Children's sensitivity to the conventionality of sources

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Abstract

Four studies examined the extent to which preschoolers are sensitive to how knowledgeable an agent is about conventional forms, when interpreting the agent's referential intent. In Study 1, children were familiarized with a speaker who either consistently used conventional or wrong labels to refer to familiar objects. Children were then shown another familiar and an unfamiliar object, and the speaker asked them for the referent of a novel label. We found that children familiarized with a knowledgeable speaker were more likely to choose the unfamiliar object than children familiarized with a wrong labeler. Study 2 replicated this finding with a different manipulation of speakers’ knowledge. Study 3 showed that children selected the unfamiliar object even when familiarized with a speaker who used peculiar but linguistically correct labels to refer to familiar objects. Study 4 replicated Study 1 with object functions instead of labels, and produced analogous results. The findings suggest that children hold an assumption of conventionality with regard to both object labels and functions, and they apply this assumption primarily towards agents who manifest some knowledge of conventions in these domains.
Children's sensitivity to the conventionality of sources

An implicit assumption adults make when communicating, is that their partners in a conversation share with them the knowledge that there are certain preferred linguistic forms to express certain meanings. In fact, adults expect their partners to use these forms when intending to express certain meanings, and consequently draw inferences about their partners' communicative intents based on their choice of forms. Clark (1988, 1990) defined this basic assumption as the Principle of Conventionality, and an ensuing inference based on the use of non-conventional forms as the Principle of Contrast – namely, that if a speaker uses a linguistic form that is different from the conventional one expected, it is probably because the speaker has a contrastive intent in mind.

A number of recent studies show that from a young age, children too seem to rely on an assumption of conventionality when interpreting people's utterances. In fact, studies indicate that already by 3-years of age, children manifest a nuanced assumption of conventionality, such that they are capable of modulating when and when not to apply this assumption (see Kalish & Sabbagh, 2007, for a review).

Most studies of children’s assumption of conventionality regarding words have investigated it in the context of its contrastive implication. A widely studied situation in which this implication is manifest is when children are presented with two objects, one familiar and one unfamiliar, and are simply asked to point to the referent of an unfamiliar noun. Based on a Principle of Conventionality, children in such a situation should assume that the speaker knows the conventional name of the familiar object, and they should thus expect speakers to use that name if he or she intends to refer to that object. According to a Principle of Contrast, children should reason that if a speaker uses a different unfamiliar name, it is probably because she has a different
object in mind. That is, children should select the unfamiliar object as the referent of the unfamiliar name. And indeed, that is what a number of studies with preschool children have found (Markman & Wachtel, 1988; Merriman & Bowman, 1989).

In itself, however, this type of response is also consistent with proposals arguing that children have a number of constraints that guide their word learning. In particular, the response is consistent with a mutual exclusivity bias (Markman & Wachtel, 1988) and a novel-name nameless-category principle (Golinkoff, Mervis, & Hirsh-Pasek, 1994). Two unique predictions of the pragmatic reasoning process exposed above are that children's inferences of contrast should be contingent upon: a) whether or not the form used is thought to be conventional, and b) whether or not the speaker/user is believed to know the form.

Regarding the forms about which children assume conventionality, studies have found that children seem to believe that common nouns are known by other speakers of their language, but arbitrary facts about objects, proper nouns, or people's preferences and goals are not. For instance, in Diesendruck and Markson (2001), an experimenter showed 3- to 4-year-old children two novel objects, and taught them either a novel label or a novel fact for one of the objects. A puppet, who was either present or absent during this introduction, then asked children to select the object associated with a different novel label or fact, accordingly. Diesendruck and Markson found that children avoided assigning two facts for an object only when the puppet was present during the experimenter’s introduction of the fact, but not when he was absent. In contrast, children avoided assigning two labels for an object both when the puppet was present and when he was absent. In fact, when directly asked whether or not the puppet knew the labels given by the experimenter, most children replied that the absent puppet did. These findings suggest that children presuppose that speakers
of a language know the names of objects in their language, but hold no such presupposition about arbitrary facts associated with objects. Children assumed the puppet knew the conventional names of objects, and inferred that if he asked them for the referent of a different name it was because he had a different object in mind. Using a similar methodology, Diesendruck (2005) found that preschoolers assume that speakers know the common nouns associated with objects, but not the proper nouns (see also Birch & Bloom, 2002). In other words, only certain words are believed to be conventional, thus warranting an inference of contrastive intents.

Finally, Henderson and Graham (2005) found that 2-year-olds assume absent adults share with an experimenter knowledge of the novel names of objects, but not the experimenter's preferences towards the objects (see also Buress & Woodward, 2007; Graham, Stock, & Henderson, 2006, for similar findings with younger children).

Regarding the second pragmatic prediction mentioned above, there are a number of studies indicating that already by 2-years of age, children are sensitive to speakers' knowledge state when interpreting their utterances (Akhtar, Carpenter, & Tomasello, 1996; Diesendruck, Markson, Akhtar, & Reudor, 2004; Sabbagh & Baldwin, 2001). Only one study, however, has attempted to address whether children's inference of contrast is modulated by speakers' presumed knowledge of language. Diesendruck (2005) presented pairs of novel objects to Hebrew-English bilingual 3- to 4-year-olds. An experimenter labeled one of the objects with a novel English label, and then a puppet – who was present during the labeling event – asked children for the referent of a novel Hebrew label. The crucial manipulation was that for half of the children, the puppet was introduced – and behaved – as a monolingual Hebrew speaker, and for the other half the puppet was introduced as being a Hebrew-English bilingual. Diesendruck found that children selected the yet unlabeled object
when the puppet was bilingual, but selected randomly between the two objects when
the puppet was monolingual. In other words, children seem to have reasoned that if a
monolingual speaker of Hebrew hears an experimenter teach them an English novel
word, then the monolingual speaker does not necessarily know that foreign word.
Consequently, if that speaker asks children for the referent of a novel Hebrew word,
they infer that the speaker might be referring to either object – not necessarily the
object that did not have an English label applied to it. In turn, if a bilingual speaker
who has heard the experimenter use an English label, chooses to use a different label
– even if in a different language – then children assume that he knows that English
label and thus take the speaker's use of a different label to imply a contrastive intent.

Whereas the findings from this latter study are consistent with the prediction
that children assume conventionality only with respect to people who are
knowledgeable about the conventions of a language, children in the above study did
not get any direct evidence for the speakers' knowledge of the relevant conventions.
In fact, the above study did not manipulate whether or not the speakers were
knowledgeable about conventional linguistic forms, but rather whether or not the
speakers were knowledgeable about the language in general. In other words, we
cannot determine unambiguously from that study that children's responses derived
specifically from the fact that the monolingual speaker violated conventionality per
se. The rationale behind Diesendruck's (2005) study was that children might have
presumed that a monolingual Hebrew speaker would not have understood the English
interaction between the experimenter and the child, and thus would not have learned
the novel label the experimenter taught the child to one of the objects. The study did
not assess, however, whether children believed either speaker knew the familiar
labels of objects. A primary goal of the present studies was to provide children with
specific evidence that certain speakers of their language do not know the conventional names of objects, and that consequently, children should withhold from applying an assumption of conventionality towards such speakers. Thus, different from the Diesendruck (2005) study, the present studies attempted to manipulate only the most relevant aspect of knowledge presupposed by the conventionality account of the disambiguation response.

