Language and Cognitive Processes

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Available online: 25 Oct 2011

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Ψ **Psychology Press**
Taylor & Francis Group

Turkish- and English-speaking children display sensitivity to perceptual context in the referring expressions they produce in speech and gesture

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Speakers choose a particular expression based on many factors, including availability of the referent in the perceptual context. We examined whether, when expressing referents, monolingual English- and Turkish-speaking children: (1) are sensitive to perceptual context, (2) express this sensitivity in language-specific ways, and (3) use co-speech gestures to specify referents that are underspecified. We also explored the mechanisms underlying children's sensitivity to perceptual context. Children described short vignettes to an experimenter under two conditions: The characters in the vignettes were present in the perceptual context (*perceptual context*); the characters were absent (*no perceptual context*). Children routinely used nouns in the *no perceptual context* condition, but shifted to pronouns (English-speaking children) or omitted arguments (Turkish-speaking children) in the *perceptual context* condition. Turkish-speaking children used underspecified referents more frequently than English-speaking children in the *perceptual context* condition; however, they

compensated for the difference by using gesture to specify the forms. Gesture thus gives children learning structurally different languages a way to achieve comparable levels of specification while at the same time adhering to the referential expressions dictated by their language.

An object or person can be identified using a variety of referring expressions. For example, a toy can be referred to in English as *a toy, the toy, this, that,* or *it*. Speakers choose a particular expression based on many factors. Perceptual context (physical co-presence) and preceding discourse context (linguistic co-presence) influence a speaker's choice of a specific referring expression form. Referents that are available in the perceptual or discourse context are typically conveyed in a more attenuated manner; that is, with less specified linguistic forms such as pronouns or omitted arguments. Referents that are not available in the perceptual and discourse context, and thus need to be specified, are conveyed more explicitly, often with specified linguistic forms such as nouns. For example, if a child sees her friend looking at a teddy bear, since the object is present in the perceptual context, the child is likely to use an attenuated form, *it* in "*I like it*", to refer to the teddy bear. Similarly, if the child first says "*My mother bought me a teddy bear last week*", establishing the teddy bear as a referent in discourse context, she can also go on to say "*I like it*", again using an attenuated form *it* to refer to the teddy bear. A speaker also has the option of using gesture to help specify the intended referent. For example, the child can point to the teddy bear or produce an iconic gesture that represents a characteristic of the teddy bear (e.g., a gesture with open hands to the sides characterising the size of the teddy bear) along with an underspecified verbal form to refer to the teddy bear. The purpose of this study is to explore whether young children are sensitive to what is, and is not, available in the perceptual context when choosing how to refer to an object or person in speech and gesture and the mechanisms behind this sensitivity.

PREVIOUS RESEARCH ON FACTORS INFLUENCING CHILDREN'S USE OF REFERRING EXPRESSIONS

Young children have been shown to be sensitive to whether a referent is available in the preceding *discourse context.* Starting from around 2 years of age, children use nouns for referents that have not been mentioned previously in the discourse more frequently than pronouns or omitted arguments (e.g., for Inuktitut: Allen, 2000; for English: Matthews, Lieven, Theakston, & Tomasello, 2006; for Italian: Serratrice, 2005; for German: Wittek & Tomasello, 2005). Our first goal is to examine children's sensitivity to *perceptual context* when choosing referring expressions. There is evidence suggesting that,

starting from 3- to 3.5-years of age, children are sensitive to whether an entity is perceptually available in the context. Children use nouns to refer to entities that were not available in the past perceptual context (e.g., for English: Allen & Schroder, 2003; O'Neill, 1996; Salomo, Lieven, & Tomasello, 2010) or are not available in the current perceptual context (e.g., for Turkish: Gürcanlı, Nakipoğlu, & Özyürek, 2007; for English: Matthews et al., 2006) more frequently than pronouns or omitted arguments. Children also choose their referring expressions to unambiguously identity a referent in the perceptual context. English-speaking children are less likely to use a pronoun as a referring expression if there is more than one referent that can match the gender of the pronoun (Karmiloff-Smith, 1985). Our study experimentally manipulates availability of referents in the perceptual context. The study differs from previous studies in three ways: (1) we compare two groups of children, each learning a structurally different language (English or Turkish); (2) we examine children's gestures as well as their speech as referring expressions; and (3) we explore the mechanisms behind children's sensitivity to information in perceptual context.

CROSS-LINGUISTIC DIFFERENCES IN REFERRING EXPRESSIONS

All languages provide ways for speakers to display their sensitivity to how available a referent is in the perceptual context. However, the specific forms that languages offer for this purpose vary across languages. In the current study, we focus on two languages, English and Turkish, which differ from each other on a number of important dimensions with respect to referring expressions. English is a language that does not allow argument omission.[1] It uses nouns to express referents that are not available in the perceptual or preceding discourse context. Referents that are available are likely to be expressed using pronouns (Chafe, 1976; Levinson, 1987, 1991). In contrast, Turkish is generally considered a pro-drop language, and thus allows optional omission of arguments[2] (as do other pro-drop languages such as Chinese,

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[1] There are a few exceptions in English where subjects can be omitted; clauses that allow subject omission include imperatives, e.g., "*Open this door.*", wanna questions, e.g., "*Wanna eat this?*", implied first person declaratives in past tense, e.g., "*Got it!*", progressive participles in responses to questions, e.g., "*Brushing teeth*".

[2] In Turkish, since person and number information about the subject is marked on the verb (through agreement morphemes), the subject can be recovered even when it is omitted (Küntay & Slobin, 1999; Turan, 1995). Turkish-speaking children mark person and number information on the verb when they omit subjects beginning around 2 years of age (Küntay & Slobin, 1999). Turkish also allows omission of objects. Since objects are not identified via morphemes on the verb, their omission is governed by discourse-pragmatic factors (Gürcanlı et al., 2007).

Korean, and Inuktitut). Like English, Turkish also uses nouns to specify referents that are not available in the perceptual or discourse context. However, in Turkish, referents that are available are often omitted completely from the discourse (i.e., they are conveyed using omitted arguments; Allen, 2000; Clancy, 1993; Gürcanlı et al., 2007; Huang, 1994).

