

Aspectuality and Scalar Implicatures^{*}

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1 Introduction

Aspectual predicates such as *start* and degree modifiers such as *half* consistently give rise to SCALAR IMPLICATURES (SIs). For instance, an utterance such as (1a) or (2a) is typically taken to implicate (1b) or (2b) respectively:

- (1) a. I started/began reading ‘Crime and Punishment’.
b. I didn’t finish reading ‘Crime and Punishment’.
- (2) a. I read ‘Crime and Punishment’ halfway/half of ‘Crime and Punishment’.
b. I didn’t read all of ‘Crime and Punishment’.

According to the standard analysis, such aspectual verbs and degree modifiers are scalar expressions with lower-bounded semantics (Horn, 1972; Grice, 1989; Carston, 1998; Sperber and Wilson, 1995; Levinson, 2000). In cases where this semantic content falls short of the informativeness and relevance expectations raised by the conversational exchange, the hearer is entitled to derive an upper-bounding implicature of the sort in (1b/2b). In other words, assuming that the speaker is trying to be co-operative and will say as much as she truthfully can that is relevant to the exchange, the fact that she chose a weaker term (e.g. *start*) from an informational scale $\langle \textit{finish}, \textit{start} \rangle$ gives the listener reason to think that she is not in a position to offer an informationally stronger statement (using *finish*) – presumably because such a statement is false.¹ In this sense, aspectual expressions pattern alongside with a variety of scalar expressions, including quantifiers ($\langle \textit{all}, \textit{some} \rangle$), connectives ($\langle \textit{and}, \textit{or} \rangle$), numbers ($\langle \dots \textit{two}, \textit{one} \rangle$), etc.

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¹ There is disagreement in the literature about the precise mechanisms which give rise to scalar implicatures. For discussion, see Carston (1998), Horn (1992), Sperber and Wilson (1995), Levinson (2000).

Scalar inferences raise a host of interesting developmental questions, since the ability to compute them relies on a variety of resources at the semantics-pragmatics interface. Recent experimental studies have suggested that preschool children are often insensitive to scalar implicatures in language comprehension tasks (Noveck, 2001; Chierchia, Crain, Guasti, Gualmini and Meroni, 2001; Gualmini, Crain, Meroni, Chierchia and Guasti, 2001). In these studies, young language learners were shown to attend only to the semantic content of scalar expressions such as the quantifier *some* and the connective *or*; for instance, preschoolers would treat *some* as compatible with *all*, a fact which squares well with the encoded content but not with the standard usage of the quantifier.

More recent results, however, raise the possibility that children's failures in previous studies might be due to experimental demands rather than a genuine inability to compute scalar pragmatics. Papafragou and Musolino (2002), using evidence from Modern Greek, showed that 5-year-olds had some success in computing non-completion SIs from aspectual terms such as 'start',² if the experimental demands are clear and the information expectations are salient. They also uncovered some intriguing asymmetries in children's success with scalar terms: Greek-speaking preschoolers were much more successful with the scalar pragmatics of numerals such as 'two' (*dtio*) than with SIs derived from quantifiers such as 'some' (*meriki*), even though the experimental scenarios were otherwise identical. The authors concluded that the nature of the scalar expression (e.g. whether the scale was discrete or continuous) crucially affected children's ability to compute the relevant SIs.

In this paper I present findings from a new experimental study which was conducted with native speakers of Modern Greek in order to probe further into the acquisition of non-completion SIs. The study compared 5-year-olds' and adults' comprehension of the SIs associated with two aspectual verbs, *arxizo* ('start') and *keekino* ('begin'), and two degree modifiers, *miso* ('half') and *mevri ti mesi* ('halfway'). The aims of the study were two-fold: first, to uncover whether children can draw non-completion inferences; second, to examine the properties of such SIs in child language, especially across semantically related expressions.

² Throughout this paper, I will use quotes (rather than italics) whenever an English form is used as a gloss of a Greek scalar term.

2 Experiment

2.1 Method

2.1.1 Participants

Participants in this study were a group of 40 Greek-speaking 5-year-olds between the ages of 4;10 and 5;11 (mean 5;6) and a group of 40 adult native speakers of Greek. Children participants were recruited from a daycare in Athens, Greece. The adult speakers were also recruited from the Athens area.

2.1.2 Materials and Procedure

Following Papafragou and Musolino (2002), the present study used a pragmatic judgment task in order to tap into children's comprehension of scalar inference. The main phase of the experiment was preceded by a training phase which aimed at making children familiar with the task of detecting pragmatic infelicity. Children were presented with a puppet, Minnie. Minnie would be shown some acted-out stories and then she would be asked what happened in the story. Children were told that Minnie sometimes says 'silly things' and that the child should help her 'say things better'. In one of the training scenes, Minnie was shown a spoon and asked what it was. She described the object as 'something we use for eating'. When asked whether Minnie answered well, children were expected to correct this truth-conditionally accurate but pragmatically infelicitous statement. Whenever they failed to do so, the experimenter finally corrected Minnie and offered a more appropriate description of the object ('Minnie didn't say that very well. This is a SPOON'). The training phase included two truth-conditionally correct but pragmatically inappropriate descriptions and two descriptions which were both correct and appropriate. This was to make sure that children didn't develop a bias for assuming that Minnie always said silly things.