The second major goal of the studies was to extend the examination of the scope of an assumption of conventionality. As reviewed above, originally, studies on children's assumption of conventionality targeted primarily the domain of language. In fact, there are some suggestions that such an assumption derives from the manner in which parents talk to children (Callanan & Sabbagh, 2004). Like linguistic forms, however, certain cultural forms are also conventionalized. For instance, the functions we attribute to objects (e.g., what forks are for), and the manner in which we use objects (e.g., how we hold forks), are different types of culture-specific knowledge that members of a community need to know, and expect peers to know. In recent years, a number of researchers have suggested that, in addition to the domain of language, an assumption of conventionality seems to hold in domains such as games (Rakoczy, 2007) and object functions (German, Truxaw, & Defeyter, 2007; Siegel & Callanan, 2007). For instance, Casler and Kelemen (2005; 2007) showed that 2-and-a-half year olds assume that objects have unique functions. In particular, upon seeing an object being used intentionally for a specific function, even 2-year-olds readily picked that object over other equally-affording objects to perform that function. These studies, however, have been conducted with a variety of methodologies and age groups (see Kalish & Sabbagh, 2007, for a review), and thus do not allow for direct comparisons between domains. The present studies used almost identical methods to
evaluate whether children hold an assumption of conventionality about both object labels and object functions, and whether they draw similar inferences – namely, about contrast – based on people's manifest knowledge of conventional labels and functions.

In order to address both goals described above, we adopted a methodology originally developed by Koenig and Harris (2005; Koenig, Clement, & Harris, 2004; see also, Birch, Vaulthier, & Bloom, 2008; Jaswal & Neely, 2006). In Koenig et al. (2004), for instance, children were either exposed to speakers who manifested knowledge of the conventional names of objects – so called "reliable" speakers – or to speakers who manifested ignorance of conventional names – "unreliable" speakers. Koenig et al. found that 3- to 4-year-olds were more likely to subsequently learn a novel name from a knowledgeable speaker than from an ignorant one (see also Sabbagh & Baldwin, 2001). Different from all these previous studies, in the present studies, rather than assessing whether the knowledge states of speakers differentially influence children's willingness to learn labels from such speakers, we asked whether children within this same age range would draw different inferences about such speakers' communicative intents in an ambiguous context. That is, we asked whether variations in speakers' manifest knowledge of conventional forms influence the extent to which 3- to 4-year-olds respond to speakers in the manner stipulated by an assumption of conventionality.

To address the first goal, in Study 1 we familiarized 3- to 4-year-old children with two different kinds of speakers: a speaker who showed evidence of being knowledgeable about the conventional labels used to refer to familiar objects, and a speaker who showed evidence of being ignorant of the conventional labels used to refer to familiar objects. Children then participated in a standard disambiguation task, in which they were presented with pairs of objects consisting of one familiar and one
unfamiliar object, and the same speaker to which they had been previously exposed asked them for the referent of a novel label. The rationale is that if children's inference of contrast is contingent on them assuming that the speaker knows the conventional forms of the language, then children who had been exposed to a knowledgeable speaker should be more likely than those exposed to an ignorant speaker to select the unfamiliar object as the referent of the novel label. Study 2 replicates Study 1 with a different operationalization of speakers’ knowledge. Study 3 examines a further implication of this hypothesized reasoning process.

In order to address the second goal, in Study 4 the same method described above was employed, but instead of exposing children to speakers and object labels, we exposed children to users and object functions. A recent study using a similar methodology found that just as with labels, children are more willing to learn a new function from a knowledgeable labeler of object functions than from an ignorant one (Birch et al., 2008). Here we ask whether users' knowledge affects children's inferences about the conventionality of users. As in the first three studies, we first familiarized children with two kinds of users: a user who showed evidence of being knowledgeable about the conventional functions of familiar objects, and a user who showed evidence of being ignorant about the conventional functions of familiar objects. Children then participated in a function disambiguation task, in which they were presented with pairs of objects consisting of one familiar and one unfamiliar object, and the same user to which they had been previously exposed asked them for the object to be used for a new function. The rationale is that if children infer the functions of objects via the same reasoning process deployed for object labels, then in the function disambiguation task, they should show the same differential responding
to a knowledgeable and an ignorant user as that hypothesized for knowledgeable and ignorant speakers.

Study 1
Method

Participants

Participants were 33 monolingual Hebrew-speaking Israeli preschoolers, 19 boys and 14 girls ($M = 3$ years 10 months, $SD = 4$ months, $range = 3$ years 3 months to 4 years 5 months). Children were primarily from middle- and upper-middle-class socio-economic backgrounds. Most children were recruited from and tested in preschools around the university. A few others were recruited from the local community and were tested at their homes. Parental consent was obtained for each child prior to participation.

Materials

In the familiarization phase, four objects highly familiar to children this age were used. The objects were: a plastic banana, a stuffed dog, a doll-size shirt, and a plastic cookie. In the disambiguation phase, eight objects were used: four familiar and four novel. The objects were arranged into pairs of familiar-novel, in such a way that the objects in each pair were similar in their color salience and size. The familiar/novel pairs were: 1- shoe/funnel, 2- car/door-stopper, 3- cup/cylinder, 4- pen/original object created in the lab. A hand-puppet was also used in order to provide the labels. The experimenter manipulated the puppet, using a distinctive adult voice whenever speaking for him.

Design

Children were randomly assigned to one of two conditions, Knowledgeable ($n = 16$, 7 girls and 9 boys, $M_{age} = 3$ years 10 months) or Ignorant ($n = 17$, 7 girls and 10
boys, $M_{age} = 3$ years 9 months). There was neither a significant age difference nor a significant difference in the gender distribution between the two conditions. Children participated in four familiarization trials followed by four disambiguation trials.

**Procedure**

Prior to testing children, the experimenter came to the preschool and played with children for at least one hour, so that children would become comfortable with the experimenter. Once rapport had been established, the experimenter invited each child to come sit with her in a quiet area set up ahead of time in the preschool. The entire interaction – in this and all the other studies – was conducted in Hebrew (verbatim translations of what children were told are provided). The child and the experimenter sat at a table, and the experimenter introduced children to her "friend" – a hand-puppet named "Yossi". The experimenter exchanged a few greeting words with the puppet, speaking with a lower-toned voice when speaking for the puppet. This introduction was meant to establish that the puppet could speak, and was separate from the experimenter. After this brief introduction – which was identical for children in both conditions – the experimenter moved on to the familiarization phase.

