The Role of the Lexical Component in the Acquisition of Scalar Implicatures

Anna Verbuk
Harvard University

1. Introduction

Scalar implicatures (SIs) belong to the species of Quantity-based conversational implicatures, which are derived based on the maxim of Quantity 1, which compels speakers to be as informative as is required. If a speaker makes a statement that is less informative than is required in the given context, the hearer may compute a Quantity-based implicature to the effect that the speaker did not provide a more informative statement because she does not know if it holds, as in (1), or the implicature that she knows that it does not hold.

(1) a. A: When is John in his office?
b. B: On Mondays.
c. Quantity implicature: B does not know if John is in his office on other days of the week.

Horn (1972) argued that a subclass of Quantity-based implicatures -- SIs -- are generated based on scales, such as <and, or> and <boiling, hot, warm>. In the case of SIs, the more informative statement is the one that contains a stronger scalar item. In an entailment-based scale, stronger items on the scale unilaterally entail all the weaker ones. Thus in the quantifier scale <all, most, many, some>, *all* unilaterally entails *most*, *many* and *some*, and *most* unilaterally entails *many* and *some*, etc. SIs are generated in the following manner: by affirming a weaker scalar item in a context where it is relevant whether or not a stronger scalar item holds, the speaker implicates that he knows that the stronger item does not hold.

(2) a. A: Did all of your students come to class on Friday?
b. B: Some of them did.
c. Scale: <all, some>
d. SI: B knows that not all of B's students came to class on Friday.

Experiments on the acquisition of SIs have been done by a number of researchers (e.g., Papafragou et al., 2004; Guasti et al., 2005). In this paper, I focus on the role of the lexical component involved in the acquisition of SIs. In computing SIs based on "logical" scales, e.g., <all, some> and <and, or>, one typically uses relatively little world knowledge, as I illustrate in (3).

(3) a. A: Are the cruncks[1] here?
b. B: Some of them are here.
c. Scale: <all, some>
d. B's SI: B knows that not all the cruncks are here.

A's question in (3) concerns the entire set of *cruncks*; Since B affirms that *some* of the *cruncks* are here, B's utterance gives rise to the SI that is relevant to A's question-under-discussion. Note that the SI in (3) is computed despite the lack of information about the identity of the *cruncks* or about any of their attributes.

[1] *Crunck* is a nonsense word.

In computing SIs based on "world-knowledge-based" scales such as <excellent, good, fair>, <boiling, hot, warm> and <tiny, small>, one typically needs to use more world-knowledge than in the case of "logical" scales.

(4) a. A. What size are the cruncks?
b. B. They are small.
c. <tiny, small>
d. B's (possible) SI: B knows that the cruncks are not tiny.

Note that in (4) A's question-under-discussion concerns the size of the *cruncks*, whereby the SI would potentially be relevant to the question-under-discussion. In terms of the SI being (potentially) relevant to the question-under-discussion, the mini-dialogues in (3) and (4) are exactly parallel. The SI in (4) will be computed if the information that the *cruncks* can be *tiny* is part of the Common Ground. However, if the Common Ground contains only the information that the *cruncks* can be either *small*, medium-sized or big, or contains no information about the typical size of the *cruncks*, then this SI will not be computed.

In terms of the child's experience, "logical" and "world-knowledge-based" scales are distinct precisely in terms of the amount of knowledge about the world that she needs to have in order to compute SIs. Next, I will briefly summarize previous research on the acquisition of SIs based on two "logical" scales -- the quantifier scale and the logical connective scale, and then go on to the discussion of my own experiment in which I compared children's performance on computing SIs based on "logical" vs. "world-knowledge-based" scales.

2. Previous Experiments on the Acquisition of the Quantifier and Logical Connective Scales

Studies where a variety of research methods were employed converge on the finding that at the age of five children are able to compute SIs based on the quantifier scale. Thus Papafragou and Tantalou (2004) tested 30 Greek-speaking children whose mean age was 5;3 on computing SIs based on the quantifier scale, among other scales, and found that children computed SIs 77.5% of the time. Papafragou and Tantlou employed an experimental technique which consisted in telling children stories and asking them indirect questions, which revealed whether or not they computed an SI; this technique was well-suited for probing children's pragmatic knowledge, and was distinct from a Truth Value Judgment Task.

