011), which is a Turkish adaptation of the original MacArthur-Bates Communicative Development Inventory (MB-CDI). After a year, as a control language measure, at Time 2, children were tested on their receptive vocabulary skills using TIFALDI-R (Berument & Güven, 2010), a Turkish adaptation of Peabody Picture Vocabulary Test (PPVT). At Time 3, same children were tested when they were 32- to 39-months-old, using a verb comprehension task adapted from Konishi et al. (2016) as well as the motion event description task (Akhavan, Nozari, & Göksun, 2017; Göksun, Lehet, Malykhina, & Chatterjee, 2015). As a control language measure, children were also tested on their expressive vocabulary skills using TIFALDI-E (Berument & Güven, 2010).

First, we hypothesize that the novelty preference for path and manner changes (as an indicator of infants' attention to events and being language-generalists) at Time 1 will predict verb comprehension at Time 3 over and beyond children's vocabulary knowledge assessed by standardized tests at Time 2 and Time 3. That is, based on the previous findings of Konishi et al. (2016), infants who were good at detecting changes in events (a requirement for verb learning) would have larger relational vocabulary later. We also predict that the ability to prefer novel path and manner at Time 1 will be related to how motion events are lexicalized at Time 3. That is, we expect that at age 3, Turkish children will produce both manner and path of motion in their descriptions as found in the previous studies (Allen et al., 2007; Özçalişkan & Slobin, 1999). However, Turkish, as being a verb-framed language, encodes path of motion frequently in the main verb. Thus, we hypothesize that the novelty preference score for event components (i.e., being attentive to event components—overall sensitivity to event components) at Time 1 will predict children's use of path of motion more than manner of motion (i.e., either by mentioning the path in the verb or together with the manner of motion in a particle) as an indication of being language-specific interpreters of events. It is important to note that children who attend to both components (as indicated by the novelty score) will be more attuned to events and will later encode them better in line with their native language.

Method

Time 1: Infants' Preference to Path and Manner Changes

Participants. Thirty-two 12- to 16-month-old (15 girls, M_{age} = 14.5, SD_{age} = 1.43), full-term monolingual, Turkish-reared children from upper-middle class families formed the final sample. Five of these infants were excluded from the analyses due to either presence of side bias (for split-screen trials, looking at one side more than 80% of their looking time) or lack of sufficient attention (looking at the entire video less than 50% of their looking time) or not completing the task at the preferential looking paradigm. This sample was drawn from a larger study in which we recruited 58 children (power analysis with .80 power and .10 effect size yielded 64 participants). However, in this article we only included children who participated in all three sessions (and finished at least one task in each session). This resulted in a total of 32 participants for the final sample for this article. Infants were tested at infant daycare centers where they came for play groups. Before or after the play group session, the experiment was conducted in a separate room cleared from decorations. The study was approved by Koç University's Institutional Review Board (Project name: Turkish learning children's relational word learning: A longitudinal study - Protocol no: 2014.052.IRB.2.015).

Stimuli and procedure. Test stimuli consisted of four path (up, down, around, and in front of) and four manner combinations (walk, run, slide, and twirl), making a total of four different motion events performed by a woman outdoors. Children were tested via nonlinguistic Preferential Looking Paradigm (Göksun et al., 2011; Golinkoff et al., 1987; Konishi et al., 2016) where they were seated on their mothers' laps approximately 50 cm away from the 13-in. MacBook laptop computer screen (12 × 8 in.). The built-in camera of the laptop computer was used to record children's eye gaze for offline coding. The stimuli contained the following phases: introduction, salience, familiarization, and test trials (see Figure 1 for the design). All trials were separated by animated fixation stimuli (a moving baby face coupled with a melody) to grab attention. No linguistic stimuli or audio of any type accompanied the clips.

Introduction phase. A mother and a baby (sitting on the mother's lap) appeared first on one side of the screen and then on the other side to ensure that infants were familiarized to clips playing on both sides of the screen. Each stimulus was presented for 6-s.

Salience phase. Infants saw two salience trials that became test trials later. This was used to determine whether there was any a priori preference for either clip before familiarization. The sa-

	Path and Manner Discrimination Study Design	
Salience Trial 1 (12 s)	a woman walking upstairs	a woman walking downstairs
Salience Trial 2 (12 s)	a woman walking downstairs	a woman running downstairs
Familiarization (4 times – 12s)	a woman walking downstairs	
Path Change Test Trial (12 s)	a woman walking upstairs	a woman walking downstairs
Manner Change Test Trial (12 s)	a woman walking downstairs	a woman running downstairs

Figure 1. The design presented to the infants in the preferential looking paradigm. The dynamic visual videos were presented to children. For a sample stimulus see Göksun et al. (2015).

lience phase contained two 12-s clips of two events on a split-screen.

Familiarization phase. Infants watched four 12-s clips of the same stimulus on full screen that presented a woman performing an action (e.g., a woman is *walking downstairs*).

Test phase. Infants watched the test events simultaneously on the split-screen for 12-s for both path and manner test trials. In the path discrimination test trial, infants were presented with the stimuli demonstrating both the *same path* (a woman is *walking downstairs*) and a *novel path* (a woman is *walking upstairs*). Similarly, in the manner discrimination test trial, infants were presented the *same manner* (a woman is *walking downstairs*) from the familiarization phase together with a *novel manner* (a woman is *running downstairs*).

Attention-getter. A 3-s smiling baby face accompanied by the children's song "Oh, Susanna" was used between each phase of the experiment. The attention-getter helped renew infants' interest in the clips and reorient the infants' looking to the center of the screen.

The side of the novel path and novel manner was counterbalanced in both salience and test trials. The order of the path and manner discrimination trials was also counterbalanced in the salience and test trials. There were four counterbalanced conditions. Infants' looking times were recorded for later coding.

Coding and reliability. Using SuperCoder, two individuals coded infants' visual fixation to each event offline, frame by frame, by pressing a button to indicate how long infants looked to the left, right, and center of the screen (Hollich, 2008). Infants' novelty preference scores were calculated for each infant by taking looking time for the novel path or novel manner scene on the split screen and dividing it by their total looking time for path or manner test trial. The novelty preference scores were averaged across the two test trials (path and manner test trials) and calculated for each participant (Konishi et al., 2016). To calculate the interrater reliability, two trained coders independently coded the data of 20% of the participants. The interrater reliability scores were high between the two coders ($r = .92$).

Assessment of children's language competence by parents. Parents filled Turkish Communicative Development Inventory–I (TCDI-I) that evaluated communicative behaviors and vocabulary knowledge in children. TCDI-I was normed on children aged 8 to 16 months of age. TCDI-I consists of two parts: (a) Vocabulary Checklist (418 items) and (b) Actions and Gestures (69 items; Aksu-Koç et al., 2011). The Vocabulary Checklist includes separate sections that constitute relational words: 95 verbs (e.g., come, go, put, show, and take) and 10 prepositions (e.g., in, on, under, here, and behind), which enable us to derive scores such as relational word comprehension and nonrelational word comprehension.

Time 2: Assessment of Children's Vocabulary Knowledge

Participants. The same participants who were tested at Time 1 participated at Time 2 ($n = 32$, 15 girls, $M_{age} = 22.07$, $SD = 1.96$). Children were again tested at the same infant daycare center, in the same room.

Stimuli and procedure. At Time 2, participants were assessed for their vocabulary development by the Turkish Receptive Language Test (TIFALDI-R; Berument & Güven, 2010). This test aims to assess 2- to 12-year-old children's receptive vocabulary skills and includes 104 items. All items except seven (that were verbs) evaluates children's knowledge of nouns. Each item consists of four pictures on a page, one of which represents the stimulus word presented by the experimenter. The child's task was to respond by selecting the picture that best illustrates that word's meaning.