**Familiarization phase.** The familiarization phase was the only phase that differed between the two conditions. In this phase, the experimenter invited the child and the puppet to play with some objects she had brought. The experimenter pulled out one object at a time from her bag and laid it on the table. The puppet looked at the object, and named it three times while asserting his knowledge of what the object is (i.e., saying, "I know what this is!"). The main manipulation had to do with whether or not the labels provided by the puppet were correct. In the Knowledgeable condition, the puppet labeled the objects correctly with their conventional basic-level names (e.g., upon seeing a banana, he said, "That's a banana, it's a banana; look at the
banana!"). In the Ignorant condition, the puppet labeled the objects incorrectly (e.g., called the banana, "apple"). After a few seconds during which the child and the puppet could play with an object, the experimenter returned the object to her bag, and brought out another familiar object. Again the puppet reacted according to the child's condition. This procedure was repeated for four trials, in order to allow the child to build an assessment of the puppet's knowledge – or ignorance – of the familiar objects' names. The correct labels used for the items banana, dog, shirt, and cookie, were "banana", "dog", "shirt", and "cookie", respectively. The incorrect labels used were: "apple", "cow", "pants", and "egg", respectively. Objects were presented in four different orders, such that each object appeared in each position the same number of times across children.

Disambiguation phase. This phase was identical in both conditions. The experimenter placed the first pair of familiar/novel objects in front of the child. The puppet then looked at the child, and asked for one of the objects by using a Hebrew-sounding made-up novel label (e.g., "Can you give me the beega?", the other three novel labels were: bakakhat, shafek, and geet). Both the puppet and the experimenter refrained from looking at either one of the objects, and instead maintained their gaze on the child. Once the child responded by pointing to, picking up, or handing to the puppet one of the objects, the experimenter removed the two objects, and replaced them with the next pair of familiar/novel objects. The experimenter did not provide any feedback to the child about his/her performance, and instead commented on the game and the toys (e.g., "It's fun to play with these things, right?"). The experimenter recorded children's choices and any other verbal comments children made throughout the entire procedure. Upon completion of the four disambiguation trials, children were
thanked, given a sticker in appreciation for their participation, and returned to their class.

The order of presentation of the object pairs was counterbalanced across children, such that each object pair appeared an equal number of times as the first, second, third, and fourth. The left/right placement of each object within a pair was counterbalanced within children, so that on half of the pairs, the familiar object was placed on the right-side of the child, and on the other half of the pairs, the novel object was placed on the right-side of the child.

Results

The main prediction was that children would be more likely to choose the novel object in response to a request made by a knowledgeable speaker than to one made by an ignorant speaker. The dependent measure used to address this prediction was the number of times (0 – 4) children selected the novel object as the referent of the novel label used by the puppet in the disambiguation phase.

An ANOVA with condition (Knowledgeable vs. Ignorant) and gender as between-subjects variables, and the participants' age in months as a covariate, on the above dependent measure revealed a main effect of condition, $F(1, 28) = 5.17$, $p < .05$, $\eta_p^2 = .16$, no effect of gender, $p > .8$, no effect of age, $p > .5$, and no interaction between gender and condition, $p > .7$. As illustrated in Figure 1, children in the Knowledgeable condition ($M = 3.75$, $SD = .45$) were more likely than children in the Ignorant condition ($M = 3.00$, $SD = 1.17$) to pick the novel object in response to the puppet's request for a novel label. Interestingly, analyses against chance (chance = 2 selections of a novel object) revealed that children in both conditions were more likely to pick the novel object than would be expected by chance: in the
Knowledgeable condition, \( t (15) = 15.65, p < .001 \), and in the Ignorant condition, \( t (16) = 3.52, p < .005 \).

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Insert Figure 1 about here

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In order to evaluate children's individual pattern of responses, we classified children into two groups based on how consistently they selected the novel object. Children who selected the novel object on 3 or 4 of the four trials were considered *disambiguators*, and those who selected the novel object on 2 or less of the four trials were considered *overlap accepters*. As shown in Table 1, all the children in the Knowledgeable condition were disambiguators, whereas only 10 of the 17 children in the Ignorant condition were so, \( \chi^2 (1, N = 33) = 8.36, p < .005 \).

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Finally, in order to directly address a potential interaction between age and condition, we broke down the participants into two age groups according to the median age. This new "age group" variable was then entered into an ANOVA on children's selection of the novel object, with Condition as the other between-subjects variable. The interaction between these variables was not significant, \( p > .7 \).

**Discussion**

The goal of Study 1 was to investigate whether children would rely on a speaker's pre-established knowledge or ignorance of conventional object names when later interpreting his request for the referent of a novel label. We hypothesized that children exposed to a speaker who had manifested knowledge of conventional object
names, compared to those exposed to a speaker who had manifested ignorance of conventional object names, would be more likely to uphold conventionality regarding such a speaker, and thus expect him to use conventional labels to refer to familiar objects. Such a knowledgeable speaker's use of a non-conventional (novel) label would thus be more likely to be inferred as manifesting a contrastive referential intent, than when an ignorant speaker does so. Namely, a knowledgeable speaker's, but not an ignorant speaker's, use of a novel label would likely indicate his intent to refer to an unfamiliar object.

The results of Study 1 were consistent with this hypothesis. Children were more likely to select a novel object as the referent of a novel label when the speaker asking for the novel label had previously manifested knowledge of the conventional names of objects than when the speaker manifested ignorance of conventional names. These results show that by three years of age, children monitor speakers' knowledge of the conventional forms existent in their language, and use this information to draw inferences about speakers' referential intents. This adds to Diesendruck's (2005) findings on children's responses to bilingual vs. monolingual speakers, and reveals that not only can children monitor whether or not a speaker knows the language in general, but that they in fact react differently to a speaker of the language depending on how knowledgeable or ignorant of conventional object labels the speaker has proven to be.

A possible alternative interpretation of these findings is that children's responses did not derive from assessments of the speakers' knowledge. Rather, children might have simply noticed that one speaker uses the labels that are expected, and the other does not. Consequently, when in the disambiguation phase the ignorant speaker used an unusual label, children might have simply inferred that it is plausible
that here too he was referring to the familiar object. According to this interpretation, children might have conceived of the ignorant speaker not so much as lacking knowledge of familiar object names, but rather as being silly or joking. Such an interpretation might have been especially exacerbated if children thought it unlikely that a “mature” speaker of a language – as the puppet in Study 1 was portrayed to be – would not know the names of familiar objects.

In order to address this alternative interpretation, in Study 2 we attempted to create scenarios in which a speaker’s ignorance would: a) seem more ecologically plausible, and consequently, b) less likely to be interpreted as manifesting playfulness.

Study 2

Study 2 followed the same exact design and procedure as Study 1 except for two modifications. First, instead of introducing the puppet as a friend of the experimenter, the experimenter described the puppets as children. Crucially, in the Ignorant condition, the puppet was described as a young child who had just started learning Hebrew. In the Knowledgeable condition, the puppet was described as a school-aged child who already knows a lot of Hebrew. It was expected that this modification would make the behavior of the speaker in the Ignorant condition more plausible to the participants. Second, in order to directly assess children’s appraisal of the speakers’ behaviors, at the end of the experimental trials, the experimenter asked children explicitly about whether they thought the speaker knew the names of the familiar objects in the disambiguation phase, and whether they thought the speaker was joking when he labeled the familiar objects in the familiarization phase. These questions served as manipulation checks, to verify that children’s answers in the two different conditions derived primarily from their assessments of speakers’ knowledge states rather than differences in speakers’ playfulness.
Method

Participants

Participants were 24 monolingual Hebrew-speaking Israeli preschoolers, 13 boys and 11 girls (M = 3 years 10 months, SD = 5.5 months, range = 3 years 0 months to 4 years 7 months). Children were primarily from middle- and upper-middle-class socio-economic backgrounds. Children were recruited from, and tested, in their preschools. Parental consent was obtained for each child prior to participation.