English and Turkish also have different pronoun systems. The simple personal pronouns in Turkish are *ben, sen, o, biz, siz, onlar.* Unlike English, Turkish personal pronouns are not marked for gender or animacy. Thus, the pronoun *o* can be translated as *he, she,* or *it.* Again unlike English, Turkish has a three-way distinction in its demonstrative pronoun system: *bu, o,* and *şu. Bu* refers to objects closer to the speaker's point of view; *o* refers to objects that are more distant; *şu* is neutral with respect to distance and is used for referents that are not in the listener's visual attention, regardless of the actual distance of the referent (if the listener's attention is already on the referent, *bu* or *o* is used, Küntay & Özyürek, 2006). The *O* can be used as both a personal and demonstrative pronoun. Locative pronouns, such as *buraya,* are derived by adding a dative suffix (*-a*) to demonstrative pronouns, and display similar referential characteristics to the demonstrative pronouns from which they are derived (Göksel & Kerslake, 2005). Given cross-linguistic differences of this sort, by comparing children exposed to English versus Turkish, we can examine not only whether children take perceptual context into account when choosing referring expressions, but also whether they display this sensitivity in language-specific ways. Furthermore, we can explore whether the developmental trajectory for referring expressions is similar across languages.

Previous studies have asked whether children display sensitivity to *perceptual context* in language-specific ways. For example, Matthews et al. (2006) showed that, when asked to describe events on a video, English-speaking 3- to 4-year-old children chose different referring expressions (nouns versus pronouns) depending on whether the listener could see the intended referent. Similarly, Gürcanlı et al. (2007) showed that, when asked to describe short vignettes, Turkish-speaking 3- to 4-year-old children omitted arguments more frequently if their listener watched the vignette with them, compared to a condition where the listener did not watch the vignette with them. However, no previous study has used the same materials, or examined the full range of referring expressions, to compare speakers of languages that differ in the specific forms that they offer for expressing sensitivity to availability of referents. Given cross-linguistic differences in the forms and functions of referring expressions, the second goal of our study is to examine whether children learning different languages make use of language-specific devices when they choose referring expressions for referents that are, and are not,

available in the perceptual context. To investigate the question, we compared referring expressions in children exposed to English or Turkish.

GESTURE AS A REFERRING EXPRESSION

Much of the previous literature exploring children's sensitivity to perceptual context has focused exclusively on children's speech. In contrast, our study examines how children use gesture as well as speech to identify referents. Gesture and speech form a tightly linked system. Gestures are an integral part of communication, not only for older children and adults (e.g., Goldin-Meadow, 2003; McNeill, 1992, 2005), but also for children at the earliest stages of language learning (e.g., Bates, 1976; Furman, Özyürek, & Küntay, 2010; Goldin-Meadow, 2005; Liszkowski, 2008; Liszkowski, Carpenter, & Tomasello, 2007). Children use gestures that convey information, including information that is not expressed or fully specified in their speech, during spontaneous conversations with caregivers (Goldin-Meadow & Butcher, 2003; Iverson & Goldin-Meadow, 2005; Özçalışkan & Goldin-Meadow, 2005), when telling a story (Demir, 2010; Demir & So, 2007), or when explaining how they solved a problem (Church & Goldin-Meadow, 1986; Goldin-Meadow, 2005; Goldin-Meadow, Alibali, & Church, 1993).

Because gesture can be used to refer to objects or people that are not referred to in speech, analysing gesture in addition to speech has the potential to reveal a more complete picture of children's sensitivity to perceptual context than analysing speech alone. Indeed, starting from 2 years of age, children have been found to use pointing gestures to disambiguate referents in the perceptual context (O'Neill & Topolevec, 2001). Similarly, So, Demir, & Goldin-Meadow (2010) found that children are particularly likely to use gestures when their speech is underspecified. In this study, both English- and Chinese-speaking children, ages 4 to 5, used gesture to disambiguate their pronouns and supplement their omitted arguments, and did so more often when the referent was new to the discourse context. The third goal of our study, then, is to examine whether gesture plays a similar role in children's sensitivity to perceptual context. We ask whether young children use gesture to specify referents that are, and are not, in the perceptual context when the accompanying speech is underspecified.

THE MECHANISMS UNDERLYING CHILDREN'S SENSITIVITY TO PERCEPTUAL CONTEXT

What are the mechanisms behind children's sensitivity to perceptual context? The research on referring expression choice primarily focuses on

audience design or, more specifically, speakers' sensitivity to the listener as the basis for choosing particular referring expressions. According to this account, speakers assume that referents available in the perceptual or discourse context are cognitively accessible (i.e., given, accessible) to the listener and thus do not need to be further specified. In contrast, referents that are not available in the perceptual or discourse context are assumed to be cognitively inaccessible (i.e., new) to the listener and thus need to be expressed through highly specified forms such as nouns (e.g., Chafe, 1976, 1994; Clark, 1992; Grice, 1975; Gundel, Hedberg, & Zacharski, 1993). The findings on children's sensitivity to perceptual context described thus far can be explained by children's sensitivity to the information needs of their listener. For example, in Matthew et al. (2006), 3-year-old children were more likely to refer to entities with nouns when they were not visible because those entities were not accessible to their listeners. Similarly, in Karmiloff-Smith (1985), English-speaking children were less likely to use pronouns if there was more than one referent that could match the gender of the pronoun because using a pronoun would create ambiguity for the listener.

A more recent approach to explaining sensitivity to perceptual context focuses on speaker internal processing constraints. According to this approach, top-down constraints (e.g., sensitivity to the listener) and bottom-up constraints (e.g., memory constraints or processing limitations) work in tandem to influence referential expression choice (e.g., Epley, Morewedge, & Keysar, 2004; Horton & Gerrig, 2005; Nadig & Sedivy, 2002). For example, a recent study by Arnold and Griffin (2007) showed that adults were less likely to use pronouns in narratives containing two characters of different genders than in narratives containing only one character, even though a pronoun would have been unambiguous for the listener in both conditions. The difference is attributed to the competition between the two characters in the *speakers'* discourse model, making each character less accessible. Thus, choosing to use a pronoun to refer to a character is assumed to be a function of how accessible the referent is in the speaker's own internal discourse model. Recent studies suggest that internal processing constraints might also play a role in children's referential expression choice. Under high processing load, children are more likely to perform egocentrically in referential communication tasks than under low processing load (e.g., Epley et al., 2004). However, not much is known about how sensitivity to listener needs versus speaker internal constraints influence children's referring expressions. Thus, the fourth goal of our study is to examine the contribution of these two different factors to children's sensitivity to perceptual context.