Time 3: Assessment of Children's Verb and Vocabulary Knowledge

Participants. The same children participated at Time 3 when they were 3-year-old ($n = 32$, 15 girls, $M_{age} = 35.05$, $SD = 1.76$). As children did not attend to play groups anymore, they were tested in the university lab.

The verb comprehension task. This task was adapted from Konishi et al. (2016), in which children were presented with a split-screen depicting two side-by-side actions. Before test trials, children were given two practice trials with common everyday objects (e.g., dog vs. cat) to make sure they pointed at the instructed stimulus. In a test trial, the same human actor performed similar actions simultaneously (e.g., running vs. walking). The task consisted of 20 trials. Children were tested on each verb once and they saw each verb pair only for one time. These verbs were taken from Konishi et al. (2016) and checked for their saliency in Turkish (from Turkish CDI). Once the video-clip started, the experimenter asked the child to point to the target action (e.g., [hangisi *koşuyor*?], which one is *running*?). If the child did not make any response, the video-clip would be shown again. After the second display, if there was still no response from the child, the experimenter would continue with the next verb pair. Children were assigned to one of the two conditions in which verb pairs were randomly ordered (verb pairs presented in each condition can be seen in Table 1). All children watched the same videos; however, the verb that was asked changed from one condition to the other. For example, in Condition 1, we asked which one was "running," whereas in Condition 2 we asked which one was "walking" (see Table 1 for the full list of stimuli).

Coding and reliability. All sessions were videotaped. One person coded each response into three categories: (a) correct responses (pointing clearly to the image), (b) incorrect responses (pointing to the nontarget or pointing somewhere in the middle of the targets), and (c) missing trials (failing to give any response). We calculated the accuracy by taking the percentage of correct responses with respect to the number of trials answered. If the child had responded less than 10 trials, their data would have been excluded, because they were not attentive during the task. Four children in total were excluded from this task due to failing to satisfy this criterion. The experimenter coded all trials online while implementing the task. Another coder separately coded all trials from videotaped recordings. The percent agreement between the experimenter and the independent coder was 100%.

The motion event description task. Children watched 12 movie clips, depicting different motion events with combinations of nine manners (cartwheel, climb, crawl, hop, jump, run, slide, skip, and walk) and 7 paths (across, around, behind, down, to, over, through, up, and under). Each movie lasted for 3–4 s. All actions were performed by a woman in an outdoor

Table 1
The Verb Pairs Used in the Experiment

Intransitive pair			Instruction: English	Instruction: Turkish
Wave	Point		Which one is waving/pointing?	Hangisi el sallıyor/işaret ediyor?
Run	Walk		Which one is running/walking?	Hangisi koşuyor/yürüyor
Creep	Crawl		Which one is creeping/crawling?	Hangisi sürünüyor/emekliyor?
Crouch	Stand up		Which one is crouching/standing up?	Hangisi çömeliyor/ayağa Kalkıyor?
Dance	Turn		Which one is dancing/turning?	Hangisi dans ediyor/dönüyor?
Sit	Stand up		Which one is sitting/standing up?	Hangisi oturuyor/ayağa kalkıyor?
Hug	Blow kiss		Which one is hugging/blowing kiss?	Hangisi sarılıyor/öpücük yolluyor?
Jump	Lie down		Which one is jumping/lying down?	Hangisi zıplıyor/yere yatıyor?
Transitive pair		Direct object		
Pull	Push	Chair	Which one is pulling/pushing the chair?	Hangisi sandalyeyi çekiyor/itiyor?
Eat	Peel off	Banana	Which one is eating/peeling off the banana?	Hangisi muzu yiyor/soyuyor?
Open	Cover	Scarf	Which one is opening/covering the scarf?	Hangisi örtüyü açıyor/kapıyor?
Drink	Pour	Water	Which one is drinking/pouring the water?	Hangisi suyu içiyor/döküyor?
Throw	Hold	Ball	Which one is throwing/holding the ball?	Hangisi topu atıyor/tutuyor?
Take off	Put on	Hat	Which one is taking off/putting on the hat?	Hangisi şapkayı çıkarıyor/takıyor?
Blow	Burst	Balloon	Which one is blowing/bursting the balloon?	Hangisi balonu patlatıyor/şişiriyor?
Open	Close	Umbrella	Which one is opening/closing the umbrella?	Hangisi şemsiyeyi açıyor/kapıyor?
Light	Blow	Candle	Which one is lighting/blowing the candle?	Hangisi mumu yakıyor/söndürüyor?
Open	Shut	Lid	Which one is opening/shutting the lid?	Hangisi kapağı açıyor/kapatıyor?
Tie	Pull off	String	Which one is tying/pulling off the string?	Hangisi ipi bağlıyor/çekiyor?

area (e.g., woman *climbing up* a tree). These movies were a subset of videos used before to test adults in English (Göksun et al, 2015), Farsi (Akhavan et al., 2017), and Turkish (Karaduman, Çatak, Bahtiyar, & Göksun, 2015; see Table 2 for the full list of stimuli used in this study).

After watching each movie clip, the child was asked to describe the movie to the experimenter who was deliberately sitting across the child not to view the movie. All descriptions were videotaped for later transcription and coding. Two children did not perform the task and were excluded from the data.

Coding and reliability. All event descriptions were transcribed verbatim by native Turkish speakers. For each description, we coded whether each trial included manner, path or both information. (a) *Manner-only* descriptions included only manner of motion, but not path (e.g., atlıyor, [*she is*] *jumping*), (b) Path-only descriptions involved path description, but not manner information (e.g., çıkıyor, [*she is*] *exiting*), (c) Path-and-Manner descriptions included both path and manner components (e.g., sekerek giriyor, [*she*] *enters skipping*). Finally, to assess how frequently children produced Manner or Path information in any format, for each trial we also coded: (a) Manner-any (Manner-Only + Path-and-Manner descriptions) and (b) Path-any (Path-only + Path-and-Manner descriptions) categories.

Table 2
Motion Event Description Task Stimuli

Stimuli
Woman *climbing up* a tree
Woman *crawling under* a sign
Woman *hopping through* a door
Woman *jumping down*
Woman *running across* the street
Woman *skipping around*
Woman *running upstairs*
Woman *cartwheeling behind* a statue
Woman *sliding down*
Woman *stepping over* a bench
Woman *skipping to* door
Woman *walking across* the road

For the specific type of information children mentioned in their descriptions, the percentages of Manner-only, Path-only, and Path-and-Manner out of all their descriptions were calculated. For Manner or Path information produced in any format, the percentages of Manner-any and Path-any descriptions were calculated. "Manner-any" corresponded to descriptions including either manner-only or path-and-manner expressions. "Path-any" corresponded to descriptions including either path-only or path-and-manner expressions. The percentages were computed by taking the number of descriptions that pertained to a specific category and dividing the number to the total number of descriptions (all depict the target events) a child has responded to.

To establish reliability, two independent coders took part in the coding process. Reliability for the Manner-only, Path-only, and Path-and-Manner percentages was calculated via intraclass correlation coefficients (ICC). A high degree of reliability was found between the two coders. The average measure ICCs were .93, .92, and .94 for Manner-only, Path-only, and Path-and-Manner, respectively.

Assessment of children's vocabulary knowledge. Participants were assessed for their general vocabulary development by the Turkish Expressive Language Test (TIFALDI-E; Berument & Güven, 2010). This test aims to assess 2- to 12-year-old children's expressive vocabulary skills and includes 80 items. All items evaluate children's knowledge of nouns. Each item consists of a single picture demonstrated on a page. The child's task was to tell the word that corresponded to the object seen in the picture.