Materials

The same materials used in Study 1 were used in Study 2.

Design

Children were randomly assigned to one of two conditions:

Knowledgeable/Older child (n = 12, 6 girls and 6 boys, M_age = 3 years 9 months) or

Ignorant/Younger child (n = 12, 5 girls and 7 boys, M_age = 3 years 11 months). There was neither a significant age difference nor a significant difference in the gender distribution between the two conditions. As in Study 1, children participated in four familiarization trials followed by four disambiguation trials.

Procedure

The procedure in Study 2 was almost identical to that of Study 1 except for two modifications: one having to do with the presentation of the puppets, and the second with the addition of two questions at the end of the procedure.

Children in the Knowledgeable condition in Study 2 were introduced to a puppet described as being an older child. Children were prompted about their acquaintance with children who already attend school and thus know a lot of Hebrew, and were told that Yossi, the puppet, is like these children. In contrast, children in the Ignorant condition were told that the puppet is a young child, and that he has just
started learning Hebrew. After the introduction of the puppet, the procedure continued
exactly as in Study 1. That is, the puppet named, either correctly (Knowledgeable
condition) or incorrectly (Ignorant condition) the four familiar objects in the
familiarization phase, and then asked children for the referents of novel labels in the
four trials of the disambiguation phase. The same counterbalancing precautions taken
in Study 1 were undertaken in Study 2.

After children completed the disambiguation phase, the experimenter pointed
to the familiar object in the last trial of that phase (e.g., a pen), and asked children
whether they thought the puppet knew the name of the object (e.g., "Do you think that
Yossi knows that this is called a 'pen'?"). Children's yes/no answers were recorded.
The experimenter then brought out one of the familiar objects from the familiarization
phase (e.g., the dog), reminded children what the puppet had called it (e.g., "cow", in
the Ignorant condition), and asked children if they thought the puppet was joking
when he said that. Again, children's yes/no responses were recorded.

Results

The main prediction was that children would be more likely to choose the
novel object in response to a request made by a knowledgeable speaker than to one
made by an ignorant speaker. The dependent measure used to address this prediction
was the number of times (0 – 4) children selected the novel object as the referent of
the novel label used by the puppet in the disambiguation phase.

An ANOVA with condition (Knowledgeable vs. Ignorant) and gender as
between-subjects variables, and the participants' age in months as a covariate, on the
above dependent measure revealed a main effect of condition, $F(1, 19) = 14.90, p
< .005, \eta^2_p = .44$, an effect of gender, $F(1, 19) = 6.97, p < .05, \eta^2_p = .27$, but no effect
of age, $p > .3$, and no interaction between gender and condition, $p > .2$. The effect of
gender resulted from boys ($M = 2.69, SD = 1.32$) being more likely than girls ($M = 1.64, SD = 1.36$) to choose the novel object. In terms of the condition effect, children in the Knowledgeable condition ($M = 3.00, SD = 1.05$) were more likely than children in the Ignorant condition ($M = 1.42, SD = 1.31$) to pick the novel object in response to the puppet's request for a novel label. Analyses against chance (chance = 2 selections of a novel object) revealed that children in the Knowledgeable condition, $t(11) = 3.32, p < .01$, but not in the Ignorant condition, $p > .1$, selected novel objects more often than expected by chance. Finally, as in Study 1, we looked at a possible interaction between age and condition, by breaking down the participants into two age groups according to the median age. Here too we found no interaction between these factors, $p > .1$.

Analogous to Study 1, in order to evaluate children's individual pattern of responses, we classified children into two groups based on how consistently they selected the novel object. Children who selected the novel object on 3 or 4 of the four trials were considered *disambiguators*, while those who selected the novel object on 2 or less of the four trials were considered *overlap accepters*. As shown in Table 1, there were more disambiguators in the Knowledgeable than in the Ignorant condition, and the opposite was the case in terms of overlap accepters, $\chi^2 (1, N = 24) = 4.20, p < .05$.

Our last set of analyses looked at children’s responses to the two questions at the end of the procedure. We found that all children in the Knowledgeable condition responded affirmatively to the question whether or not the puppet knew the name of the last familiar object, however, all but one child in the Ignorant condition, responded negatively, $\chi^2 (1, N = 24) = 20.31, p < .001$. In turn, all children in both
conditions, except for one in the Ignorant condition, responded that the puppet was not joking when he named the familiar object in the familiarization phase.

Discussion

The results of Study 2 are consistent with our interpretation that children’s responses to the requests of speakers’ who had correctly versus wrongly labeled familiar objects, indeed derived from their assessments of these speakers’ knowledge of conventional object names, rather than estimations of their seriousness/playfulness. This finding is consistent with Koenig and Harris (2005), who found that children infrequently explained an unreliable speaker's incorrect labeling of familiar objects in terms of "pretense" or "silliness". This interpretation is also consistent with previous findings showing that children are more willing to learn new information from sources who had previously been accurate, than from those who had been inaccurate (e.g., Birch et al., 2008; Koenig & Harris, 2005). Moreover, the finding that children were capable of differentiating explicitly between a knowledgeable and an ignorant puppet indicates that their responses indeed reflected their appraisal of the puppets, not of the experimenter manipulating the puppets.

An unexpected finding from Study 2 is that boys were more likely than girls to select the novel object. We do not have a clear account of this gender effect. In fact, given that this effect occurred only in this study, it might have been due to some peculiarity in the sample. Moreover, the fact that gender did not interact with condition, i.e., both boys and girls were more likely to select the novel object in response to a request made by a knowledgeable than by an ignorant speaker, suggests that any difference there might exist between the genders, it does not seem to involve their capacity to assess speakers' knowledge.
One difference between the findings in Study 2 from those in Study 1 is that whereas children in the Ignorant condition of Study 2 selected the novel objects at rates no different from chance, children in the Ignorant condition of Study 1 selected the novel objects at rates significantly above chance. Interestingly in this regard, children in Diesendruck's (2005) study, who were exposed to a monolingual speaker who did not know anything about the language used previously to label an object, also responded at chance levels. A possible reconciliation of these findings has to do with the inferences children might have made about the different kinds of speakers. Namely, it is possible that an encounter with a mature speaker who knows the language but nonetheless commits errors in naming familiar objects (i.e., the Ignorant speaker in Study 1), was quite puzzling to children. Such a speaker may have prompted children to doubt about his knowledge of other familiar words, and the subsequent reasoning process children needed to engage in to fix this skepticism may have led to decrement in disambiguation responses. In this light, the encounter with an *inmature* speaker who committed errors in naming familiar objects (i.e., the Ignorant speaker in Study 2) might have been less puzzling, and thus easier to process. Specifically, children might have felt more comfortable simply attributing ignorance to such a speaker, thus not disambiguating at above chance levels.