Foppolo et al. (in press) tested 40 Italian-speaking children whose mean age was 5;4 on computing SIs based on the quantifier scale using a Truth Value Judgment Task. The authors found that children computed SIs 70% of the time for *some of* in the subject position and 75% of the time for *some of* in the object position.

Computing SIs based on the logical connective scale has been found to be more problematic for children. In the first experiment discussed in Chierchia et al., 15 children whose mean age was 5;2 were tested on computing SIs generated by the use of *or*. It was found that 50% of the subjects accepted an *or* statement, "every space-guy took a strawberry or an onion ring," as a description of a story where both disjuncts were true of every space-guy. Thus 50% of the children failed to compute an SI generated by the use of *or*. Chierchia et al. presented another experiment, which demonstrated that children whose mean age was 4;8 were able to distinguish between utterances containing *and* vs. identical utterances containing *or*. When presented with a situation where the *and* utterance is true, and asked to choose between the *and* utterance and the *or* utterance as a description of this situation, 93.3% of the children chose the target *and* utterance, "every farmer cleaned a horse and a rabbit." However, as Chierchia et al. point out themselves, the findings of these two *or* experiments show that, while children have knowledge of Grice's maxim of Quantity 1, they are having trouble with computing SIs based on the <and, or> scale.

It needs to be noted that the Truth Value Judgment Task was employed in the experiment discussed in Chierchia et al. where children were tested on computing SIs based on the <and, or> scale. As the authors themselves suggest, this task is not ideal for testing children on computing SIs because children may provide non-target responses not as a result of having failed to compute SIs but as a result of responding based on the truth-value of test sentences rather than based on SIs that these sentences generate. Thus it remains to be investigated experimentally how children fare on computing SIs based on the <and, or> scale using a methodology that is more suitable for this task.

To accomplish this task, in the present experiment, I tested children on the quantifier scale and the logical connective scale using the same methodology, which was not a Truth Value Judgment Task. To date, children have not been tested on computing SIs based on gradable adjective scales, such as <excellent, good, fair> and <boiling, hot, warm>. In the present experiment, I tested children on computing SIs based on these scales.

3. The Experiment

3.1. The Hypothesis

Given the difference between the amount of world knowledge one needs to be aware of in order to compute SIs based on "logical" scales vs. SIs relying on "world-knowledge-based" scales, I expect this asymmetry to have an effect on the way in which the child masters SIs based on these scales. I predict that computing SIs relying on "world-knowledge-based" scales should be more challenging for the child than computing SIs based on "logical" scales. Thus H1 is predicted.

(5) H1: Children do better on computing SIs based on "logical" than "world-knowledge-based" scales.

3.2. Methods

In order to test this hypothesis, I tested 40 English-speaking children, aged 4;3-7;7, on computing SIs. 20 children were aged 4;3-5;11 (*M*=5;03), and 20 children were aged 6;1-7;7 (*M*=6;10). I employed a mixed design; 20 children (10 4-5-year-olds and 10 6-7-year-olds) were tested on the <and, or> scale (3 experimental items) and <wonderful, good>[2] scale (3 experimental items), and 20 children (10 4-5-year-olds and 10 6-7-year-olds) were tested on the <all, some> scale (3 experimental items) and the <hot, warm> scale (3 items). Also, 12 fillers that did not contain these scalar terms were used.

The general set-up of the experiment was as follows. Children were introduced to several animal characters. Then they were told that a Tiger character gave different animals a series of tasks. If an animal had performed a task successfully, Tiger rewarded it with a jewel; if not, Tiger gave it a card as a consolation prize. The child's task was to answer the question, "What will Tiger give animal X?," and to justify her answer. Next, consider an example of an experimental scenario in which the <all, some> scale is employed.

(6) a. Tiger said, "I feel like drawing a picture but I can't find my crayons. I need all of my crayons because I want to draw a rainbow. Monkey, I want you to find all of my crayons for me." Monkey found some of the crayons.
b. Question: What will Tiger give Monkey? Why?
c. Target answer: a card.
d. SI: Monkey did not find all of the crayons.

Next, consider a scenario where an SI is based on the <wonderful, good> scale.