Results

Time 1: Infants' Preference to Path and Manner Changes

We first analyzed whether infants had any preferences to one of the stimuli at the salience phase. For both the path salience trials (M = .60, SD = .28 and M = .40, SD = .28) and the manner salience trials (M = .39, SD = .29 and M = .61, SD = .29) infants showed no preference for neither of the scenes depicting different motions, $t(25) = 1.89$, $p = .071$, $d = .08$ and $t(25) = -1.95$, $p = .063$, $d = .07$, respectively. We then investigated whether children's attention levels differed among the four consecutive familiarization trials and found no differences among these four trials, $F(3, 23) = 2.31$, $p = .142$, $\eta_p^2 = .233$ (for four familiarization trials M = .58, SD = .32; M = .63, SD = .29; M = .66, SD = .26; M = .49, SD = .36, respectively). That is, infants continued to watch the actions across four trials during the familiarization phase. Next, we analyzed whether there were any differences among the counterbalanced conditions in terms of novelty preferences for path and manner change. There were no main effects of condition for the path and manner test trials, $F(3, 23) = 2.52$, $p = .08$, $\eta_p^2 = .233$ and $F(3, 23) = .364$, $p = .78$, $\eta_p^2 = .042$, respectively.

We then carried out one-sample t tests to assess whether infants looked longer to the novel path and the novel manner above chance level. As a group, infants did not significantly look longer to the novel path or novel manner, $t(22) = .628$, $p = .54$ and $t(23) = 1.57$, $p = .13$, respectively. The differences between salience trial and test trial for both path and manner trials were not significant either, $t(22) = -1.81$, $p = .08$, and $t(23) = .376$, $p = .71$, respectively. Additionally, infants' looking times to the novel path and novel manner at test trials did not differ from each other, $t(22) = -.351$, $p = .62$. The underlying reason that infants failed to discriminate the novel path and manner stimuli might be due to the challenging within-design of this study (see Discussion section for further points). Although as a group infant failed to discriminate each component above chance level, there was a variance for path and manner test trials (see online supplemental materials Figure 1 for the distribution of path and manner test scores). Additionally, failing to detect a novel stimulus as a group does not mean that each participant failed to detect the novel path and novel manner. Therefore, we computed an average novelty preference score by taking looking time to the novel path and manner at test trials, following Konishi et al. (2016). This would allow us to examine whether attending to motion events as a whole (rather than each component; overall sensitivity to event components) relate to later language outcomes. Table 3 presents descriptive statistics for infants' total word comprehension, relational and nonrelational word comprehension assessed by TCDI-I.

Time 2: Assessment of Children's Vocabulary Knowledge

At Time 2, children were also assessed for their general vocabulary development by the TIFALDI-R (as a control measure for later analyses). Children's mean scores can be seen on Table 3.

Time 3: Assessment of Children's Verb Knowledge, Description of Motion Events, and Vocabulary Production

The verb comprehension task. Children who did not respond to at least 10 out of 20 verbs were excluded from the analyses, because those children were not attentive during the task. Twenty-nine children fulfilled this requirement; thus, three children were excluded for not completing the task. The percentage of correct responses ranged from 50 to 95%, with a mean score of 78.25% (SD = 15.15%). We computed one sample t test to investigate whether verb comprehension percentage was above chance

Table 3
Descriptive Statistics for Time 1, Time 2, and Time 3

Measure	M	SD	Min.	Max.
12–16 months				
Novelty preference score (average) (proportion)	.54	.21	.13	.95
Novelty preference score-path (proportion)	.54	.33	0	1.00
Novelty preference score-manner (proportion)	.60	.32	0	1.00
TCDI-I word comprehension	130.54	77.13	33	392
TCDI-I relational word comprehension	51.93	38.32	6	154
TCDI-I non-relational word comprehension	81.41	58.61	12	289
22–29 months				
TIFALDI-R ([2 to 80] possible score range)	13.15	5.74	3.00	24.00
32–39 months				
TIFALDI-E ([2 to 104] possible score range)	34.20	5.65	22.00	49.00
Motion event conceptualization task (proportions)				
Manner-only	.64	.17	.25	.90
Path-only	.24	.12	0	.42
Path-and-Manner	.12	.15	0	.38
Manner-any	.77	.12	.58	1.00
Path-any	.37	.17	.10	1.00
Verb comprehension task performance (proportions)	.79	.15	.50	.95

Note. TCDI-I = Turkish Communicative Development Inventory–I; TIFALDI-R = Turkish Receptive Language Test; TIFALDI-E = Turkish Expressive Language Test.

level (50%). We found that children performed significantly above chance level, $t(28) = 9.87$, $p < .001$, $d = 1.97$. We repeated the same analyses separately for transitive and intransitive verbs and found that children again performed above chance level for the each type of verbs, $t(28) = 4.143$, $p < .001$, $d = .82$ and $t(28) = 3.649$ $p < .001$, $d = .72$, respectively (see Table 3).

The motion event description task. Children's descriptions were coded for path, manner, and both path and manner use. The percentages were calculated using the number of total trials they provided proper event descriptions (e.g., if the child had not explained what happened in the video but only had given static depictions such as "there was a road," those trials would have been excluded). The number of trials that were correctly described ranged from 8 to 12 (out of 12) with a mean 10.19 trials ($SD = 1.6$).

A repeated measures analysis of variance (ANOVA) using categories (Path-only, Manner-only, and Path-and-Manner) as the within-subject variable showed that there was a main effect of the category, $F(2, 24) = 59.43$, $p < .001$, $\eta_p^2 = .712$. As shown in Figure 2, children preferred to use Manner-only ($M = 64$, $SD = 17$) descriptions more than Path-only ($M = 24$, $SD = 12$) or Path-and-Manner ($M = 12$, $SD = 12$) constructions. Likewise, Path-only descriptions were used more than Path-and-Manner descriptions (see Figure 2).

Assessment of children's vocabulary production. At Time 3, children were also assessed for their overall expressive vocabulary development by the TIFALDI-E. Children's mean scores can be seen on Table 3.

Preliminary analyses among variables. We performed correlations as preliminary analyses (see Table 4). Next, we ran one way-MANOVA to investigate whether there were any sex differences for the potential predictors. Results indicated that there were no sex differences on path-manner novelty preference score, TCDI-I, TIFALDI-R, and TIFALDI-E scores ($F(1, 16) = .826$, $p = .37$, $\eta_p^2 = .142$, $F(1, 16) = .551$, $p = .47$ and $F(1, 16) = .642$, $p = .436$, $\eta_p^2 = .121$, $F(1, 16) = 1.72$, $p = .296$, $\eta_p^2 = .072$, respectively; see Table 4). Thus, we did not include sex as a variable in the following analyses.

Time 1, 2, and 3: Is Early Detection of Event Components Related to Children's Later Verb Comprehension?

Based on the analyses and findings of Konishi et al.'s (2016) study, we predicted that infants' novelty preference score would predict verb knowledge over and beyond vocabulary competence and age at Time 3. Even though there was no correlation between the novelty preference score at Time 1 and the verb comprehension score at T3, infants' age, total vocabulary knowledge at Time 1 and Time 2 can hide the relation between these variables. A complete picture between these two variables would be presented by taking different variables into account at three timepoints in the same analysis.

For this purpose, we ran four linear regression models taking verb comprehension task performance as an outcome variable. We used either Time 1 TCDI-I overall word comprehension (general receptive vocabulary; Model 1) or Time 1 TCDI-I relational word comprehension (relational receptive vocabulary; Model 2) as the fourth predictor to predict verb comprehension. The total word comprehension score was included to test the hypothesis that only total relational word comprehension would be related to novelty preference. Additionally, the total word comprehension and total relational word comprehension did not correlate. Time 1 measures in these models depended on parental report (TCDI-I). The remaining two models (Model 3 and Model 4) included predictors depending only on child's performance at all time points without any TCDI scores. That is, Models 3 and 4 did not include parental report scores. As age at Time 1 and Time 3 was highly correlated, $r(31) = .93$, $p < .001$, we only included age at Time 3 as a control variable.