A second possible reconciliation has to do with the identity of the speakers. Namely, children may assume that young children or speakers of a different language indeed know very little, if anything, about their language, but presumably mature speakers, even if they have been temporarily inaccurate, may nonetheless know more about the language. In other words, children may be relatively tolerant in their upholding of an assumption of conventionality, and it is only when a speaker is
immature or does not understand the language at all that they more readily abandon this assumption (see also, Lampinen & Smith, 1995, for consistent findings).

One implication of this latter interpretation is that if a mature speaker manifests knowledge of the language – even if the manner in which he or she refers to objects is unusual – then children should nonetheless uphold an assumption of conventionality about him or her. Study 3 addresses this implication.

Study 3

In order to assess how tolerant children’s assumption of conventionality is, in Study 3 we exposed children to a speaker (a puppet friend of the experimenter, as in Study 1) who employed unusual but correct labels to refer to familiar objects. In other words, this type of speaker gave evidence that he was knowledgeable about the language in general, even if his choice of labels to refer to the objects in the familiarization phase was peculiar. To ascertain that children were familiar with these unusual labels and could assess their accuracy, the superordinate labels for each of the familiar objects was used as the unusual label. While familiar to children of this age, superordinate labels are much less frequent in the linguistic input to which children are typically exposed, and are used less frequently by children (Callanan, 1985; Hall, 1994).

The alternative predictions were that if children hold a rigid assumption of conventionality (i.e., that each object has only one correct label – typically its basic-level label), then they should infer that an unusual labeler does not know the names of familiar objects, and they should thus respond like children in the Ignorant condition of Study 1 did. In turn, if children hold a more tolerant assumption of conventionality – as hinted by the fact that even children in the Ignorant condition of Study 1 selected the novel object at above chance levels – then they should infer that speakers who are
knowledgeable about the language might know the conventional labels of familiar objects. In this case, children should respond to Study 3’s unusual but knowledgeable labeler like children in the Knowledgeable condition of Study 1.

Method

Participants

Participants were 19 monolingual Hebrew-speaking Israeli preschoolers, 12 boys and 7 girls (M = 3 years 10 months, SD = 4.7 months, range = 3 years 4 months to 4 years 9 months). Children were primarily from middle- and upper-middle-class socio-economic backgrounds. Most children were recruited from and tested in preschools around the university. A few others were recruited from the local community and were tested at home. Parental consent was obtained for each child prior to participation.

Materials

The same materials used in Studies 1 and 2 were used in Study 3.

Design

All 19 children participated in the Unusual condition, in which they were introduced to a puppet in the same way as they had been in Study 1 (i.e., the puppet was introduced as a friend of the experimenter, not as a child). As in Studies 1 and 2, the procedure consisted of four familiarization trials followed by four disambiguation trials.

Procedure

The procedure in Study 3 was identical to the one used in Study 1 with only one exception. In the familiarization phase, children were exposed to a puppet who consistently used unusual but correct labels to name the four familiar objects (the same objects used in Study 1). In particular, the puppet used superordinate labels, and
thus called the banana "fruit", the dog "animal", the shirt "clothes" (in Hebrew, there is a singular form for clothes), and the cookie "food". The rest of the procedure, including the disambiguation phase and the counterbalancing precautions, was identical to the procedure in Study 1.

Results

As in Study 1, the dependent measure used to assess children's responses was the number of times (0 – 4) children selected the novel object as the referent of the novel label used by the puppet in the disambiguation phase. In general, children in Study 3 selected the novel object an average of 3.79 times ($SD = .42$), which was significantly more than would be expected by chance (chance = 2), $t (18) = 18.62, p < .001$.

In order to address the alternative predictions described above, two planned comparisons were conducted. First, we compared children's performance in Study 3 with the performance of children in Study 1's Knowledgeable condition. This comparison revealed no significant difference, $p > .7$. Next, we compared children's performance in Study 3 with the performance of children in Study 1's Ignorant condition. This comparison revealed that indeed, children in the Unusual condition of Study 3 were more likely to select the unfamiliar object in response to the novel label than were children in the Ignorant condition of Study 1, $t (34) = 2.75, p < .01$.

As in Study 1, we also conducted a non-parametric test in order to evaluate differences in individual children's response patterns. Using the same classificatory criterion described in Studies 1 and 2, we divided children in the Unusual condition into disambiguators and overlap accepters. All of the 19 children in the Unusual condition were disambiguators. This distribution was similar to the one found among children in the Knowledgeable condition of Study 1, and was significantly different
from the distribution found in the Ignorant condition of Study 1, $\chi^2 (1, N = 36) = 9.71$, $p < .005$.

Taken together, the findings from Study 3 reveal that children responded to an unusual but knowledgeable speaker in the same way that they responded to a knowledgeable speaker who used typical basic-level labels to name familiar objects.

Discussion

The goal of Study 3 was to examine whether children would uphold an assumption of conventionality towards a speaker who – while manifesting knowledge of the language – had used unusual names to refer to familiar objects. The results of Study 3 indicate that children did just that. Children seemed to have assumed that if a speaker knows that a banana is called "fruit", then he likely also knows what a car and a shoe are called. Consequently, when he asked children for the referent of a completely novel word, children inferred that he must be referring to a novel object rather than to one for which children knew the name. This finding also undermines an associationist account of the findings in Study 1: children did not think that an unusual labeler would always refer to familiar objects with unusual names.

These findings also point to a further implication of conventionality; namely, that while there are typical ways of referring to objects, there is not necessarily only one correct way. As Clark (1997) discusses, adults and children are aware of the multiple perspectives one can take to refer to objects. We will return to this point in the General Discussion.

Study 4

The previous three studies revealed that children rely on a speaker's manifested knowledge or ignorance of the conventional names of objects when subsequently inferring the speaker's referential intent. In other words, when children
have sufficient evidence to uphold an assumption of conventionality towards a speaker, they feel licensed to draw contrastive inferences. This conclusion adds to a growing number of studies revealing children's reliance on an assumption of conventionality regarding words (Buresh & Woodward, 2007; Callanan & Sabbagh, 2004; Diesendruck & Markson, 2001; Henderson & Graham, 2005).

As noted in the Introduction, an assumption of conventionality is useful not only in the realm of language, but also with regard to other cultural forms that although somewhat arbitrary and symbolic, are also conventionalized within cultural groups (Kalish & Sabbagh, 2007). The goal of Study 4 was to examine the scope of an assumption of conventionality, by investigating whether young children hold such an assumption in regard to object functions. There is evidence that children believe that objects have unique functions (Casler & Kelemen, 2005; 2007), and that these functions are the ones shared by multiple people (Siegel & Callanan, 2007). A recent study also demonstrated that just as with labels, 3- and 4-year-olds prefer learning about the function of a novel object from a user who had been previously accurate in describing the uses of objects, than from a user who had been faulty (Birch et al., 2008). In Study 4, we wanted to directly compare children's assumptions and subsequent inferences about names and functions. Study 4 adopts the same methods used in Study 1 to assess children's reasoning process in the domain of names, in order to assess their reasoning in the domain of object functions.

Method

Participants

Participants were 36 monolingual Hebrew-speaking Israeli preschoolers, 14 boys and 22 girls ($M = 3$ years 11 months, $SD = 6.2$ months, $range = 3$ years 3 months to 4 years 8 months). Children were primarily from middle- and upper-middle-class
socio-economic backgrounds. Most children were recruited from and tested in
preschools around the university. A few others were recruited from the local
community and were tested at home. Parental consent was obtained for each child
prior to participation.