(7) a. Tiger said, "Deer, I really care about the way my furniture looks. I have some good furniture, but I don't have any wonderful furniture. Deer, I want you to make a really wonderful wardrobe for me. Deer made a good wardrobe for Tiger.
b. Question: What will Tiger give Deer? Why?
c. Target answer: a card.
d. SI: Deer did not make a wonderful wardrobe for Tiger.

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[2] While the lexical items included into the "goodness" scale usually are <excellent, good, fair> (e.g., Horn 1989), I used the scalar term *wonderful* instead of *excellent* because I assumed that children would be more familiar with the former than with the latter. On Grice's (1975) definition, conversational implicatures are "detachable," i.e., a conversational implicature should persist after a lexical substitution has taken place. Thus scales may contain synonyms. In other words, it is legal to substitute *excellent* with *wonderful* on the "goodness" scale.

3.3. Results

The experimental hypothesis was supported: there was a statistically significant difference between children's performance on "logical" scales and that on "world-knowledge-based" scales. Children fared statistically significantly better on the "logical" scale <all, some> than on the "world-knowledge-based" scale <hot, warm>. The mean number and the SD for SIs computed based on the <all, some> scale were *M=2.42, SD=1.12;* the mean number and the SD for SIs computed based on the <hot, warm> scale were *M=1.31, SD=1.15*; *F(1, 19)=6.90, p<.01.*

However, the difference between children's performance on the <and, or> scale vs. that on the <wonderful, good> scale was marginally significant. The mean number and the SD for SIs computed based on the <and, or> scale were *M=1.4, SD=1.5;* the mean number and the SD for SIs computed based on the <wonderful, good> scale were *M=.8, SD=1.32; F(1, 19)= 4.44, p<.049.* Children's performance on all four scales is shown in figures one and two.

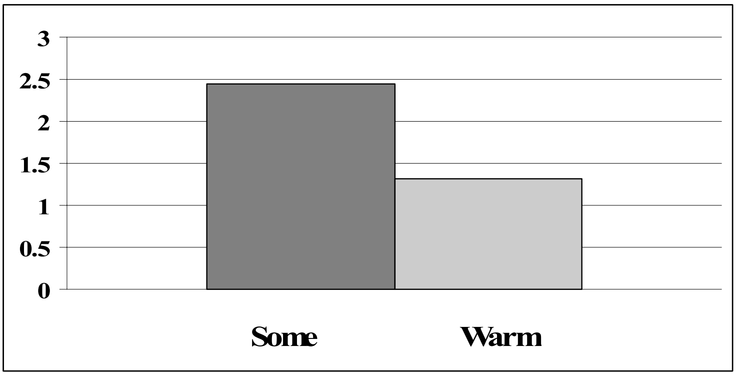

Figure one. SIs based on <all, some> and <hot, warm> scales

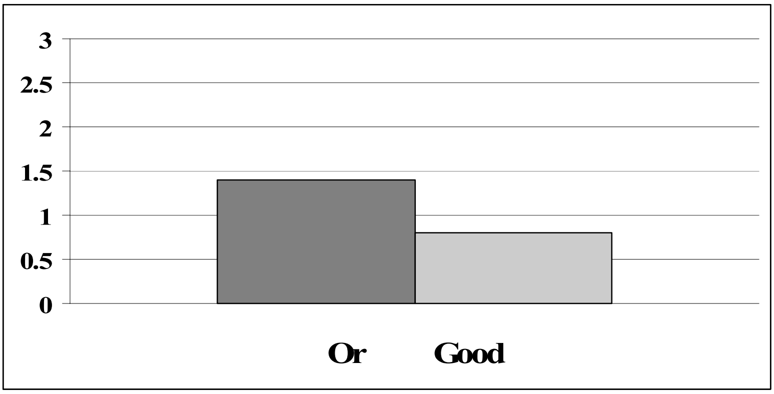

Figure two. SIs based on <and, or> and <wonderful, good> scales

3.4. Discussion

The distinction between "logical" and "world-knowledge-based" scales is that, in the case of the "logical" scales, one typically uses relatively little world knowledge in computing SIs based on them, while in the case of the "world-knowledge-based" scales, one typically uses more world-knowledge in computing SIs. The only scale that four- and five-year-old children demonstrated mastery of in the present experiment was the "logical" quantifier scale. Four- and five-year-old children computed 83% of SIs based on this scale, and six- and seven-year-olds computed 80% of SIs based on this scale.