Model 1 included four predictors: (a) the path-manner novelty preference score at Time 1, (b) vocabulary competence assessed by TIFALDI-R at Time 2, (c) TCDI-I total word comprehension at Time 1, and (d) age at Time 3. Model 2 again included four predictors: (a) the path-manner novelty preference score at Time 1, (b) vocabulary competence assessed by TIFALDI-R at Time 2, (c) TCDI-I relational word comprehension at Time 1, and (d) age at Time 3. Thus, the difference between Model 1 and Model 2 was

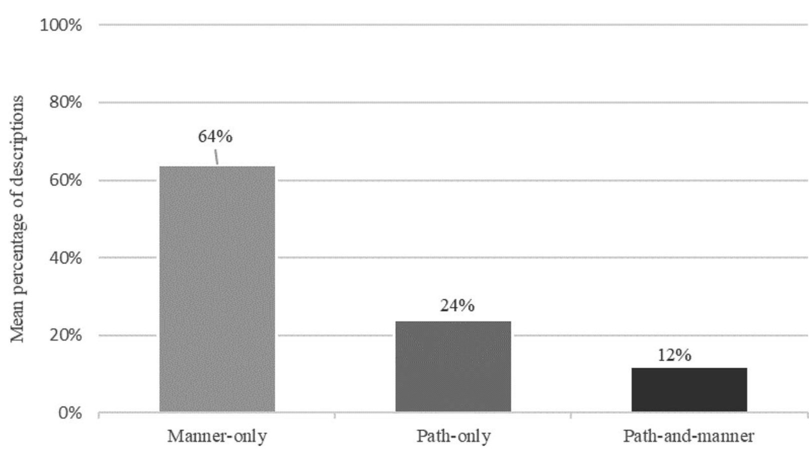

Figure 2. Children's lexicalization preferences in percentages for motion event description task.

Table 4
Correlations Between Variables for Time 1, Time 2, and Time 3

Correlations	2	3	4	5	6	7	8	9	10	11	12	13
1. Time 3 age	−.16	.44*	.37	.30	.32	.01	−.07	.09	.08	.00	.16	.13
2. Time 1 PM - average novelty preference	1	.28	.14	.24	−.27	.15	−.48*	.48*	.48*	−.14	.26	.04
3. Time 1 TCDI-I word comprehension		1	.87**	.64**	.27	.04	−.04	.01	.04	−.05	.27	.12
4. Time 1 TCDI-I nonrelational comprehension			1	.17	.27	.06	.00	−.05	.00	−.06	.16	−.03
5. Time 1 TCDI-I relational comprehension				1	.11	−.01	−.05	.07	.05	.01	.33	−.01
6. Time 2 TIFALDI-R					1	−.08	.11	−.06	−.11	.08	.58**	.22
7. Time 3 Path-only						1	−.59**	−.17	.59**	−.99*	−.09	−.17
8. Time 3 Manner-only							1	−.69**	−.1**	.59**	−.06	.17
9. Time 3 Path-and-Manner								1	.70**	.17	.15	−.06
10. Time 3 Path-any									1	−.58**	.06	−.17
11. Time 3 Manner-any										1	.09	.17
12. Time 3 verb comprehension											1	.38
13. Time 3 TIFALDI-E												1

Note. TCDI-I = Turkish Communicative Development Inventory–I; TIFALDI-R = Turkish Receptive Language Test; TIFALDI-E = Turkish Expressive Language Test.
* $p < .05$. ** $p < .01$.

either including TCDI-I total word comprehension or TCDI-I relational word comprehension.

Model 3 included three predictors: (a) the path-manner novelty preference score at Time 1, (b) vocabulary competence assessed by TIFALDI-R at Time 2, and (c) age at Time 3, without including any of the TCDI-I scores. Finally, Model 4 included four predictors: (a) the path-manner novelty preference score at Time 1, (b) vocabulary competence assessed by TIFALDI-R at Time 2, (c) vocabulary production assessed by TIFALDI-E at Time 3, and (d) age at Time 3. Model 4 included both expressive and receptive vocabulary scores taken from children at two time points.

The summary of regression analyses for all models can be seen in Table 5. Models 1 and 2 were not significant in explaining variance in verb comprehension, $F(3, 16) = 2.05$, $p = .163$ and $F(3, 16) = 2.36$, $p = .123$, respectively. However, Model 3 was significant ($R^2 = .32$), $F(3, 16) = 3.51$, $p = .046$, explaining 32% of the variance in verb comprehension scores. The only significant predictor for the model was infants' ability to prefer novel path and manner components at Time 1 ($\beta = .47$, $p = .045$). Neither age nor overall vocabulary competence was a significant predictor for verb comprehension (see Table 5). Results indicated that as children were better in detecting novel path and manner components at Time 1, they were better in verb comprehension at Time 3. Model 4 was also significant ($R^2 = .45$), $F(3, 16) = 3.35$, $p = .046$. Again, the only significant predictor was the novelty preference for path and manner at Time1 ($\beta = .48$, $p = .045$). Model 4 explained 37% of the variance that occurred in verb comprehension (see the online supplemental materials Figure 2 and Table 1 for scatterplots and correlations on the looking times at the novel path and novel manner separately and their relations to verb comprehension at Time 3).

Time 1, 2, and 3: Is Early Detection of Event Components Associated With How Children Lexicalize Motion Events In Their Native Language?

We analyzed whether infants' preference to novel path and manner components was related to how they later lexicalized motion events. As in the case of verb comprehension outcome, the total vocabulary knowledge at Time 1 and Time 2 can hide the relation between the novelty preference score at Time 1 and talking about different components at Time 3. A complete picture between these variables would be presented by taking different variables into account at three timepoints in the same analyses. For this purpose, we performed regression analyses taking the same predictor variables for models we used for verb comprehension.

Table 5
Regression Analysis: Verb Comprehension Score as the Outcome Variable

Predictor	*SE* (*B*)	β	*t*	*p*
		Model 1		
Age at Time 3	3.96	.30	.82	.43
Vocabulary competence at Time 2	.87	.33	.92	.37
TCDI-I word comprehension at Time 1	.08	.22	.81	.43
Novelty preference at Time 1	20.05	.37	1.37	.20
R^2	.23			
		Model 2		
Age at Time 3	3.63	.51	1.52	.16
Vocabulary competence at Time 2	.83	.25	.73	.49
TCDI-I relational comprehension at Time 1	.11	.28	1.19	.26
Novelty preference at Time 1	18.52	.39	1.60	.14
R^2	.28			
		Model 3		
Age at Time 3	3.30	.22	.81	.43
Vocabulary competence at Time 2	.73	.43	1.54	.15
Novelty preference at Time 1	15.45	.47	2.22	.04*
R^2	.32*			
		Model 4		
Age at Time 3	3.22	.27	.99	.34
Vocabulary competence at Time 3	.64	.31	1.42	.18
Vocabulary competence at Time 2	.77	.27	.92	.38
Novelty preference at Time 1	14.87	.48	2.32	.04*
R^2	.37*			

Note. TCDI-I = Turkish Communicative Development Inventory–I.
* $p < .05$.

We have taken four categories (Manner-only, Path-only, Manner-any, and Path-any percentage scores) we have derived from detailed speech coding of motion event description task as outcome variables. We did not run the analyses for the Path-and-Manner category, because this variable did not meet normality assumption of the regression analysis. A Kolmogorov–Smirnov test was used to test for normality. The results showed that the dependent variable Path-and-Manner was not normally distributed ($D(27) = .17$, $p = .041$).