Materials

In the familiarization phase, we used four objects highly familiar to children
this age and whose function children were assumed to know. The objects were: a toy
chair, a plastic spoon, a wooden hammer, and a plastic comb. In the disambiguation
phase, eight objects were used: four familiar and four novel. The objects in the
disambiguation phase were arranged into pairs of familiar-novel, in such a way that
the objects in each pair were similar in their color salience and size, and both objects
could fulfill the new functions mentioned in this phase. The familiar/novel pairs are
described in Table 2. The pairs were the same for all children, but were presented in
different orders across children. A hand-puppet was also used in order to provide the
functions. The experimenter manipulated the puppet, using a distinctive voice
whenever speaking for him (as in Study 1).

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Insert Table 2 about here

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Design

Children were randomly assigned to one of two conditions, Knowledgeable \( n
= 18, 12 \text{ girls and } 6 \text{ boys, } M_{\text{age}} = 3 \text{ years } 11 \text{ months} \) or Ignorant \( n = 18, 10 \text{ girls and } 8 \text{ boys, } M_{\text{age}} = 4 \text{ years } 0 \text{ months} \). There was neither a significant age difference nor a
significant difference in the gender distribution between the two conditions. Children
participated in four familiarization trials followed by four disambiguation trials.
Procedure

The procedure in Study 4 was exactly the same as in Study 1. The only difference was that in Study 4 children were familiarized with a user who was either knowledgeable or ignorant of objects' functions, and who later asked children for the object needed to perform a new function.

Familiarization phase. The familiarization phase was the only phase that differed between the two conditions. In this phase, the experimenter invited the child and the puppet to play, and presented familiar objects one at a time. The puppet looked at the object, and stated what the object was for three times while asserting his knowledge of what the object is (i.e., saying, "I know what this is!"). The main manipulation had to do with whether or not the functions mentioned by the puppet were the conventional functions associated with the objects. In the Knowledgeable condition, the puppet mentioned the conventional functions of the objects (e.g., upon seeing a spoon, he said repeatedly, "That's for eating!"). In the Ignorant condition, the puppet mentioned incorrect functions for the objects (e.g., about the spoon, "That's for cutting paper!"). After a few seconds in which the child and the puppet were allowed to play with an object, the experimenter returned the object to her bag, and brought out another familiar object. Again the puppet reacted according to the child's condition. This procedure was repeated for four trials, in order to allow the child to build an assessment of the puppet's knowledge – or ignorance – of familiar objects' functions. The conventional functions used for the items, chair, spoon, hammer, and comb, were "for sitting", "for eating", "for pounding", and "for combing hair", respectively. The incorrect functions used were: "for sweeping floors", "for cutting paper", "for singing", and "for picking flowers", respectively. Order of presentation of the objects was randomized across children, as in Study 1.
Disambiguation phase. This phase was identical in both conditions. The experimenter laid down in front of the child the first pair of familiar/novel objects. The puppet then looked at the child, and asked for one of the objects by using a new function that could be performed with either object (e.g., "Can you give me the one for making noise?"). The functions associated with each object pair were the same for all children. This was done because the functions were created so as to be affordable by both objects in each pair. The new functions applied to each pair are listed in Table 2. Both the puppet and the experimenter refrained from looking at either one of the objects, and instead maintained their gaze on the child. Once the child responded by pointing to, picking up, or handing to the puppet one of the objects, the experimenter removed the two objects, and replaced them with the next pair of familiar/novel objects. The experimenter did not provide any feedback to the child about his/her performance, and instead made comments about the game and the toys. The experimenter wrote down children's choices, and any other verbal comments children made throughout the entire procedure. Upon completion of the four disambiguation trials, children were thanked, given a sticker in appreciation for their participation, and returned to their class.

The order of presentation of the pairs was counterbalanced across children, as in Study 1. The left/right placement of each object within a pair was counterbalanced within children, so that on half of the pairs, the familiar object was placed on the right-side of the child, and on the other half of the pairs, the novel object was placed on the right-side of the child.

Results

Our main prediction was that children would be more likely to choose the novel object in response to a request made by a knowledgeable user than one made by
an ignorant user. The dependent measure used to address this prediction was the number of times (0 – 4) children selected the novel object as the referent of the new function requested by the puppet in the disambiguation phase.

An ANOVA with condition (Knowledgeable vs. Ignorant) and gender as between-subjects variables, and participants' age in months as a covariate, on the above dependent measure revealed a main effect of condition, $F(1, 31) = 4.53, p < .05, \eta^2_p = .13$, no effect of gender, $p > .6$, no effect of age, $p > .7$, and no interaction between gender and condition, $p > .9$. As illustrated in Figure 1, children in the Knowledgeable condition ($M = 3.56, SD = .70$) were more likely than children in the Ignorant condition ($M = 2.94, SD = .94$) to pick the novel object in response to the puppet's request for a new function. As in Study 1, analyses against chance (chance = 2) revealed that children in both conditions were more likely to pick the novel object than would be expected by chance: in the Knowledgeable condition, $t(17) = 9.36, p < .001$, in the Ignorant condition, $t(17) = 4.27, p < .005$. Finally, the interaction between age as a dichotomous variable based on a median-split of the sample, and condition, was not significant, $p > .8$.

In order to evaluate children's individual pattern of responses, we conducted the same non-parametric test run in Study 1, evaluating the distribution of children in terms of response consistency. As shown in Table 1, while the distribution pattern in Study 4 was similar to that found in Study 1, the difference between conditions in Study 4 did not reach significance, $\chi^2(1, N = 36) = 2.57, p = .11$.

Taken together, the results of Study 4 were consistent with our hypothesis. Children were more likely to select a novel object as the referent of a new function when the user asking for the function had previously manifested knowledge of the
conventional functions of objects than when the user manifested ignorance of conventional functions.

Comparisons between Studies 1 and 4

Given that Studies 1 and 4 had the same design and procedure, a comparison between them allowed us to directly assess potential differences between children's responses to labels (Study 1) and functions (Study 4). We conducted an ANOVA using Study (1 vs. 4) and condition (Knowledgeable vs. Ignorant) as between-subjects variables, on the mean number of times children selected the novel object in response to the puppet's request (for either a novel label, in Study 1, or a new function, in Study 4). The ANOVA revealed a significant effect of condition, $F(1, 65) = 10.71, p < .005$, $\eta^2_p = .14$, no effect of study, $p > .5$, and no interaction, $p > .7$. These findings were confirmed when looking at the distribution of children in terms of disambiguators or overlap accepters across these two studies. In the Knowledgeable conditions across the two studies, 32 of the 34 children were disambiguators, whereas in the Ignorant conditions, only 22 of the 35 were so, $\chi^2(1, N = 69) = 9.91, p < .005$. In terms of studies, 26 of the 33 children in Study 1 were disambiguators, compared to 28 of the 36 in Study 4, evidently a non-significant difference, $p > .9$.

Altogether, the knowledge state of the requester affected children's responses in the same way, whether he was asking for the referents of labels or for the functions of objects. Moreover, children did not show a stronger tendency to avoid overlap between two labels than between two functions.