THE CURRENT STUDY

We asked English- and Turkish-speaking children to describe short animated vignettes to an experimenter who watched the vignettes with them on a video screen under two perceptual availability conditions. In all vignettes at least two characters or objects were of same gender and/or animacy. In one condition (*no perceptual context*), the screen went blank after the vignette had finished, and the children were asked to described what had happened in the animation to the experimenter with no visual props. In the other condition (*perceptual context*), the video screen stayed on, and the children could point at the characters in the vignette during their descriptions. In addition, the children were given a book displaying pictures of the characters in the vignettes, and they were allowed to point to the characters in the book during their descriptions. Both the screen and the book were also visible to the experimenter. Thus, in the latter, but not the former, condition the children shared with the experimenter a current perceptual context that included the referents.

Our first goal was to examine how English-speaking and Turkish-speaking children use speech and gesture to express referents in the absence and presence of a perceptual context. If, as we shall find, both groups of children use both speech and gesture to express both present and absent referents, our second goal was to examine whether English- and Turkish-speaking children use language-specific strategies when they choose referring expressions in contexts that do, and do not, provide perceptual support. We analysed not only children's speech but also their gestures. Consequently, our third goal was to examine whether children use gesture to specify referents when their speech does not, and whether the use of gesture varies in contexts that do, and do not, provide perceptual support for their listener.

Our final goal was to examine the mechanisms behind children's sensitivity to perceptual context. The sensitivity-to-listener-needs account and the speaker-internal-constraints account both make predictions that can be tested in our data. The sensitivity-to-listener-needs account predicts that children will be more explicit when referents are not available in the perceptual context, and thus less accessible to their listener, than when referents are available in the perceptual context. In addition, the speaker-internal-constraints account makes predictions about cross-cultural differences, As described above, gender and animacy are relevant to referent choice in English but not in Turkish. In all of our vignettes, at least two characters or objects were of the same gender and/or animacy. Thus, the speaker-internal-constraint approach predicts high competition between characters for English-speaking children because gender and animacy have to be considered when planning an utterance in English. On the other hand, the account predicts relatively low competition between characters for Turkish-speaking

children because neither gender nor animacy needs to be considered when planning an utterance in Turkish. As a result, under the speaker-internal-constraint account, English-speaking children ought to produce more specified forms (i.e., more nouns) than Turkish-speaking children.

METHOD

Participants

Ten English-speaking children (five females, $M = 54.8$ months, $SD = 6.4$ months) and 10 Turkish-speaking children (five females, $M = 46.8$ months, $SD = 6.5$) participated in the *no perceptual context* condition. A different group of nine English-speaking children (three females, $M = 50.8$ months, $SD = 10.9$ months) and nine Turkish-speaking children (five females, $M = 47.4$ months, $SD = 8.5$) participated in the *perceptual context condition.*[3] All of the children were being raised as monolingual speakers and were largely from middle-class families. English-speaking children were tested in Chicago, IL, USA, and Turkish-speaking children were tested in Bursa, Turkey. We chose children in this age range because, during this period, children are able to talk about referents that are not available in the perceptual context.

Stimuli

Each child was shown 12 animated, dynamic vignettes, each 5 to 10 seconds long. Each animation depicted an event involving people, real objects, or animated toys (see Goldin-Meadow, So, Özyürek, & Mylander, 2008, for a description of the stimuli). Characters and objects included in the vignettes had names that were common in vocabularies of 4- to 5-year-old children. English marks gender (*she* versus *he*) and animacy (*she/he* versus *it*) in pronouns; Turkish does not. To make the task of distinguishing among referents of comparable difficulty for the two groups, we designed vignettes in which at least two characters or objects were of same gender and/or animacy (e.g., two objects, two boys) and would require the same pronominal form (*it, he*). As a result, the English-speaking children could not use different pronouns to distinguish the two characters (and, in this sense, were on a par with the Turkish-speaking children). For example, to describe a vignette where a dog carries a flower to a doghouse, both English- and Turkish-speaking children would have to use the same pronoun (*it* in English, *bu/o* in

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[3] English-speaking children in the *no perceptual context* condition were significantly older than Turkish-speaking children, $t(18) = 2.63$, $p < .05$. As a result, in the subsequent analyses, age was included as a covariate.

Turkish) to refer to all of the characters.[4] Three types of events were shown in the vignettes: (1) crossing-space events in which a person or animal moved an object to a new location (e.g., *a dog carries a flower to a doghouse; a man gives a black tool box to another man*), (2) in-place events in which a person or vehicle acted upon an entity but did not move it (e.g., *a bike bumps a dog*), and (3) crossing-space events in which a person, animal, or object moved on its own to a new location (e.g., *a tool box moves to a school bus; a duck moves to a wheelbarrow*). A list of the events can be found in the Appendix 1.

Procedure

Data collection was carried out in the children's homes and in a kindergarten classroom using a laptop computer. In both conditions, the experimenter watched each vignette with the child in order to ensure that the child was paying attention to the vignettes. After each vignette, the experimenter asked a sentence-focused question, "*What happened?*" When asked such a question, children above age 3 seem to be aware that they are expected to provide maximal information about the event participants and actions, whether or not the experimenter also witnessed the event (Serratrice, 2008). The vignettes were presented in the same order for all of the children. The stimuli and the procedure were the same in both conditions with the following exception. In the *no perceptual context* condition, after each vignette was shown, the screen went blank. In the *perceptual context* condition, the screen did not go blank thus leaving the last scene of the event on the laptop; in addition, during the descriptions, the child was given a picture of the first screen shot of the vignette. The picture was positioned between the laptop and the child so that the child and the experimenter (who sat next to the child) had a clear view of both. Characters were displayed in the book and on the screen in order to maximise children's pointing opportunities in the *perceptual context* condition. Since in both conditions the experimenter watched the vignettes with the child, the child and the experimenter had the same amount of shared knowledge. However, the referents were perceptually available to the child and experimenter (in the picture and on the screen) only in the *perceptual context* condition.