These findings concerning children's performance on computing SIs based on the quantifier scale are consistent with the previous findings that have been reported in the literature. As I have mentioned, Papafragou & Tantalou found that five-year-olds computed SIs based on the <all, some> scale 77.5% of the time and Foppolo et al. found that five-year-olds computed SIs based on the <all, some> scale between 70% and 75% of the time, depending on the condition.

3.4.1. Gradable Adjective Scales

To the best of my knowledge, the present experiment is the first one in which children were tested on computing SIs based on gradable adjective scales. In computing SIs based on "world-knowledge-based" gradable adjective scales, children of both age groups performed poorly. Thus four- and five-year-olds computed 13% of SIs based on the <wonderful, good> scale and six- and seven-year-olds computed 40% of SIs based on this scale. Four- and five-year-olds also computed 37% of SIs based on the <hot, warm> scale and six- and seven-year-olds computed 46.6% of SIs based on this scale.

The following factors prevent the child from computing SIs based on the <hot, warm> and <wonderful, good> scales early on. Firstly, adult speakers' use of gradable adjectives is highly context-dependent. A speaker may use the adjective *warm* to describe a +75F° weather in May and a +40F° weather in December in Massachusetts. In describing the May weather, the speaker may be referring to his own standards of warmth, while in describing the December weather, the speaker may be referring to the December standards of warmth. Moreover, different speakers may refer to a +80F° weather in July as either *warm* or *hot*, depending on their personal perceptions. Being exposed to this kind of contradictory input, the child will experience difficulties in computing SIs based on the "warmth" scale.

Next, consider an additional complicating factor associated with the temperature scale. Note that, on a purely semantic account of SIs, a scalar term cannot be associated with two scales of different polarities. From the purely semantic standpoint, *lukewarm* belongs to the scale <cold, cool, lukewarm>, which is classified as an entailment-based Horn scale. However, in a given context, *lukewarm* may be part of a "warmth" scale, which is classified as a pragmatic scale. When used in reference to a beverage that is normally supposed to be cold, such as beer, *lukewarm* is part of the "warmth" scale <warm, lukewarm>. When used in reference to a beverage that is normally supposed to be warm, such as coffee, *lukewarm* is part of the scale <cold, lukewarm> with which it is semantically associated (Horn, 1989). Note that, while *lukewarm* is considered to be part of a Horn scale, without taking into account contextual information, one cannot determine which scalar value should combine with *lukewarm*. On van Kuppevelt's (1996) account, a topic-forming question makes salient the scale that is appropriate in the given context.

(8) a. A: How warm is your beer?
b. B: My beer is lukewarm, if not warm.
c. Scale: <warm, lukewarm>

(9) a. A: How cold is your coffee?
b. B: My coffee is lukewarm, if not cold.
c. Scale: <cold, lukewarm>

(van Kuppevelt 1996: 425).

While the scalar item *lukewarm* was not used in the present experiment, the above discussion provides additional evidence to the effect that SIs associated with the "warmth" scale are highly context-dependent.

An additional challenge that the gradable adjective scales pose for the child is the fact that the child may be unsure if the adjectives are lexicalized to the same degree. As I have mentioned, I employed the <wonderful, good> scale in my experiment. It is likely that the term *wonderful* is much less frequent in the child's input than the term *good*. One of the scalehood conditions is that lexical items that constitute a scale have to be lexicalized to the same degree. The child may wonder if *wonderful* is as lexicalized as *good* in the sense of being as commonly used if she has been exposed to many more uses of *good* than *wonderful*. According to Levinson, "the lexicalization constraint requires that stronger items on a scale be lexicalized to an equal or greater degree than weaker items" (Levinson 2000: 80). *Wonderful* is, in fact, the stronger item on the relevant Horn scale. The lexicalization constraint specifically concerns the stronger scalar items because obeying the maxim of Manner[3] cannot be the speaker's reason for eschewing a stronger scalar term. If a potentially stronger scalar item is avoided for reasons of prolixity or obscurity, the speaker's use of a weaker scalar item will fail to generate an SI to the effect that the stronger one does not hold. In a nutshell, because the child may (justly) classify the stronger items on the "goodness" scale as less lexicalized than the weaker ones, this may prevent him from constructing this scale early on. Note that the lexicalization constraint is not an absolute rule -- the "goodness" scale is operative in adult language despite the fact that the stronger items are less lexicalized.