Discussion

The goal of Study 4 was to assess whether children's inferences about the referents of functions would be similar to their inferences about the referents of object names. The findings indicate that they were. Children in Study 4 were more likely to
infer a contrastive intent when a user seemed knowledgeable about the conventional functions of objects than when a user seemed ignorant of such conventions. In fact, the direct comparison of children's responses to object functions and their responses to object labels revealed no significant differences. Given the similarity in the methodologies used to assess children's responses in these two domains, the above findings intimate that the same inferential process underlies children's responses in both domains.

General Discussion

A fundamental assumption for successful communication to take place is that partners in a conversation share one's knowledge about the expected ways to refer to familiar concepts. This assumption of conventionality has been documented in children, primarily via its contrastive implication; namely, that if a speaker uses a form that is different from the one expected in a given context, then that speaker likely has a different concept in mind (Clark, 1988). A number of studies have shown that children indeed draw this kind of inference when a conventional form is expected but is not used (Diesendruck, 2005; Diesendruck & Markson, 2001; Henderson & Graham, 2005). One of the central goals of the present studies was to address whether the extent to which a source has proven to be knowledgeable of conventional forms affects children's tendency to infer contrastive intents.

The results of the present studies reveal that it does. In Study 1, when a speaker proved knowledgeable of familiar names, then his subsequent request for the referent of a novel label was taken by children as indicative of an intent to refer to a novel – rather than a familiar – object. Children drew this inference to a significantly lesser extent when the speaker had manifested ignorance of the conventional names of familiar objects. Study 2 confirmed these findings, and provided evidence that
children's inferences, particularly those about an ignorant speaker's requests, were not
driven by considerations of playfulness or silliness, but rather considerations of
knowledge states (see also Koenig & Harris, 2005, on this point).

A social-pragmatic account of these findings is that children expected a
knowledgeable speaker to know the names of familiar objects, and expected such a
speaker to use these conventional names if intending to refer to the familiar objects.
Given that the speaker used novel names, children inferred that the speaker had a
contrastive intent in mind. In turn, given that the ignorant speaker proved not to know
the conventional names of familiar objects, children relaxed their expectation of
conventionality towards him, and thus did not as decisively draw a contrastive
inference in response to his use of a novel label. The present findings cannot
determine whether evidence for knowledge reinforced an assumption of
conventionality, evidence for ignorance weakened it, or both. What is crucial for the
present purposes, however, is that children modulated their contrastive inferences
based on their assessments of speakers' knowledge states.

A previous study (Diesendruck, 2005) had shown that children withhold an
assumption of conventionality from a speaker who does not speak the language in
which children were taught a novel name. The present findings add to that by
revealing that children's modulation of an assumption of conventionality operates
even within a single language, and may lead children to doubt that a speaker knows
even the names of highly familiar objects. On a separate issue, these findings add to a
growing number of studies indicating that children's avoidance of lexical overlap is
not driven by lexical constraints (Golinkoff et al., 1994; Markman & Wachtel, 1988;
Merriman & Bowman, 1989). Rather, children are willing to accept two names for an
object, especially in cases where an assumption of conventionality regarding the
speakers cannot be upheld (Diesendruck, 2005; Sabbagh, Wdowiak, & Ottaway, 2003).

The primary goal of Study 3 was to assess the leniency of children's assumption of conventionality. As Clark (1997) has advocated, an assumption of conventionality has to be flexible enough to allow speakers to deviate from rigid expectations of what should be said, without treating them as outcasts in one's linguistic community whose knowledge of the language cannot be trusted. The results of Study 3 confirmed that children respond to a speaker who refers to familiar objects with peculiar yet linguistically correct labels in the same way in which they respond to a speaker who uses conventional familiar labels to name those objects. In other words, the peculiarity in the labels used by Study 3’s speaker to refer to familiar objects did not throw children off, and did not lead them to withhold an assumption of conventionality towards that speaker.

A comparison of these results to those in Studies 1 and 2 Ignorant conditions, and those reported by Diesendruck (2005), intimates that children are quite resistant to abandoning an assumption of conventionality. In particular, children seem to uphold an assumption of conventionality towards an otherwise mature speaker of a language who momentarily mislabeled familiar objects (Ignorant condition of Study 1), or who provided peculiar but correct labels to familiar objects (Unusual condition of Study 3). In turn, children withhold an assumption of conventionality towards an immature speaker of a language who momentarily mislabeled familiar objects (Ignorant condition of Study 2) or a speaker who does not know the language at all (Diesendruck, 2005). In sum, children might operate with the default assumption that mature speakers of the child’s native language are knowledgeable of the conventional forms prevalent in the language.
It is important to point out that the above conclusion may be true only of the particular aspect of conventionality assessed in the present studies. That is, children may have a lenient assumption that speakers ignorant of certain familiar object labels nonetheless know the names of other familiar objects in their language. It is possible, nonetheless, that children would treat such speakers as untrustworthy teachers of novel labels, and thus would not treat novel labels used by them as conventional. A few studies are consistent with this possibility (Birch et al., 2008; Buresh & Woodward, 2007; Graham et al., 2006), but the issue of leniency in light of atypical labeling has not been directly addressed in this regard.

Study 4 evaluated whether children respond in a similar way to users who violate the conventional functions of objects, as they do to speakers who violate the conventional names of object. The findings from that study confirmed that children indeed treat these two cases equivalently. Children in Study 4 were just as sensitive to the knowledge state of object users when inferring which object a user had in mind for performing a function, as they were to the knowledge state of object labelers when inferring which object a speaker had in mind as the referent of a label. Namely, they drew contrastive inference when a user was knowledgeable more often than when the user was ignorant. It is important to note that while in the present study, knowledge of function was instantiated by the puppet naming the function – as opposed to actually performing it –, studies by Casler & Kelemen (2005, 2007) found that children draw contrastive inferences also in cases where the functions are performed. In other words, we believe that the patterns revealed in the present study are indeed representative of how children reason about the mapping of functions to objects.

An additional finding from Study 4 was that, just as in the case of labels, children manifested some resistance to abandoning an assumption of conventionality
towards object functions altogether. Specifically, even children in the Ignorant
condition of Study 4 selected the novel object as appropriate for performing a new
function more than would be expected by chance. Again, it is as if children reasoned
that while the user might not know what the specific familiar objects in the
familiarization phase are for (e.g., saying that a spoon is for cutting), he must know, in
general, what familiar objects are for (e.g., that a plate is not for making noise). Thus,
momentary evidence for ignorance of conventions merely weakens children's default
assumption in this case as well.

The idea that a reasoning process that invokes an assumption of
conventionality and inferences about users' intentions underlies children's assignment
of functions to objects, is consistent with a number of recent findings regarding
artifact categories in children. First, this conclusion is consistent with the notion that
children's concepts of artifacts are informed by beliefs regarding the artifacts' intended
function (Bloom 1996; Diesendruck, Markson, & Bloom, 2003). Children do not
read-off functions from objects directly, but rather via guessing what somebody meant
the object to be. Second and more central to the present proposal, the conclusion is
consistent with findings that by 2-1/2 years of age, children believe that objects have
unique purposes, which are known by all members of a culture (Casler & Kelemen,
2005). Children not only expect others to know what objects are for, but, as the
present findings indicate, they draw contrastive inferences about users' intended
function based on their assessment of users' knowledge of conventional functions.