Model 1 was not significant for Manner-only and Path-only outcome variables, $F(3, 16) = 1.76$, $p = .221$ and $F(3, 16) = .58$, $p = .685$, respectively. Similarly, for Model 2, regression analyses for Manner-only and Path-only as outcome variables were not significant, $F(3, 16) = 2.05$, $p = .170$ and $F(3, 16) = .331$, $p = .850$, respectively. For Model 3, regression analyses for Path-only was not significant, $F(3, 16) = .64$, $p = .602$. The model predicting Manner-only was significant ($R^2 = .32$), $F(3, 16) = 3.50$, $p = .04$. The only significant predictor was the novelty preference ($\beta = -.62$, $p = .012$). Neither age at Time 3 nor vocabulary competence at Time 2 was significant. However, the results of this analysis indicated that there was a negative relationship between novelty preference at Time 1 and Manner-only scores. In other words, as children's novelty preference increased, they tended to use fewer Manner-only in their descriptions. Finally, Model 4 was marginally significant in explaining variance in Manner-only scores ($R^2 = .34$), $F(3, 16) = 3.07$, $p = .059$. Again, the only significant predictor was the novelty preference ($\beta = -.65$, $p = .01$), confirming the inverse relationship between novelty preference at Time 1 and use of Manner-only descriptions at Time 3. Model 4 was not significant when Path-only was taken as the outcome variable, $F(3, 16) = .453$, $p = .769$ (see Table 6 for all regression analyses).

Finally, we ran linear regression models taking Manner-any and Path-any descriptions as outcome variables. Neither Model 1 nor Model 2 was significant in predicting Manner-any ($F(3, 16) = .617$, $p = .661$ and $F(3, 16) = .347$, $p = .84$, respectively) and Path-any descriptions ($F(3, 16) = 1.75$, $p = .223$ and $F(3, 16) = 2.05$, $p = .170$, respectively). For Model 3, the regression equation predicting Manner-any descriptions was not significant, $F(3, 16) = .68$, $p = .58$. However, the model predicting Path-any descriptions was significant, ($R^2 = .31$), $F(3, 16) = 3.42$, $p = .04$. The only significant predictor was infants' preference to novel path and manner components ($\beta = .62$, $p = .01$). Neither age at Time 3 nor vocabulary competence at Time 2 was a significant predictor. This finding indicates that infants who preferred to look longer to novel path and manner components produced more path information in any form at Time 3. Finally, Model 4 was not significant in predicting Manner-any descriptions, $F(3, 16) = .48$, $p = .74$; however, it was marginally significant in predicting Path-any descriptions, ($R^2 = .33$), $F(3, 16) = 2.99$, $p = .06$. In line with Model 3, again the only significant predictor was the novelty preference at Time 1, ($\beta = .65$, $p = .01$). Neither of the general vocabulary competence scores were significant predictors (see Table 7 for the regression analyses; see the online supplemental

Table 6
Regression Analyses: The Use of Manner-Only and Path-Only Structures in the Motion Event Lexicalization Task as Outcome Variables

Predictor	*SE* (*B*)	β	*t*	*p*	*SE* (*B*)	β	*t*	*p*
	Model 1: Manner-only				Path-only			
Age at Time 3	.04	.36	1.06	.32	.04	−.56	−1.37	.20
Vocabulary competence at Time 2	.01	−.27	−.78	.45	.01	.20	.49	.63
TCDI-I word comprehension at Time 1	.00	.09	.32	.76	.00	.35	1.01	.34
Novelty preference at Time 1	.33	−.65	−2.30	.04	.29	−.14	−.42	.69
R^2	.19				.15			
	Model 2: Manner-only				Path-only			
Age at Time 3	.04	.41	1.42	.19	.04	−.36	−.98	.35
Vocabulary competence at Time 2	.01	−.26	−.82	.43	.01	.12	.29	.78
TCDI-I relational comprehension at Time 1	.00	.22	.88	.40	.00	.11	.36	.73
Novelty preference at Time 1	.32	−.68	−2.47	.04	.31	−.13	−.36	.72
R^2	.24				.25			
	Model 3: Manner-only				Path-only			
Age at Time 3	.03	.26	1.15	.27	.03	−.33	−1.16	.27
Vocabulary competence at Time 2	.01	−.91	−.39	.70	.01	.23	.77	.45
Novelty preference at Time 1	.21	−.63	−2.93	.01	.20	.21	.78	.45
R^2	.32*				.12			
	Model 4: Manner-only				Path-only			
Age at Time 3	.03	.177	.76	.46	.03	−.31	−1.01	.33
Vocabulary competence at Time 3	.01	.269	1.22	.24	.01	−.1	−.19	.85
Vocabulary competence at Time 2	.01	−.13	−.55	.59	.01	.24	.76	.46
Novelty preference at Time 1	.20	−.65	−3.07	.01	.21	.22	.77	.46
R^2	.34				.15			

Note. TCDI-I = Turkish Communicative Development Inventory–I.
* $p < .05$.

Table 7
Regression Analyses: The Use of Manner-Any and Path-Any in the Motion Event Lexicalization Task as Outcome Variables

Predictor	*SE* (*B*)	β	*t*	*p*	*SE* (*B*)	β	*t*	*p*
	Model 1: Manner-any				Path-any			
Age at Time 3	.04	.58	1.43	.19	.04	−.35	−1.02	.33
Vocabulary competence at Time 2	.01	−.22	−.55	.59	.01	.25	.74	.48
TCDI-I word comprehension at Time 1	.00	−.36	−1.05	.32	.00	−.10	−.36	.73
Novelty preference at Time 1	.29	.14	.40	.69	.33	.65	2.30	.04
R^2	.13				.18			
	Model 2: Manner-any				Path-any			
Age at Time 3	.04	.37	1.01	.34	.04	−.40	−1.39	.19
Vocabulary competence at Time 2	.01	−.14	−.34	.75	.01	.25	.78	.46
TCDI-I relational comprehension at Time 1	.00	−.12	−.39	.71	.00	−.22	−.90	.39
Novelty preference at Time 1	.31	−.13	−.4	.73	.32	.68	2.47	.04
R^2	.25				.24			
	Model 3: Manner-any				Path-any			
Age at Time 3	.03	.33	1.18	.25	.03	−.25	−1.12	.28
Vocabulary competence at Time 2	.01	−.24	−.82	.43	.01	.08	.34	.74
Novelty preference at Time 1	.20	−.22	−.83	.42	.21	.62	2.89	.01
R^2	.13				.31*			
	Model 4: Manner-any				Path-any			
Age at Time 3	.03	.32	1.02	.33	.03	−.17	−.74	.47
Vocabulary competence at Time 3	.01	.061	.21	.84	.01	−.3	−1.21	.25
Vocabulary competence at Time 2	.01	−.25	−.81	.43	.01	.12	.50	.63
Novelty preference at Time 1	.21	−.23	−.81	.43	.20	.65	3.03	.01
R^2	.14				.33			

* $p < .05$.

materials Figures 3 and 4, and Table 1 for scatterplots and correlations on the looking times at the novel path and novel manner separately and their relations to lexicalization of events at Time 3).

Discussion

The present study investigated whether Turkish-learning children's early understanding of motion event components predicted their later verb comprehension and how they lexicalized these event components in line with their native language. We asked whether (a) infants learning Turkish, a verb-framed language, differentiated both manner and path changes in motion events; (b) early detection of path and manner was related to children's later verb comprehension; and (c) how they described motion events.