Speech coding

Native speakers of English and Turkish transcribed the children's speech. Our unit of analyses was the clause. The clause is a grammatical unit that

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[4] In English, gendered personal pronouns can also be used to refer to animals. Four vignettes included an animal and an object. Across the two conditions, English-speaking children used the pronoun *it* more frequently (53 times) than the gendered pronoun *he* (10 times) to refer to the animal in these vignettes. Thus, although a gendered personal pronoun can be used to refer to animals in English, the children in our study preferred to use the pronoun *it*.

expresses a proposition[5] and includes a predicate[6] (Crystal, 1980; Hartmann & Stork, 1972; Pei & Gaynor, 1954). We analysed only the first clause that the children produced in their descriptions to equate the discourse status of all referents mentioned by children, i.e., all of the referents were introduced to the discourse context for the first time. Each clause could contain a subject and one or more objects. For each clause, we identified the words used to refer to the subject and the object(s) and categorised the words as a function of their form: noun (e.g., in English: *flower, baby*; in Turkish: *bisiklet* [*bicycle*], *köpek* [*dog*]), pronoun (e.g., in English: *she, it, this, there*; in Turkish: *bu, o, buraya*), or omitted argument.

For each sentence, we calculated the total number of referring expressions that could be expressed in that sentence. We identified the number of referring expressions based on the event type described by the verb the child used in that sentence. For example, to describe the vignette in which a dog carries a flower to a doghouse, if a child used "*carry*" as the verb, then the sentence could contain referring expressions for the *dog*, the *flower*, and the *doghouse*. If the child chose to describe the same event with the verb "*go*", the sentence could contain the *dog* and the *doghouse*. The number of referring expressions that could have been mentioned served as the denominator for each of our analyses. We then calculated how many times a given child produced a noun, how many times the child produced a pronoun, how many times the child omitted an argument entirely, and divided each number by the total number of referring expressions that the child could have produced. We performed square-root transformations on all proportions before conducting statistical analyses (Kirk, 1995).

Gesture coding

After transcribing and coding the speech, we coded children's gestures. We followed Goldin-Meadow and Mylander's (1984) (see also Butcher & Goldin-Meadow, 2000; Iverson & Goldin-Meadow, 2005; Özçalışkan & Goldin-Meadow, 2005) criteria for isolating gestures from the ongoing stream of motor behaviour. We classified gestures into two types: (1) pointing gestures[7] that referred to objects, people, or places by singling out the referent (e.g., index finger point to a doghouse; and (2) iconic gestures[8] that bore a resemblance to the referents they represented in terms of shape or movement (e.g., two curved hands, palms facing each other representing a ball).

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[5] A proposition consists of a predicate and its arguments.

[6] A predicate is the portion of a clause that expresses something about the subject.

[7] Pointing gestures are also known as deictic gestures (e.g., McNeill, 1992, 2005).

[8] Iconic gestures are also known as characterising (Goldin-Meadow & Mylander, 1984) or representational (Gullberg, de Bot, & Volterra, 2008) gestures.

We next assigned each gesture a semantic meaning. The meaning of a gesture was determined by its form, in conjunction with the speech in the clause with which it occurred. The meaning of a point gesture depended on the context of interpretation; for example, a point at an object was assumed to be a reference to that object. The meaning of an iconic gesture depended on the form of the gesture in relation to the speech surrounding it; a fist hand placed high in front of the torso as though holding a flower stem, produced in conjunction with the clause, "*The dog is taking the flower to his house*", was assumed to refer to the flower. If the gesture was not accompanied by a word that expressed its referent, gesture form and vignette context were used to determine the gesture's meaning. The proportion of referents conveyed in gesture was calculated by dividing the total number of referents conveyed in gesture by the total number of referents that could potentially be expressed. All proportions were subjected to a square root transformation before statistical analysis.

We established reliability by having a second individual transcribe 20% of the children's descriptions. We then measured inter-rater reliability on our speech and gesture measures using Cohen's kappa. For the *no perceptual context* condition, Cohen's kappa for inter-rater agreement was .85 for assigning meaning to referents in speech, and .87 for assigning meaning to referents in gesture for English-speaking children; comparable numbers for Turkish-speaking children were .95 and .91, respectively. For the *perceptual context* condition, Cohen's kappa was .97 for assigning meaning to referents in speech, and .96 for assigning meaning to referents in gesture for English-speaking children; comparable numbers for Turkish-speaking children were .98 and .87, respectively. Disagreements were resolved through discussion.

RESULTS

Speech

We first examined how children used speech to refer to the characters in the vignettes. Figure 1 presents the proportion of total referring expressions conveyed using either a noun or a pronoun or omitted by the English-speaking and Turkish-speaking children in *no perceptual context* versus *perceptual context* conditions. In the *no perceptual context* condition, for both English- and Turkish-speaking children the majority of referring expressions were nouns, whereas in the *perceptual context* condition, the two groups of children used fewer nouns and increased their use of pronouns and omitted arguments. To examine the effect of language and condition on children's referring expressions, we conducted three separate 2×2 between-subjects
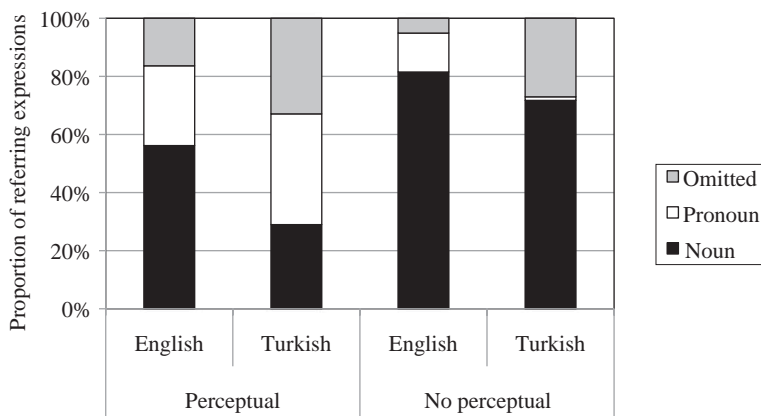
Figure 1.   The proportion of referring expressions that the English-speaking and Turkish-speaking children conveyed using a noun or a pronoun or that they omitted entirely when describing the scenes without (no perceptual context) and with (perceptual context) perceptual support.