In the main part of the experiment, children were shown a set of four test stories and four control stories. Each test story satisfied the truth conditions of an informationally stronger element within an aspectual/degree scale but was described by Minnie in terms of a weaker element from that scale. For instance, in one of the test stories, Daisy watched Mickey while he carefully colored a star. Daisy wanted to color another star for herself, even though Mickey doubted that she could do it. At the end of the story, Daisy managed to color the star. When asked how Daisy did, Minnie offered a statement such as the following:

- (3) I Dezi arxise na zografizi to asteraki.
 Det-Daisy started to-paint det-star-dimin.
 'Daisy started painting the star'.
 (4) I Dezi ksekinise na zografizi to asteraki.
 Det-Daisy began to-paint det-star-dimin.
 'Daisy began painting the star'.
 (5) I Dezi zografise to miso asteraki.
 Det-Daisy painted det half star-dimin.
 'Daisy painted half the star'.
 (6) I Dezi zografise to asteraki mexri ti mesi.
 Det-Daisy painted det-star-dimin. up-det-middle
 'Daisy painted the star halfway'.

After hearing Minnie's statement, children were asked whether Minnie had 'answered well'. In case they responded 'Yes', no further questions were asked. In case they responded 'No', children were asked whether we can 'say it better'. It was expected that, if children are pragmatically savvy, they should reject statements such as (3)-(6) as descriptions of the story and offer utterances such as (7)-(9) as improved ways of describing what happened:

- (7) I Dezi teliose to asteraki.
 Det-Daisy finished det-star-dimin.
 'Daisy finished the star'.
 (8) I Dezi zografise olo to asteraki.
 Det-Daisy painted all det-star
 'Daisy painted all of the star'.
 (9) I Dezi zografise to asteraki mexri to telos.
 Det-Daisy painted det-star up det-end
 'Daisy painted the star to the end'.

Children were randomly assigned to one of the four aspectual/degree expressions, *arxizo*, *ksekiniso*, *miso* and *mexri ti mesi*. All test stories were identical across all conditions: for instance, children in all conditions saw the star-coloring scene as described above. What was different across conditions was the critical statements used to describe these stories. The purpose of this step was to ensure that, other things being equal, any differences among conditions should be attributable only to aspects of the semantics-pragmatics of individual scalar terms.

Control items (which were identical across conditions) also involved two characters engaged in some sort of contest. They were always correctly (and

feliculously) described by Minnie and never involved the use of scalar terms. For instance, in one of the fillers a horse and a turtle entered a race and the horse finished first. Minnie's description was: 'The horse beat the turtle'. It was expected that children should find no difficulty accepting all control statements as good answers. The test stories and the control stories were administered in a pseudo-random order. Within each condition, order of presentation was counterbalanced.

Adult participants were randomly assigned to one of the four conditions in a modified version of the same task. They were given a leaflet which contained in written form the instructions verbally given to the children. For the warm-ups, the control and critical trials, adults read a description of the stories which did not contain any scalar items and which did not specify the ending. For instance, for the star-coloring story, adults read the following description (translated from Greek):

(10) Daisy and Mickey are playing with markers. Mickey shows Daisy a star and how to color it. He tells her that one should not leave white spaces and makes it clear that he doesn't trust her to color a star on her own. Daisy thinks she can manage. She takes another star and a marker. The story ends as shown in picture [number of picture provided].

In order to see how the story ended, adults had to consult a digital photograph in the booklet which showed the outcome of the event (e.g. Daisy holding a completed star). Participants then read Minnie's statement and had to answer the same questions as the children did ('Did Minnie answer well? If not, can we say it better?') by filling in their answers in the space provided. It was expected that adults would overwhelmingly correct the puppet's statements on all critical trials.

2.2 Results

Beginning with test trials, it was found that adult subjects overwhelmingly rejected the puppet's statements in all four conditions (95% of the time for 'start', 97.5% of the time for 'begin', 95% of the time for 'half' and 100% of the time for 'halfway'). By contrast, it was found that 5-year-olds did not generally reject the puppet's statements in the critical trials (32% of rejections for 'start', 37% for 'begin' and 32% for 'halfway'), with the exception of 'half' (67% of the answers were rejections; see Figure 1).

On the control items, adults gave correct answers 70% of the time for 'start', 82.5% of the time for 'begin', 97.5% of the time for 'half' and 87.5% of the time for 'halfway'. On the same items, children gave correct responses

97.5% of the time in the 'start' condition, 87.5% of the time in the 'begin' condition, 100% in the 'half' condition and 90% of the time in the 'halfway' condition.

Recall that, in case they rejected Minnie's statement, subjects had to offer an improved version of her utterance. This gave the opportunity to participants to justify their rejection of the puppet's utterance by providing their own description of the outcome of the story. It was expected that adults would not only reject Minnie's underinformative statements on the critical trials but also go on to reformulate her descriptions using a stronger (more informative) term - cf. (7)-(9). This expectation was borne out: all corrections provided by adult subjects were of this sort.