Another stumbling block that children are likely to run into in constructing gradable adjective scales is their perception of the degree of contrast between adjacent scalar items. The knowledge concerning the degrees of contrast between specific scalar items is language-specific information that is acquired from the input. Suppose that for English-speaking adults, *fantastic* is stronger than *great* on the relevant "goodness" scale. However, the two items are close, if not adjacent, on the "goodness" scale, and *great* is fairly high on the scale. Thus it is likely that an adult would compute an SI from the speaker's use of *great* to "not fantastic / marvelous / fabulous etc." only in contexts where it has been made explicit that a greater degree of goodness than that designated by *great* is relevant, as in (10).

(10) a. A. Isn't she fabulous?
b. B. She is great.
c. A weak SI: Speaker B knows that she is not fabulous.

That is, if an explicit or implicit question-under-discussion is of the form, "Isn't x fantastic / marvelous / fabulous?," the SI "not fantastic" from the use of *great* may be computed. However, if a stronger scalar term (*fantastic* / *marvelous* / *fabulous*) is not part of the question-under-discussion, this SI will not be computed from the use of *great* (11).

(11) a. What is your impression of her?
b. She is great.
c. No SI: Speaker B knows that she is not fabulous.

As a result, it is likely that the use of *great* would generate an SI only in contexts where a question-under-discussion contains a stronger scalar item.

It is likely that, initially, children are unsure about the level of contrast between scalar items such as *warm* and *hot* or that between *wonderful* and *good*. Moreover, there may be a stage where the child has constructed a scale where *wonderful* is stronger than *good,* but, for the child, the contrast between the two scalar items is as subtle as the contrast between *great* and *fantastic* is for adults.

In this connection, consider N. P.'s (7;5) erroneous responses to two scenarios based on the <hot, warm> scale.

(12) a. Experimenter's question: What will Tiger give Deer?
b. Target response: a card because X was only warm but not hot.
c. N. P.: "A jewel. Because warm is close to hot. It's like, this is cold, this is warm, this is hot" (N. P. gestured with his hand to indicate three different heights corresponding to *cold*, *warm* and *hot*, respectively).

[3] Grice (1989) included the following four submaxims into the maxim of Manner.
1. Avoid obscurity of expression.
2. Avoid ambiguity.
3. Be brief (avoid unnecessary prolixity).
4. Be orderly.
(Grice 1989: 26-27).

(13) a. Experimenter's question: What will Tiger give Monkey?
b. Target response: a card because X was only warm but not hot.
c. N. P.: "A jewel. Because he made it warm and warm is close to hot."

Thus some children may experience difficulty in computing SIs based on the gradable adjective scales because they have yet to infer the degree of contrast between scalar items on these scales that exists in the adult language.

Moreover, speaker variation plays a role here as well. There are speakers who commonly use terms like *great*, *fantastic* and *fabulous*, and there are those who never use these terms but prefer to express the highest praise through using litotes like "not bad." A speaker who eschews the terms that are ranked high on the "goodness" scale may never intend an SI by using the term *good* because, in his I-language, *good* may be ranked as strongest. The I-language uses related specifically to gradable adjective scales are likely to be part of the child's input. This type of input may delay the child's construction of the relevant scale because the child is exposed to uses of gradable adjectives that are not the strongest on the relevant Horn scales in contexts where the stronger scalar item is relevant.

3.4.2. Logical Connective Scales

As I pointed out earlier, gradable adjective scales were not the only scales that were challenging for the children. I also found that the logical connective scale was challenging. 20 younger children (*M*=5;03) computed SIs generated by *or* 23% of the time; 20 older children (*M*=6;10) computed SIs generated by *or* 70% of the time.

Recall that Chierchia et al. also found that children whose mean age was 5;2 fared poorly on computing SIs based on the <and, or> scale. To the best of my knowledge, the fact that children's performance on computing SIs based on the <and, or> scale is poor has not been accounted for in the acquisition literature. Note, moreover, that <and, or> is a "logical" scale.