ANCOVAs, one for each of the referring expression types, with mean proportion of referring expressions as the dependent variable, and with language (English, Turkish) and condition (no perceptual context, perceptual context) as between-subjects independent variables, and age as a covariate.

Nouns

The ANCOVA for nouns revealed that age was significantly related to the proportion of referring expressions expressed as nouns, $F(1, 33) = 4.86$, $MSE = 0.11$, $p = .04$, partial $\eta^2 = .13$. There was a marginally significant main effect of language after controlling for age, $F(1, 33) = 3.47$, $MSE = 0.08$, $p = .07$, partial $\eta^2 = .10$. English-speaking children expressed a higher proportion of nouns ($M = 0.70$, $SD = 0.26$) than Turkish-speaking children ($M = 0.51$, $SD = 0.29$). The main effect of condition was also significant, controlling for age, $F(1, 33) = 23.06$, $MSE = 0.52$, $p < .01$, partial $\eta^2 = .41$. In the *no perceptual context* condition, 77% of the referring expressions were nouns ($SD = 0.26$), whereas in the *perceptual context* condition only 43% of the referring expressions were nouns ($SD = 0.23$). The interaction between language and condition reached marginal significance, $F(1, 33) = 3.89$, $MSE = 0.09$, $p = .06$, partial $\eta^2 = .11$. We used independent samples *t*-tests (with Bonferroni correction, $\alpha = .025$) to further explore this interaction. English-speaking children expressed a significantly higher proportion of their referents as nouns, compared to the

Turkish-speaking children in the *perceptual context* condition, $t(16) = 2.49$, $p = .02.$[9] However, the two groups did not differ significantly in the *no perceptual context* condition, $t(18) = 0.882$, $p = .39$ (Figure 1). Overall, English-speaking and Turkish-speaking children primarily used nouns to refer to the characters in the vignettes in the *no perceptual context* condition, a sensible strategy given that the characters were not visible during their descriptions. The two groups responded similarly to changes in perceptual context, decreasing their use of highly specific nouns in the *perceptual context* condition. However, in the presence of a perceptual context, the Turkish-speaking children produced specified referring expressions (nouns) less frequently than the English-speaking children.

Pronouns

Neither age, $F(1, 33) = 0.05$, $MSE = 0.002$, $p = .82$, *partial* $\eta^2 = .002$, nor language, $F(1, 33) = 0.74$, $MSE = 0.03$, $p = .39$, *partial* $\eta^2 = .02$, was significantly related to the proportion of referring expressions that were pronouns. However, the main effect of condition was significant, controlling for age, $F(1, 33) = 33.56$, $MSE = 1.35$, $p < .01$, *partial* $\eta^2 = .50$. A higher proportion of referring expressions were pronouns in the *perceptual context* condition ($M = 0.33$, $SD = 0.14$), compared to the *no perceptual context* condition ($M = 0.07$, $SD = 0.23$). The interaction between language and condition was also significant, $F(1, 33) = 4.35$, $MSE = 0.18$, $p = .045$, *partial* $\eta^2 = .12$. We used independent samples *t*-tests (with Bonferroni correction, $\alpha = .025$) to further explore this analysis. English-speaking children ($M = 0.13$, $SD = 0.17$) expressed marginally more pronouns than Turkish-speaking children ($M = 0.01$, $SD = 0.02$) in the *no perceptual context* condition, $t(18) = 2.28$, $p = .04$. The two groups did not significantly differ in the *perceptual context* condition, (English: $M = 0.27$, $SD = 0.16$; Turkish: $M = 0.38$, $SD = 0.27$), $t(16) = 0.81$, $p = .43$; see Figure 1).

Omitted arguments

The ANCOVA for omitted arguments did not reveal a significant association between age and proportion of referring expressions omitted, $F(1, 33) = 2.34$, $MSE = 0.11$, $p = .14$, *partial* $\eta^2 = .07$. The main effect of language controlling for age was significant, $F(1, 33) = 5.50$, $MSE = 0.26$,

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[9] We also explored whether children's referring expressions varied by semantic role. We found that English-speaking children used 43% of their nouns to express actors and 27% to express patients. Similarly, Turkish-speaking children used 56% of their nouns to express actors and 18% to express patients. The differences were not significant. Thus, the higher proportion of noun use by English-speaking children compared to Turkish-speaking children cannot be attributed to the semantic role of the nouns.

$p = .03$, *partial* $\eta^2 = .14$; Turkish-speaking children omitted a higher propor-tion of their referring expressions ($M = 0.30$, $SD = 0.19$) than English-speaking children ($M = 0.16$, $SD = 0.24$). There was a marginally significant effect of condition controlling for age, $F(1, 33) = 3.48$, $MSE = 0.16$, $p = .07$, *partial* $\eta^2 = .10$. The proportion of omitted arguments was higher in the *perceptual context* condition ($M = 0.25$, $SD = 0.24$) than in the *no perceptual context* condition ($M = 0.16$, $SD = 0.19$). The interaction between language and condition was not significant, $F(1, 33) = 0.74$, $MSE = 0.04$, $p = .40$, *partial* $\eta^2 = .02$ (Figure 1). Comparing pronoun versus omitted arguments across the two conditions, we found that English-speaking children used pronouns more often than omitted arguments, $t(18) = 2.73$, $p = .01$, and that Turkish-speaking children tended to use omitted arguments more frequently than pronouns, $t(18) = 1.71$, $p = .10$. Overall, as expected, both groups of children increased their use of less specified forms (i.e., pronouns and omitted arguments) when a perceptual context was available, showing sensitivity to changes in perceptual context. In addition, when children did not use nouns, English-speaking children relied on pronouns more frequently than omitted arguments and relied on pronouns more frequently than Turkish-speaking children, whereas Turkish-speaking children tended to use omitted arguments more frequently than pronouns and tended to use omitted arguments more frequently than English-speaking children, thus adhering to the linguistic patterns in their respective languages.