For this purpose, we tested children at three time points: Time 1 (12- to 16-month-olds), Time 2 (22- to 29-month-olds), and Time 3 (32- to 39-month-olds). Overall, we found that as a group, infants did not look at novel path and novel manner above chance level at Time 1. However, our results suggested that individual differences in early detection of event components (Time 1) were related to children's later verb comprehension (Time 3). Children who preferred to look at the novel path and manner components had also better performance later for comprehending verbs. Early detection of event components was also associated with how children lexicalized motion events at a later age. Children who were better at discriminating path and manner changes at the end of their first year, were more likely to lexicalize events in line with Turkish language by using more path structures (with or without manner of motion) and less manner structures.

The first goal of this study was to examine whether Turkish-learning children can recognize path and manner changes in dynamic motion events. Previous research found that before 13- to 15-months of age, infants attend to changes in both path and manner with animated (Pulverman et al., 2008, 2013) and realistic stimuli (Song et al., 2016). However, in our study at Time 1, infants, as a group, did not prefer to look longer to the novel path or novel manner displays above chance level. Konishi and colleagues (2016) found the same result in their path and manner categorization task. One possibility would be related to infants' familiarization to the stimuli. Even though infants attended to the stimuli in the familiarization trials, the mean proportion of looking times was lower than the previously reported proportions in Song et al. (2016). There was variation across infants as indicated by the standard deviations in looking times. Still some infants might have needed to process the stimuli longer to better discriminate path and manner changes. One would also consider whether this difference could be related to the specific language acquired (in this case Turkish). We do not think this is a likely possibility as the discrimination of path and manner components has been replicated in different languages like Spanish, which is similar to Turkish in terms of encoding motion (Pulverman et al., 2008). The differences between our results and earlier studies might be due to the stringent within-subject design used to test path and manner components in the current study. All previous studies used between-subjects designs. Infants might have shown novelty preference above chance level if path and manner tests had given separately in a between-subjects design that simplifies the components to attend to. Another possibility was that our stimuli were different than the previous ones in terms of body orientation or gait use, even though adults did not mention these in their ratings (Göksun et al., 2015).

Second, we examined whether individual differences in 12- to 16-month-old infants' ability to distinguish changes in path and manner in dynamic motion events predicted their verb comprehension when they were 32- to 39-months-old. Infants' novelty preference score at Time 1 did not correlate with their comprehension score at Time 3. However, the novelty preference score at Time 1 predicted children's verb comprehension performance when the overall vocabulary comprehension score at Time 2 and age at Time 3 or overall vocabulary production at Time 3 were included in the regression model. This suggests that there is a unique relationship between attending to event components and later verb comprehension above and beyond children's overall vocabulary comprehension at Time 2 and overall vocabulary production at Time 3. That is, after taking out the variance for the total word comprehension at Time 2 or overall vocabulary production at Time 3, children who attended to the novel event components at Time 1 had more verb comprehension at Time 3. Even though it is a surprising finding that we did not find any relation between overall receptive and expressive vocabulary measures and verb comprehension, the vocabulary tests primarily assessed children's noun knowledge. These findings suggest that verb comprehension would be more linked to event perception than overall word production. Similarly, infants' relational vocabulary knowledge at Time 1 was not related to their later verb comprehension. This could be due to the nature of these two different scores: one was obtained from parents and the other one was received directly from children. Yet, our result is in line with Konishi et al. (2016) who found that infants' (13-to-15-month-olds) earlier ability to categorize path and manner components predicted their verb comprehension when they were 27- to 32-months-old. We demonstrated that not only categorizing event components but also simply attending to event components (or preferring to look at novel event components) might be related to verb learning. That is, infants who are better at extracting changes in event components may continue to attend to events and can learn verbs better at later stages of their developmental trajectory. Although our verb comprehension task involved a variety of verbs including manner and path verbs, there were not many items specific for path and manner verb comprehension. Future studies can specifically be designed to test whether a novelty preference score for path and manner can be directly related to path and/or manner verb comprehension.

During the process of learning relational terms, we argued that the first step is detection of event components (Göksun et al., 2010, 2017). In this prospective longitudinal study, we presented one of the first evidence on the link between basic event detection and children's later verb learning. One explanation for this relationship is that children who attend to events, continue to do it throughout their early childhood and comprehend a variety of relational language at an earlier age. Another possibility is that a general attentional mechanism might be correlated with infants' attention to events and their naming of these events later. Even though we did not test infants' general attention, only the infants who were attentive during the entire video were included in the preferential looking study. Thus, attention was similar across children and it may not be the overall attentional skills, but specifically detecting the event components, that lead to better verb knowledge.

Our results also provide further support on the individual differences in infants' earlier attentiveness to linguistic components and how they relate to their later word knowledge. For example, Kuhl and colleagues (2005) showed that infants' discrimination of phonetic contrasts at 6 months of age predict their later vocabulary knowledge at 13, 16, and 24 months of age assessed by MacArthur-Bates Communication Development Inventory (see also Tsao et al., 2006). Similarly, children's identification of spoken words at 18 months of age is linked to their vocabulary knowledge after a year (Fernald & Marchman, 2012). Even though different processes occur in the phonological and semantic domains, here, we present evidence for the acquisition of specific vocabulary growth (i.e., verbs) and how it can be predicted by earlier understanding of events.

The last aim of the present study was to examine whether early detection of critical event components in dynamic events was associated with how children lexicalized motion events in their native language later. To become language-specific interpreters of events, children need to talk about motion events as coded in their native language. We found that children mainly used Manner-only descriptions compared with Path-and-Manner and Path-only descriptions. Turkish is a path-focused language and, therefore, the overall use of Manner-only descriptions (mostly in single clauses) might point to the fact that language-specific patterns might not yet been consolidated by age 3. This finding corroborates previous research; some remnants of universal tendencies for encoding motion might still be in line at this age (Allen et al., 2007). Likewise, Özçalişkan and Slobin (1999) showed that 3-year-old Turkish-learning children produced Path and Manner verbs equally. Another possible explanation for this finding could be related to our stimuli. The dynamic motion events children watched involved salient Manners, such as skipping and crawling. These are not usual Manners to be performed to reach a destination; hence, it could attract children's attention. As part of another study, we used the same stimuli with Turkish native adult speakers (n = 29) and asked them to describe these same motion events (Aktan-Erciyes, Kızıldere, & Göksun, 2019). Results showed that native Turkish adult speakers used Path-and-Manner constructions as a dominant form of expressing events (in 83% of the responses), followed by Path-only (13%) and Manner-only (4%) constructions. That is, Turkish speaking adults incorporate Manner and Path information together. For 3-year-olds it might have been difficult to integrate both Path and Manner in the same description. As a result, these children would prefer to mention the salient component (here Manner of motion) in their responses.

Even though children preferred to describe the events using Manner-only constructions, earlier detection of Path and Manner components predicted how children lexicalize motion events in line with their native language. When Turkish-reared infants were more successful in detecting Path and Manner components, they lexicalized motion events using more Path descriptions. Path is the core component in motion events and Turkish is a path-salient language that encodes path of motion in the main verb (Talmy, 1985). Thus, children with greater novelty preference for Path and Manner, talked about path more frequently in any form (with or without Manner). This result is further supported by the inverse relationship found between early novelty preference for path and manner components and later use of Manner-only descriptions. As infants could attend to novel Paths and Manners at Time 1, they used fewer Manner-only descriptions at Time 3. It seems that those children who paid more attention to changes in events could also learn to use Turkish-specific encodings in their descriptions. A possible question would be why attending to both Path and Manner changes is linked to language-specific encoding of motion. We suggest that children first need to attend to each component within an event and then they figure out which components are more pronounced in their native language. That is, to be an effective speaker of one's native language at an early age in the domain of relational vocabulary, one needs to be, first of all, attentive to events; a precursor for learning and talking about relational words. This finding can be taken as the first direct evidence showing the role of detecting event components on children's later lexicalization of events; on the way to becoming *language-specific* interpreters of events (Göksun et al., 2017).