I will propose an account of children's poor performance on computing SIs based on the <and, or> scale in the light of Grice's original conception of the implicature associated with *or* and some recent theoretical work on the origins of the exclusive meaning of *or* in Geurts (2006). Grice's (1989) original argument was that *or* is used in contexts where one wishes to posit a non-truth-functional reason for accepting P v Q, as in (14).

(14) a. The prize is either in the garden or in the attic.
b. Ignorance implicature: The speaker doesn't know for a fact that the prize is in the garden.

(Grice 1989: 44).

The context in (14) is an instance where affirming disjunct "P" is more informative than affirming a disjunction "P or Q." In contexts where affirming one of the alternatives (e.g., "P") is more informative than affirming "P or Q," the speaker's use of the disjunction generates a (Quantity-based) ignorance implicature. In contrast, the use of *or* may generate an SI in contexts where affirming a conjunction "P and Q" is more informative than affirming a disjunction "P or Q".

Geurts (2006) demonstrates that, contra the widely accepted view, the SI associated with *or* arises only in a very limited range of contexts. In a vast majority of cases, the SI is not derived and either an ignorance implicature is derived, as in (14), or a disjunctive reading of the sentence is computed but not via an SI. In order for a stronger SI of the form, "speaker knows that not P," to be derived, the *competence assumption*, "the speaker is knowledgeable about the alethic status of the stronger statement," needs to be fulfilled (Geurts 2006: 2). Geurts demonstrates that, while in the case of *some*, the competence assumption is easily derivable, in the case of *or*, the competence assumption can be derived only in a very limited range of contexts, (15) being one example thereof.

(15) a. A to B: You may have an apple or a pear.
b. Stronger statement: You may have an apple and a pear.

In (15), the competence assumption is that A knows whether or not he will allow B to have an apple *and* a pear, whereby the use of *or* may give rise to an SI. (16) below is a case where an SI cannot be generated.

(16) a. A: John had an apple or a pear.
b. Stronger statement: John had an apple and a pear.
c. Ignorance implicature: Speaker A does not know if John had an apple.
d. Ignorance implicature: Speaker A does not know if John had a pear.
e. Disjunctive implicature: Speaker A does not know if John had an apple and a pear.
f. Underivable SI: Speaker A knows that John did not have an apple and a pear.

In (16c) and (16d), it is implicated that speaker A does not know that disjunct P holds and does not know that disjunct Q holds, respectively; these are ignorance implicatures. Because of these intervening implicatures, the speaker cannot be assumed to know if the stronger statement "P and Q" holds. Therefore, the competence assumption cannot be derived and an SI cannot be computed (Geurts 2006: 3). As Geurts notes, this problem does not arise with the derivation of SIs based on the quantifier scale.

(17) a. A: John had some of the pears.
b. Stronger statement: John had all of the pears.
c. SI: Speaker A knows that John did not have all of the pears.

The speaker of (17a) is normally assumed to be knowledgeable about the alethic status of the stronger statement in (b) in a context where it is relevant whether or not (b) holds; ignorance implicatures do not interfere with the competence assumption. Thus the SI can be derived.

The distinction between SIs based on the quantifier scale vs. SIs based on the logical connective scale made in Geurts (2006) straightforwardly accounts for the fact that children master SIs based on the quantifier scale at an earlier age than that at which they master SIs based on the connective scale. In the majority of uses of *or* that the child is exposed to, either an ignorance implicature is generated, as in (14b), or a disjunctive reading of the sentence is generated, as in (16e). It is for this reason that the <and, or> scale takes a relatively long time to get lexicalized.

To return to the discussion of my experimental results, all of my relevant SI condition scenarios based on the <and, or> scale were contexts where the competence assumption was satisfied, i.e., they were precisely the instances where the use of *or* generated an SI. Consider one of my *or* scenarios.

(18) a. Tiger said, "Monkey, I'd like to borrow your motorcycle and your car for the weekend. I want to drive them both to see which one can go faster. Can you lend me your motorcycle and your car?" Monkey said, "I can lend you my motorcycle or my car."
b. Experimenter's question: What will Tiger give Monkey? Why?

The test sentence in (18) is, "I can lend you my motorcycle or my car." Note that (18) is a context where the competence assumption that "Monkey knows whether or not he can lend Tiger his motorcycle and his car" is fulfilled. It is safe to assume that Monkey, who is the speaker, can be assumed to know if the stronger statement,

(19) I can lend you my motorcycle and my car

holds. (The modal *can* in Monkey's statement is ambiguous between the epistemic and deontic readings; however, this is immaterial because on either reading the competence assumption is satisfied). No ignorance implicatures arise. Therefore, an SI, "I know that I cannot lend you my motorcycle and my car," can be derived.