Gesture

We next examined how children used gesture to express referents. In the *no perceptual context* condition, only 5 of the 10 English-speaking children, and 4 of the 10 Turkish-speaking children used gesture to refer to the characters or objects in the vignettes. English-speaking children used gesture to express 7% ($SD = 0.12$) of their total referents; Turkish-speaking children used gesture to express 3% ($SD = 0.04$).[10] Among the subgroup of children who used gesture, a nonparametric Mann-Whitney U test comparing the proportion of referring expressions with gesture did not reveal significant differences between English- and Turkish-speaking children, $U = 4$, $p = .14$.

All of the gestures that the children produced in the *no perceptual context* condition were iconic gestures (with the exception of an abstract point in space produced by one English-speaking child). Almost all of these gestures were used in conjunction with nouns. For example, in describing the vignette where a man throws a ball to a basket, a Turkish-speaking child said, "*Öyle*

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[10] In terms of overall number of gestures produced in the *no perceptual context* condition, English-speaking children produced on average 1.8 ($SD=3.08$) iconic gestures and Turkish-children produced 0.7 ($SD=1.25$) iconic gestures.

sepetin içine attı top" (ø threw the ball into the basket like that) and produced a two-handed gesture mirroring the shape of the basket. Only one Turkish-speaking child used an iconic gesture to disambiguate a pronoun. In describing a toy man carrying a toy chicken to a toy scaffolding, the child produced a flat hand gesture representing the scaffolding in conjunction with the following clause, "*Tavuku oraya koydu*" (ø put the chicken there).

In the *perceptual context* condition, all but one child produced gestures. Children produced both pointing and iconic gestures. Almost all pointing gestures were at the book, rather than the screen. Turkish-speaking children used pointing gestures to convey 33% ($SD = 0.21$) of all possible referents, and iconic gestures to convey 19% ($SD = 0.24$). English-speaking children used pointing gestures to convey 15% ($SD = 0.13$) of all possible referents, and iconic gestures to convey 2% ($SD = 0.02$).[11] Turkish-speaking children ($M = 0.52$, $SD = 0.31$) expressed a significantly higher proportion of their referring expressions with gestures in the *perceptual context* condition than English-speaking children ($M = 0.16$, $SD = 0.13$), $t(16) = 2.55$, $p = .02$.

Overall, in the *no perceptual context* condition, only half of the children used gesture, they used gesture to refer to only a small proportion of the characters in the vignettes, and neither English-speaking nor Turkish-speaking children used the few gestures that they did produce to disambiguate pronouns or to supplement omitted arguments, perhaps because the characters were already adequately specified in speech. In the *perceptual context* condition, almost all of the children used gesture, a higher proportion of referring expressions were accompanied by gesture. Thus both groups of children used gesture to refer to the vignette characters when they could; that is, in the *perceptual context* condition. However, the Turkish-speaking children used gesture more often than the English-speaking children.

To summarise thus far, both groups of children responded to the presence versus absence of a perceptual context in similar ways with respect to speech and gesture. However, the Turkish-speaking children used fewer specified forms (nouns), and more gestures, than the English-speaking children in the *perceptual context* condition. Perhaps the Turkish-speaking children were using their gestures to disambiguate the underspecified pronouns and supplement the omitted arguments that they produced. As an example of a child who used gesture to disambiguate a pronoun, a Turkish-speaking child said, "*Bu geldi buna*" (this came to this) to describe the tool box moving to the school bus, while producing two pointing gestures, the first at the picture of the tool box and the second at the picture of the school bus. As an

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[11] In terms of overall number of gestures produced in the *perceptual context* condition, English-speaking children produced 0.44 ($SD=0.73$) iconic gestures and 4.67 ($SD=4.27$) pointing gestures. Turkish-children produced 5.11 ($SD=6.13$) iconic gestures and 8.89 ($SD=5.67$) pointing gestures.
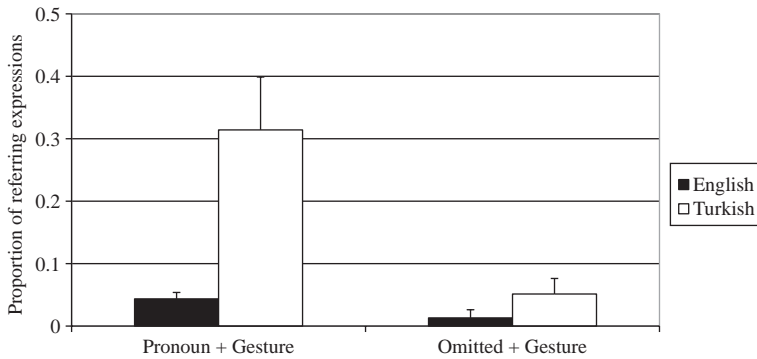
Figure 2. The proportion of referring expressions that the English-speaking and Turkish-speaking children conveyed using a pronoun disambiguated by gesture or an omitted argument supplemented by gesture when describing scenes with perceptual support (perceptual context).

example of a child who produced gesture to clarify an omitted argument, a Turkish-speaking child said, "*Gitti arabanın üstüne*" (ø went to the top of the school bus), while producing a pointing gesture at the picture of the tool box.

We calculated the proportion of pronouns and omitted arguments that were accompanied by gesture in the *perceptual context* condition for each child (out of all referring expressions, that the child produced). Figure 2 presents the data. To compare the English and Turkish-speaking children, we conducted two independent samples *t*-tests on the proportion of referring expressions conveyed as pronouns disambiguated by gesture and as omitted arguments supplemented by gesture. Turkish-speaking children expressed a significantly higher proportion of referring expressions as pronouns disambiguated by gesture,[12] $t(10.76) = 3.41$, $p = .006$, Cohen's $d = 2.08$. Although there was a trend in the direction of Turkish-speaking children conveying a higher proportion of referring expressions as omitted arguments supplemented by gesture than English-speaking children, the difference failed to reach significance, $t(16) = 1.69$, $p = .11$, Cohen's $d = 0.84$.[13,14]

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[12] Fifty-three percent of the pronouns accompanied by gesture were expressed as the demonstrative pronoun *bu*, 37% as the locative pronoun *buraya*, 8% as the locative pronoun *şuraya*, 1% as the demonstrative pronoun *şu*, and 1% as *o,* which can be used both as a personal and demonstrative pronoun.