In conclusion, the present study tested the theory whether infants' early detection of main event components, Path and Manner, is related to their later relational word knowledge and talking about motion events (Göksun et al., 2010, 2017; Golinkoff & Hirsh-Pasek, 2008). As a result of the prospective longitudinal study and testing infants at three time points, we have a small sample size, which is a limitation of the study. We only included children who participated in all three sessions (and finished at least one task in each session). Our findings need to be replicated, not only in Turkish but also in other languages to examine whether our findings on becoming language-specific interpreters can be extended to other languages. Our results provide support on the link between early event processing and later verb comprehension and production. Extending on the previous findings (Konishi et al., 2016), we also indicated that early detection of event components is not only associated with verb comprehension, but also predicts how children lexicalize event components that meet the requirements of their native language. These findings point to the importance of early event understanding in learning verbs.

References

Akhavan, N., Nozari, N., & Göksun, T. (2017). Expression of motion events in Farsi. *Language, Cognition and Neuroscience, 32,* 792–804.

Aksu-Koç, A., Küntay, A. C., Acarlar, F., Maviş, I., Sofu, H., Topbaş, S., & Turan, F. (2011). Türkçe'de erken sözcük ve dilbilgisi gelişimini ölçme ve değerlendirme çalışması. Türkçe İletişim Gelişimi Env aterleri: Tige-I ve Tige-II. Tübitak raporu [The study of early vocabulary and grammar development in Turkish. Turkish Communication Development Inventories: Tige-I and Tige-II. Tübitak report.]

Aktan-Erciyes, A., Kızıldere, E., & Göksun, T. (2019, March). *The role of second language proficiency on speech gestures and eye-gaze for descriptions of motion events in first and second languages*. Poster presented at ICPS Biennial Congress, Paris.

Allen, S., Ozyürek, A., Kita, S., Brown, A., Furman, R., Ishizuka, T., & Fujii, M. (2007). Language-specific and universal influences in children's syntactic packaging of Manner and Path: A comparison of English, Japanese, and Turkish. *Cognition, 102,* 16–48. http://dx.doi.org/10.1016/j.cognition.2005.12.006

Berument, S. K., & Güven, A. G. (2010). *Turkish expressive and receptive language test: Receptive Vocabulary Sub-Scale (TİFALDİ-RT)*. Turkey: Turkish Psychological Society.

Bowerman, M., & Levinson, S. C. (Eds.). (2001). *Language acquisition and conceptual development*. New York, NY: Cambridge University Press. http://dx.doi.org/10.1017/CBO9780511620669

Brandone, A. C., Pence, K. L., Golinkoff, R. M., & Hirsh-Pasek, K. (2007). Action speaks louder than words: Young children differentially weight perceptual, social, and linguistic cues to learn verbs. *Child Development, 78,* 1322–1342. http://dx.doi.org/10.1111/j.1467-8624.2007.01068.x

Candan, A., Küntay, A., Yeh, Y., Cheung, H., Wagner, L., & Naigles, L. (2012). Language and age effects in children's processing of word order. *Cognitive Development, 27,* 205–221. http://dx.doi.org/10.1016/j.cogdev.2011.12.001

Choi, S., & Bowerman, M. (1991). Learning to express motion events in English and Korean: The influence of language-specific lexicalization patterns. *Cognition, 41,* 83–121. http://dx.doi.org/10.1016/0010-0277(91)90033-Z

Fernald, A., & Marchman, V. A. (2012). Individual differences in lexical processing at 18 months predict vocabulary growth in typically developing and late-talking toddlers. *Child development, 83,* 203–222.

Fisher, C. (1996). Structural limits on verb mapping: The role of analogy in children's interpretations of sentences. *Cognitive Psychology, 31,* 41–81. http://dx.doi.org/10.1006/cogp.1996.0012

Gentner, D. (1982). Why nouns are learned before verbs: Linguistic relativity versus natural partitioning. In S. Kuczaj (Ed.), *Language development: Language, thought, and culture* (Vol. 2, pp. 301–334). Hillsdale, NJ: Erlbaum.

Gentner, D., & Boroditsky, L. (2001). Individuation, relativity, and early word learning. *Language Acquisition and Conceptual development, 3,* 215–256.

Gentner, D., & Bowerman, M. (2009). Why some spatial semantic categories are harder to learn than others: The typological prevalence hypothesis. In J. Guo, E. Lieven, S. Ervin-Tripp, N. Budwig, S. Özçalışkan, & K. Nakamura (Eds.), *Crosslinguistic approaches to the psychology of language: Research in the tradition of Dan Isaac Slobin* (pp. 465–480). New York, NY: Erlbaum.

Gleitman, L. (1990). The structural sources of verb meanings. *Language Acquisition, 1,* 3–55. http://dx.doi.org/10.1207/s15327817la0101_2

Göksun, T., Aktan-Erciyes, A., Hirsh-Pasek, K., & Golinkoff, R. (2017). Event perception and language learning: Early interactions between language and thought. In N. Ketrez, A. C. Küntay, Ş. Özçalışkan, & A. Özyürek (Eds.), *Social environment and cognition in language development: Studies in honor of Ayhan Aksu-Koç. Trends in Language Acquisition Research (TiLAR) Series* (pp. 179–198). Amsterdam: John Benjamins. http://dx.doi.org/10.1075/tilar.21.12gok

Göksun, T., Hirsh-Pasek, K., & Golinkoff, R. M. (2010). Trading spaces: Carving up events for learning language. *Perspectives on Psychological Science, 5,* 33–42. http://dx.doi.org/10.1177/1745691609356783

Göksun, T., Hirsh-Pasek, K., Golinkoff, R. M., Imai, M., Konishi, H., & Okada, H. (2011). Who is crossing where? Infants' discrimination of figures and grounds in events. *Cognition, 121,* 176–195. http://dx.doi.org/10.1016/j.cognition.2011.07.002

Göksun, T., Küntay, A., & Naigles, L. (2008). Turkish children use morphosyntactic bootstrapping in interpreting verb meaning. *Journal of Child Language, 35,* 291–323. http://dx.doi.org/10.1017/S0305000907008471

Göksun, T., Lehet, M., Malykhina, K., & Chatterjee, A. (2015). Spontaneous gesture and spatial language: Evidence from focal brain injury. *Brain and Language, 150,* 1–13. http://dx.doi.org/10.1016/j.bandl.2015.07.012

Golinkoff, R. M., & Hirsh-Pasek, K. (2008). How toddlers begin to learn verbs. *Trends in Cognitive Sciences, 12,* 397–403. http://dx.doi.org/10.1016/j.tics.2008.07.003

Golinkoff, R. M., Hirsh-Pasek, K., Cauley, K. M., & Gordon, L. (1987). The eyes have it: Lexical and syntactic comprehension in a new paradigm. *Journal of Child Language, 14,* 23–45. http://dx.doi.org/10.1017/S030500090001271X

Gullberg, M., Hendriks, H., & Hickmann, M. (2008). Learning to talk and gesture about motion in French. *First Language, 28,* 200–236. http://dx.doi.org/10.1177/0142723707088074

Hespos, S. J., & Spelke, E. S. (2004). Conceptual precursors to language. *Nature, 430,* 453–456. http://dx.doi.org/10.1038/nature02634

Hickmann, M. (2006). The relativity of motion in first language acquisition. *Space across languages: Linguistic systems and cognitive categories* (pp. 281–308). Amsterdam: John Benjamins. http://dx.doi.org/10.1075/tsl.66.17hic

Hickmann, M., Taranne, P., & Bonnet, P. (2009). Motion in first language acquisition: Manner and Path in French and English child language. *Journal of Child Language, 36,* 705–741. http://dx.doi.org/10.1017/S0305000908009215

Hohenstein, J. M. (2005). Language-related motion event similarities in English-and Spanish-speaking children. *Journal of Cognition and Development, 6,* 403–425. http://dx.doi.org/10.1207/s15327647jcd0603_5

Hohenstein, J., Naigles, L., & Eisenberg, A. (2004). Keeping verb acquisition in motion: A comparison of English and Spanish. In D. G. Hall & S. R. Waxman (Eds.), *Weaving a lexicon* (pp. 569–602). Cambridge, MA: MIT Press.