To summarize, I have pointed out a number of acquisitional challenges posed by gradable adjective and logical connective scales. The challenges posed by each of the scales are idiosyncratic and completely unrelated, which means that the child needs to overcome them one by one. In the case of the <and, or> scale, the complicating factor is the competence assumption, which in many contexts cannot be ascribed to the speaker. In the case of gradable adjective scales, the role of context creates complications on several levels. First, in using a gradable adjective, the speaker may be referring either to his own standards or to standards that hold in the given context. Second, the child may be unsure if gradable adjectives are lexicalized to the same degree; this is an issue of language use. Third, the child may be unsure concerning the degree of contrast between the given adjectives; this is also an issue of language use. Fourth, the I-language uses of gradable adjectives constitute an additional acquisitional challenge.

None of the above additional complications related to linguistic context and language use are relevant to the quantifier scale. It is for this reason that constructing a quantifier scale is less challenging than constructing the connective and the gradable adjective scales.

3.4.3. Children's Responses as Evidence of SI Computation

In most of their responses, children who were successful on computing SIs referred to the fact that the character failed to fulfill the stronger scalar item. This is precisely the content of the SI. Commonly, older children explicitly contrasted the weaker and the stronger scalar items in their responses.

(20) a. <and, or>
b. D. A. (6;5): A card. Because he (=Deer) only gave him (=Tiger) one. One wasn't good enough. Because he (=Tiger) wanted both of them, strawberries and blueberries.

(21) a. <wonderful, good>
b. D. A. (6;5): A card. Because Tiger asked for a great one but Monkey only gave him a good one.

These responses indicate that the child views the weaker and stronger scalar items as being in a salient opposition. Interestingly, sometimes children substituted the stronger scalar item that was used in the story with a synonym in their response. For example, D. A. (6;5) used *great* in place of *wonderful* in (21) above and A. A. (4;11) used *really good* in place of *wonderful* (22).

(22) a. <wonderful, good>
b. A. A. (4;11): Since he couldn't give him a really good backrub, he gets a card.

These substitutions indicate that the child conceptualizes scalar items such as *great* and *wonderful* as being stronger than *good*, and is aware that conversational implicatures are detachable, i.e., synonyms can be used in place of scalar items. These substitutions also indicate that children are not basing their responses merely on the mismatch between the weaker and stronger scalar items provided in the story. In sum, children who provided target responses also provided justifications that were clearly indicative of their having computed SIs.

4. Conclusion

The more world-knowledge and knowledge of language use is necessary for computing SIs based on a given scale, the more challenging the scale is for the child. At the same time, the broad distinction between "logical" vs. "world-knowledge-based" scales is not the only one that has a reflex on acquisition. "Logical" scales, such as <and, or>, present challenges of their own. Thus the child's success on computing SIs based on a given scale cannot be predicted based on broad classes of scales alone but rather is a function of challenges presented by individual scales. Challenges posed by individual scales affect the timeline of SI mastery.

I will conclude by briefly mentioning a recent study by Noveck and colleagues, which explores the role of the lexical component in SI acquisition from a different angle. Interestingly, given a single scale, the choice of a scalar item has a reflex on acquisition as well. In a recent experiment on the acquisition of SIs conducted by Noveck and colleagues based on two French "some"s, *certain* and *quelques*, which was reported in Pouscoulous et al. (2007), the authors found that children are significantly more likely to compute SIs generated by *quelques* than those generated by *certain*. Pouscoulous et al. attribute this difference in children's performance to the fact that *certain* is partitive, and thus has a more complex semantics than *quelques*, which is a simple existential. The authors demonstrated that 9-year-old children who were tested were able to interpret *certain* correctly.

However, interpreting this semantically complex indefinite required using some processing resources, which, in turn, made it difficult to compute SIs for processing reasons. These results tell us that even fine-grained distinctions between scalar lexical items have a reflex on children's mastery of SIs. In the future, more work needs to be done in order to identify additional lexical factors that affect the time-line of SI acquisition.

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