[13] Turkish-speaking children ($M = 0.16$, $SD = 0.10$) and English-speaking children ($M = 0.11$, $SD = 0.10$) did not significantly differ from each other in the proportion of referring expressions conveyed as nouns accompanied by gesture, $t(16) = 1.07$, $p = .30$

[14] Turkish-speaking children disambiguated 70% of their pronouns with pointing gestures and 30% with iconic gestures. They disambiguated 24% of their omitted arguments with pointing gestures and 76% with iconic gestures. English-speaking children disambiguated 86% of their pronouns with pointing gestures and 24% with iconic gestures. They disambiguated 6% of their omitted arguments with pointing gestures and 94% with iconic gestures.

These patterns suggest that the Turkish-speaking children are using gesture to flesh out their underspecified referring expressions in the *perceptual context* condition. If so, the Turkish-speaking children's referring expressions, when taken as a combination of gesture and speech, may be no more underspecified than the English-speaking children's. To explore this possibility, we calculated the proportion of specified referents that each child produced, but we enlarged our view of what counted as specified to include not only nouns but also pronouns and omitted arguments that were clarified by gesture. Figure 3 presents the data in a stacked bar graph. The height of the bar indicates the proportion of referents that were fully specified. Note that the bars do not differ for the two groups: When both gesture and speech are taken into account, the Turkish-speaking children specified as many referents as the English-speaking children. An independent sample *t*-test revealed that English-speaking children ($M = 0.61$, $SD = 0.22$) and Turkish-speaking children ($M = 0.63$, $SD = 0.32$) did not differ in the proportion of fully specified referring expressions they produced, $t(16) = 0.08$, $p = .94$, Cohen's $d = 0.04$. However, as our previous analyses have shown, the children achieved this specification in different ways—the English-speaking children used many nouns and few pronouns/omitted arguments accompanied by gesture, whereas the Turkish-speaking children did the reverse.
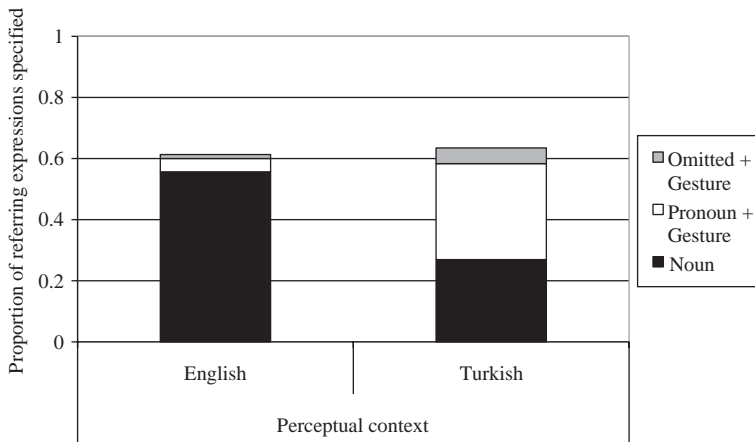

Figure 3. The proportion of arguments that the English-speaking and Turkish-speaking children fully specified by using a noun, a pronoun disambiguated by gesture, or an omitted argument supplemented by gesture when describing scenes with perceptual support (perceptual context).

DISCUSSION

Our study explored three questions: (1) whether 4- to 5-year-old monolingual English- and Turkish-speaking children are sensitive to information available in the perceptual context when choosing referring expressions, (2) whether they express this sensitivity in language-specific ways, and (3) whether they use gesture to specify referents when speech is underspecified. The answer to each of these questions is "yes". The findings also have implications for mechanisms underlying children's sensitivity to perceptual context.

Sensitivity to perceptual context

We examined how children use speech to express referents in the absence versus presence of a perceptual context. We found that both English- and Turkish-speaking children relied on specified linguistic forms (nouns) more frequently in the absence of a perceptual context than in the presence of a perceptual context. Both English- and Turkish-speaking children changed their strategies when choosing referring expressions in the presence of a perceptual context. The children decreased their use of specified forms and increased their use of less specified forms in the presence of a perceptual context, compared to the absence of a perceptual context.

We argue that these findings suggest that young children display sensitivity to their listener's access to entities in the perceptual context, suggesting that they are sensitive to their listener's informational needs when they construct their utterances and adding to the previous literature on this topic (e.g., Allen & Schroder, 2003; Gürcanlı et al., 2007; Matthews et al., 2006; O'Neill, 1996). Unlike previous studies, however, in our study, the child and the listener had access to the same information while watching the vignettes and during the child's description of the vignettes. What varied was whether the referents were visible to both participants during the child's description of the vignettes. Thus, although our study *suggests* that young children are sensitive to whether their listener can see the referent they are describing, it is possible that the children are also altering their behaviour in response to their own needs (i.e., whether they can see the referent), rather than uniquely responding to the listener's needs. In order to get a clearer picture of children's sensitivity to the listener's knowledge state, we need to examine how children behave when they have privileged access to the perceptual context during retelling. Such an experimental design would provide a more stringent test of whether children vary their referential expressions for their listener.

Unlike previous studies, we directly compared children learning Turkish, a pro-drop language, to children learning English, a language that does not permit arguments to be dropped; two languages that also differ in their

pronoun systems. Despite the fact that they were learning structurally different languages, the two groups of children used nouns to the same degree and thus achieved the same level of specification under pragmatic constraints requiring them to be explicit (i.e., in the absence of a perceptual context).

Language-specific devices for displaying sensitivity to perceptual context

We also found that English- and Turkish-speaking children displayed their sensitivity to the perceptual availability of referents in language-specific ways. In line with the requirements of their respective languages, Turkish-speaking children relied on omitted arguments when underspecifying referents, whereas English-speaking children relied on pronouns. These findings demonstrate that children as young as four are not only sensitive to the perceptual availability of referents, but can express this sensitivity using the particular devices that their language offers.