Hollich, G. (2008). *Supercoder: A program for coding preferential looking* (Version 1.7.1) [Computer software]. West Lafayette, IN: Purdue University.

Ji, Y., Hendriks, H., & Hickmann, M. (2011). Children's expression of voluntary motion events in English and Chinese. *Waiguoyu, 34,* 2–19.

Karaduman, A. N., Çatak, E. N., Bahtiyar, S., & Göksun, T. (2015, March). *The role of gestures in describing motion in English and Turkish*. Poster presented at the International Conference on Psychological Science, Amsterdam, the Netherlands.

Konishi, H., Stahl, A. E., Golinkoff, R. M., & Hirsh-Pasek, K. (2016). Individual differences in nonlinguistic event categorization predict later motion verb comprehension. *Journal of Experimental Child Psychology, 151,* 18–32. http://dx.doi.org/10.1016/j.jecp.2016.03.012

Kuhl, P. K., Andruski, J. E., Chistovich, I. A., Chistovich, L. A., Kozhevnikova, E. V., Ryskina, V. L., . . . Lacerda, F. (1997). Cross-language analysis of phonetic units in language addressed to infants. *Science, 277,* 684–686. http://dx.doi.org/10.1126/science.277.5326.684

Kuhl, P. K., Conboy, B. T., Padden, D., Nelson, T., & Pruitt, J. (2005). Early speech perception and later language development: Implications for the "critical period." *Language Learning and Development, 1,* 237–264. http://dx.doi.org/10.1080/15475441.2005.9671948

Maguire, M. J., Hirsh-Pasek, K., Golinkoff, R. M., Imai, M., Haryu, E., Vanegas, S., . . . Sanchez-Davis, B. (2010). A developmental shift from similar to language-specific strategies in verb acquisition: A comparison of English, Spanish, and Japanese. *Cognition, 114,* 299–319. http://dx.doi.org/10.1016/j.cognition.2009.10.002

Mandler, J. M. (2012). On the spatial foundations of the conceptual system and its enrichment. *Cognitive Science, 36,* 421–451. http://dx.doi.org/10.1111/j.1551-6709.2012.01241.x

Matsuo, A., Kita, S., Shinya, Y., Wood, G. C., & Naigles, L. (2012). Japanese two-year-olds use morphosyntax to learn novel verb meanings. *Journal of Child Language, 39,* 637–663. http://dx.doi.org/10.1017/S0305000911000213

Naigles, L. R. (1996). The use of multiple frames in verb learning via syntactic bootstrapping. *Cognition, 58,* 221–251. http://dx.doi.org/10.1016/0010-0277(95)00681-8

Nappa, R., Wessel, A., McEldoon, K. L., Gleitman, L. R., & Trueswell, J. C. (2009). Use of speaker's gaze and syntax in verb learning. *Language Learning and Development, 5,* 203–234. http://dx.doi.org/10.1080/15475440903167528

Özçalişkan, Ş. (2016). Do gestures follow speech in bilinguals' description of motion? *Bilingualism: Language and Cognition, 19,* 644–653. http://dx.doi.org/10.1017/S1366728915000796

Özçalişkan, Ş., & Slobin, D. I. (1999). Learning "how to search for the frog": Expression of manner of motion in English, Spanish, and Turkish. In A. Greenhill, H. Littlefield, & C. Tano (Eds.), *Proceedings of the 23rd annual Boston university conference on language development* (pp. 541–552). Somerville, MA: Cascadilla Press.

Papafragou, A., Massey, C., & Gleitman, L. (2006). When English proposes what Greek presupposes: The cross-linguistic encoding of motion events. *Cognition, 98,* B75–B87. http://dx.doi.org/10.1016/j.cognition.2005.05.005

Papafragou, A., & Selimis, S. (2010). Event categorization and language: A cross-linguistic study of motion. *Language and Cognitive Processes, 25,* 224–260. http://dx.doi.org/10.1080/01690960903017000

Pruden, S. M., Göksun, T., Roseberry, S., Hirsh-Pasek, K., & Golinkoff, R. M. (2012). Find your manners: How do infants detect the invariant manner of motion in dynamic events? *Child Development, 83,* 977–991. http://dx.doi.org/10.1111/j.1467-8624.2012.01737.x

Pruden, S. M., Roseberry, S., Göksun, T., Hirsh-Pasek, K., & Golinkoff, R. M. (2013). Infant categorization of path relations during dynamic events. *Child Development, 84,* 331–345. http://dx.doi.org/10.1111/j.1467-8624.2012.01843.x

Pulverman, R., Golinkoff, R. M., Hirsh-Pasek, K., & Buresh, J. S. (2008). Infants discriminate manners and paths in non-linguistic dynamic events. *Cognition, 108,* 825–830. http://dx.doi.org/10.1016/j.cognition.2008.04.009

Pulverman, R., Song, L., Hirsh-Pasek, K., Pruden, S. M., & Golinkoff, R. M. (2013). Preverbal infants' attention to manner and path: Foundations for learning relational terms. *Child Development, 84,* 241–252. http://dx.doi.org/10.1111/cdev.12030

Roseberry, S., Hirsh-Pasek, K., & Golinkoff, R. M. (2014). Skype me! Socially contingent interactions help toddlers learn language. *Child Development, 85,* 956–970. http://dx.doi.org/10.1111/cdev.12166

Song, L., Pruden, S. M., Golinkoff, R. M., & Hirsh-Pasek, K. (2016). Prelinguistic foundations of verb learning: Infants discriminate and categorize dynamic human actions. *Journal of Experimental Child Psychology, 151,* 77–95. http://dx.doi.org/10.1016/j.jecp.2016.01.004

Talmy, L. (1985). Lexicalization patterns: Semantic structure in lexical forms. In T. Shopen (Ed.), *Language typology and syntactic description* (pp. 57–149). New York, NY: Cambridge University Press.

Talmy, L. (2000). *Toward a cognitive semantics: Volume 1. Concept structuring systems*. Cambridge, MA: MIT Press.

Tomasello, M., & Farrar, M. J. (1986). Joint attention and early language. *Child Development, 57,* 1454–1463. http://dx.doi.org/10.2307/1130423

Tsao, F. M., Liu, H. M., & Kuhl, P. K. (2006). Perception of native and non-native affricate-fricative contrasts: Cross-language tests on adults and infants. *The Journal of the Acoustical Society of America, 120,* 2285–2294. http://dx.doi.org/10.1121/1.2338290

Werker, J. F., & Lalonde, C. E. (1988). Cross-language speech perception: Initial capabilities and developmental change. *Developmental Psychology, 24,* 672–683. http://dx.doi.org/10.1037/0012-1649.24.5.672

Werker, J. F., & Tees, R. C. (1984). Cross-language speech perception: Evidence for perceptual reorganization during the first year of life. *Infant Behavior and Development, 7,* 49–63. http://dx.doi.org/10.1016/S0163-6383(84)80022-3

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