A crucial question this conclusion invites is what is the scope of an
assumption of conventionality? One way to address this question is by evaluating the
processes by which children come to develop an assumption of conventionality.
According to one proposal, conventionality results from children's limited capacity to
entertain disparities in the knowledge states of different individuals (Sabbagh & Henderson, 2007). In other words, conventionality is a manifestation of children's overgeneralization of their knowledge states onto others – i.e., if they know something, then others probably know it as well (see also Birch & Bloom, 2003, on this so-called "curse of knowledge"). This proposal seems to imply that children's assumption of conventionality is fairly general in application. Challenging this proposal are findings that children do modulate their assumption of conventionality depending on others' knowledge state (see present studies, and Diesendruck, 2005; Sabbagh et al. 2003), and on the specific forms used (e.g., the cases of proper names, Diesendruck, 2005, and facts, Diesendruck & Markson, 2001). In fact, recent studies reveal that even prior to their second birthday, infants expect object names to be shared by distinct individuals, but do not hold such expectation regarding preferences (Graham et al., 2006) or goals (Buresh & Woodward, 2007). In other words, there are limits to the scope of children's assumption of conventionality.

A second proposal is that an assumption of conventionality derives from parental input. In particular, Callanan and colleagues have suggested that the way in which parents label objects when speaking to children (Callanan & Sabbagh, 2004), and the way in which parents demonstrate the uses of objects to children (Callanan, Siegel, & Luce, 2007), may endorse the notion that there is a best way to label and use objects. According to this proposal, conventionality would be limited to knowledge forms about which children receive this type of rich parental input.

A third proposal for the origin of conventionality with implications regarding its scope, focuses on cognitive capacities available to children from early on in development. Two capacities, in particular, seem relevant to the development of an assumption of conventionality: a) children's understanding of intentions, as already
hinted above, and b) children's capacity to detect statistical regularities in the input. Notice that while compatible with an input account, this proposal emphasizes what the child brings to the task of inferring conventionality, rather than how the input may be so structured as to facilitate this inference.

There is a vast literature indicating that already prior to their second birthday, children interpret people's actions as intentional or goal-directed (Gergely, Nadasdy, Csibra, & Biro, 1995; Meltzoff, 1995; Woodward, 1998). It has further been found that an understanding of intentions is involved in young children's inferences about word meanings (Akhtar & Tomasello, 2000; Baldwin, 1991; Bloom, 2000), and as noted above, artifact concepts (Bloom, 1996). The proposal is that children's monitoring of adults' actions in terms of intentionality might help them determine which "human products" are conventional and which are not. Evidently, this would not be sufficient for such a determination, but it might nonetheless be necessary.

In terms of children's statistical learning capacity, it has been shown that even prior to their first birthday infants are capable of picking out patterns in a stream of stimuli (Saffran, 2003). The idea being put forth here is that detection of stability in the way people refer to or use objects may contribute to children's assumption that an object label or function is conventional. In fact, Siegel and Callanan (2007) found that children's determination of what an object was for, was influenced by the number of people said to use the object in a specific way.

One of the implications of grounding an assumption of conventionality in terms of broader cognitive capacities is that we can then draw on the accumulating knowledge about the development of these capacities to explain, and generate hypotheses about, patterns regarding the development of conventionality. For instance, in none of the studies reported here was there an effect of age on children's
performance, nor an interaction between age and experimental condition. That is, children within a broad range of ages between 3 and 4 years of age responded similarly in our tasks. In contrast to this null result, there are inconsistencies with regard to the effect of age amongst studies assessing children's willingness to learn new information based on speakers' reliability. A possible reconciliation of these inconsistencies has to do with the nature of the tasks. In particular, there do not appear to be age differences in tasks that require children to rely primarily on their assessments of others' knowledge in order to infer others' intended behavior (e.g., the present studies; Birch et al., 2008; Jaswal & Neely, 2006: Koenig et al.'s, 2004, explicit judgment task). In turn, age differences were found in tasks that required children to predict a speaker's future behavior (e.g., Koenig & Harris, 2005), or in which children had to make subtle calculations about a speaker's state of knowledge (Pasquini, Corriveau, Koenig, & Harris, 2007). In a sense, this distinction seems analogous to ones made in the theory-of-mind literature between explaining behavior in terms of mental states versus predicting behavior in terms of mental states (e.g., Bartsch & Wellman, 1989).

The conclusion regarding conventionality is that one of the crucial capacities that undergo development in the preschool years is not so much the capacity to assess others' state of knowledge, but rather the capacity to apply productively and originally that assessment in pertinent real world situations. Consistent with this conclusion, recent studies show that even prior to their second birthday, infants may be capable of assessing others' knowledge states (Onishi & Baillargeon, 2005), interpret people's behavior in terms of knowledge states (Moll, Koring, Carpenter, & Tomasello, 2006), and expect others to share certain knowledge states (Buresh & Woodward, 2007). It
would be valuable for future studies to develop paradigms in order to assess children's capacity to apply conventionality flexibly.

A further implication of this latter proposal is that the knowledge forms that are treated by children as conventional are those that while arbitrary and thus without a transparent meaning, nonetheless tend to be intentionally produced and stably represented. By many accounts, these characteristics are precisely what define culture (e.g., Csibra & Gergely, 2006; Tomasello, Carpenter, Call, Behne, & Moll, 2005). Thus one can speculate that other cultural forms, such as symbolic representations, norms, or communicative signs, will also be treated as conventional by children. In this sense, the research program that investigates the development of children's assumption of conventionality meshes with the program investigating children's acquisition of culture.
References


Table 1

Distribution of children in terms of response patterns across conditions, in Studies 1, 2, and 4

<table>
<thead>
<tr>
<th>Pattern/Condition</th>
<th>Study 1</th>
<th>Study 2</th>
<th>Study 4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Know</td>
<td>Ignor</td>
<td>Know</td>
</tr>
<tr>
<td>Disambiguators</td>
<td>16</td>
<td>10</td>
<td>8</td>
</tr>
<tr>
<td>Overlap accepters</td>
<td>0</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>N</td>
<td>16</td>
<td>17</td>
<td>12</td>
</tr>
</tbody>
</table>
Table 2

Pairs of familiar-novel objects used in Study 4, and the new functions requested in the disambiguation phase.

<table>
<thead>
<tr>
<th>Familiar Object</th>
<th>Novel Object</th>
<th>New Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food plate</td>
<td>Round wooden block</td>
<td>Make noise</td>
</tr>
<tr>
<td>Toy hat</td>
<td>Oddly-shaped sponge</td>
<td>Wipe off sand</td>
</tr>
<tr>
<td>Plastic bottle</td>
<td>Ceramic cone</td>
<td>Smoosh dough</td>
</tr>
<tr>
<td>Color marker</td>
<td>Dumpling maker</td>
<td>Make holes</td>
</tr>
</tbody>
</table>
Figure 1

Mean number of selections of novel object in response to novel labels (Study 1) or new functions (Study 4)

Note. Error bars represent SEs.