Interestingly, cross-linguistic differences also emerged in how often children used underspecified forms in the presence of a perceptual context—English-speaking children were more likely to use nouns than Turkish-speaking children even though the characters were visible to both the children and the experimenter. According to the speaker-internal-constraints approach, competition between entities in the speaker's own discourse model (independent of the listener) can lead to the production of nouns instead of pronouns (Arnold & Griffin, 2007). Competition is likely to be particularly strong if the entities share features relevant to planning an utterance. In our study, all of the vignettes involved at least two characters or objects of same gender and/or animacy. Since these features are relevant to utterance-planning only for English-speaking children and not for Turkish-speaking children, competition ought to be higher and lead to more nouns in the English-speaking children than in the Turkish-speaking children—which is precisely what we found. Thus, with respect to possible mechanisms underlying children's referential expression choice, our findings add to a recent but growing body of literature suggesting that sensitivity to the informational needs of the listener and the internal processing constraints speakers face as they plan their utterances *both* influence the referential expressions that speakers choose (e.g., Arnold & Griffin, 2007; Nadig & Sedivy, 2002). Future work is needed to examine how these two factors interact as children plan their utterances under different conditions; for example, when children are under high cognitive load or when their listener's perspective is different from their own.

Use of gestures as referring expressions

Although Turkish-speaking children appeared to be underspecifying their referents more than English-speaking children, in fact, they were using gesture to compensate for their underspecification (they used gesture to clarify their underspecified pronouns and omitted arguments). Overall, although future work should replicate this and our other findings with a larger sample size, in the current study the two groups of children achieved the same level of specification, but did so in different ways—the Turkish-speaking children used few nouns and many pronouns disambiguated and omitted arguments supplemented by gesture; the English-speaking children did the reverse.

Why did Turkish-speaking children produce more gestures to disambiguate their pronouns than English-speaking children? One obvious possibility is that their gestures were a response to the particular pronouns they chose to use. A relatively large proportion of the pronouns accompanied by Turkish-speaking children's gestures were demonstrative pronouns (the Turkish equivalent of *this*) and locative pronouns (the Turkish equivalent of *here*), both of which are likely to co-occur with pointing gestures. However, it is worth noting that the Turkish-speaking children in our study not only used pointing gestures but also iconic gestures (which are not particularly tied to pronoun use).

Another possible explanation for the Turkish-speaking children's relatively prolific use of gesture is that all speakers of languages that allow argument omission (including mature adult speakers) might rely routinely on pronouns disambiguated by gesture as their *specified* referring expressions. The previous literature leaves the role of pronouns in pro-drop languages (e.g., Turkish, Chinese, Korean) ambiguous. In some studies, pronouns pattern with attenuated forms like omitted arguments; in other studies, they pattern with overt forms like nouns (Allen, 2000; Clancy, 1993; Gürcanlı et al., 2006; Huang, 1994). We suggest that pronouns (specifically those used for a deictic function) serve a dual role in languages that allow argument omission (pro-drop languages) as a function of gesture—they behave like specified nouns when they are disambiguated by gesture, but like attenuated forms when they are not. Future work is needed to determine whether the discourse-pragmatic functions of pronouns in pro-drop languages do, indeed, vary in relation to the presence or absence of gesture, and also to determine whether adult speakers of pro-drop languages routinely use pronouns disambiguated by gesture to specify their referents (using gesture to disambiguate underspecified speech may be a characteristic of child speech that fades as children become more proficient speakers; see

Özçalışkan & Goldin-Meadow, 2005 for a study of changing gesture-speech relations in English-speaking children). A recent study by So, Kita, and Goldin-Meadow (2009) found that English-speaking adults did *not* use gesture to convey information that was not found in speech; they used gesture primarily to identify referents that were also specified in speech. The interesting question, which we leave for future research, is how Turkish-speaking adults perform under similar conditions.

Another reason that might explain why the Turkish-speaking children in our study, and speakers of pro-drop languages in general, use underspecified speech forms with gesture (rather than full speech forms such as nouns) is that they may be trying to exploit the available perceptual context. Pointing gestures, as well as some iconic gestures, provide specific information about entities in a perceptual context that is not found in nouns. Thus, Turkish-speaking children might be relying on gesture, not necessarily to compensate for underspecified referents, but to make more specific references to the entities available in the context. Use of gestures, in turn, might enable use of pronouns, especially when pronouns do not make gender or animacy distinctions, as in Turkish. Future work is needed to examine whether speakers of pro-drop languages are, in general, more sensitive to the perceptual context than speakers of nonpro-drop languages.

To conclude, we have found that young children exposed to structurally different languages appear to be sensitive to whether the referents they express are perceptually available. They use specified forms (nouns) when referents are not in the perceptual context, and shift to less specified forms (pronouns or omitted arguments) when referents are perceptually available. Moreover, young children express this sensitivity to the perceptual context in language specific ways—when underspecifying a referent, English-speaking children rely on pronouns, whereas Turkish-speaking children rely on omitted arguments. Both sensitivity to the listener's access to perceptual context and speaker-internal processing constraints appear to play a role in determining the referential expressions children choose. Finally, although Turkish-speaking children use underspecified forms more frequently than English-speaking children, they compensate for this underspecification with gesture (they use gesture to disambiguate their underspecified forms). Gesture thus gives children learning structurally different languages a way to achieve comparable levels of specification while adhering to the referential expressions dictated by their language.

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APPENDIX 1

Vignette descriptions

Vignette No.	Vignette description
1	A man figure moves a toy garbage can to another man figure
2	A man figure carries a toy chicken to a toy scaffolding
3	A man figure gives a toy tool box to another man figure
4	A toy duck moves to a toy wheelbarrow
5	A toy bike pushes a girl figure to a toy giraffe
6	A dog moves to a van
7	A toy tool box moves to a toy school bus
8	A bike bumps a dog
9	A man figure throws a toy ball to a toy basket
10	A dog figure carries a toy flower to a toy doghouse
11	A toy train moves into a fenced area
12	A man figure pushes a toy wheelbarrow to a toy train