Unlike adults, 5-year-old children generally accepted Minnie's statements for all scalar expressions (with the single exception of 'half'). Nonetheless, in those cases where children did reject the puppet's statement, they did so for the right reason, since their corrections invoked a more informative item than the one used by Minnie. Such adult-like corrections accounted for 91% of the children's corrections across all four conditions.

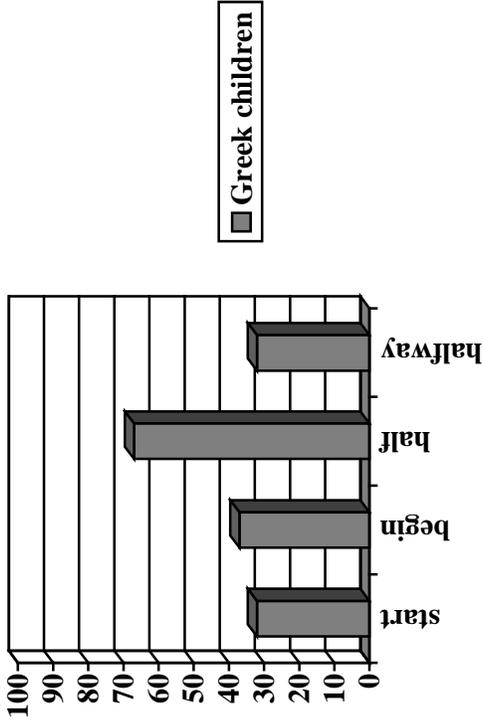


Figure 1: Proportion of children's correct responses on critical trials.

2.3 Discussion

Results from this experiment show that, for adults, scalar implicatures are regularly computed in contexts in which the relevance and informativeness requirements of the conversational exchange are not met. Specifically, adults rejected statements containing inchoative (aspectual) verbs such as 'begin'/'start', or degree expressions such as 'half'/'halfway' when these statements were used to describe completed actions. Furthermore, adults justified these rejections by offering stronger versions of these descriptions. For instance, in a situation where Daisy painted a star, adults rejected the statement 'Daisy began painting the star' as an accurate and felicitous description of what happened; furthermore, they went on to correct this description by offering instead a statement such as 'Daisy painted the star'. By contrast, it was found that preschoolers were able to reject an under-informative statement with 'start', 'begin' or 'halfway' only about one third of the time (32%, 37% and 32% of correct responses respectively). Whenever such rejections were made, children correctly suggested improved versions of the target statement which included a more informative (stronger) expression. These findings confirm - and empirically extend - previous experimental reports that scalar inferences are regularly computed, when appropriate, during adult language comprehension but do not surface consistently in language processing by young children (Papafragou and Musolino, 2002; cf. Noveck, 2001; Chierchia et al., 2001; Gualmini et al., 2001).³

The most intriguing aspect of the present findings is the fact that children, even though they generally have limited sensitivity to the pragmatics of scalar terms such as 'start' and 'halfway', are very successful at deriving SIs from the scalar modifier 'half' (67% of correct responses). Given that the materials and stories used were identical for all scalar terms in this study, this difference introduces an unexpected asymmetry in the derivation of SIs.

The behavior of 'half' in this study is worth exploring further for the following reason. Recall that one of the hallmarks of conversational implicature is non-detachability. This property ensures that expressions which have the same meaning carry the same implicature in a given context (with the reasonable exception of Manner implicatures). In our examples, the pairs 'start'/'begin' and 'half'/'halfway' allow us to test whether SIs survive

³ Papafragou and Musolino (2002) report higher success rates with 'start' using the same method but with a slightly older population of 5-5-year-olds.

across synonyms. For adults, results satisfied non-detachability: adults were equally successful at deriving SIs triggered by synonymous expressions (and, in fact, were at ceiling with all four expressions used). For children, however, results were mixed. Five-year-olds performed similarly on 'start' and its synonym 'begin' (namely, they were poor in deriving SIs from these terms). However, they were much more successful in computing the SIs triggered by 'half' rather than the closely semantically related 'halfway', even in contexts which were otherwise exactly identical.⁴

Several explanations might seem initially plausible for the asymmetry of 'half'. An obvious one is that 'half' and 'halfway' - and their Greek equivalents *miso* and *mexri ti mesi* - are not truly synonymous. After all, as (5)-(6) show, *miso* modifies the direct object of the verb, whereas *mexri ti mesi* modifies a measure provided by the direct object (cf. Tenny, 1994: 19). Nevertheless, it is hard to imagine a situation where one of these terms would apply and the other would not. If one has eaten half an apple, one has also eaten the apple halfway (and vice-versa); if one has run half a marathon, one has also run a marathon halfway (and vice-versa). So even though it is true that some subtle semantic differences exist between these two terms, there do not seem to be sufficient reasons for waiving the non-detachability requirement.

Even if the minimal pairs included in the study are synonymous, one might reasonably argue that children at this age do not yet fully know their semantics. If this is the case, children's failures with 'halfway' (but also with 'start' and 'begin') may be attributed to lack of relevant semantic knowledge rather than inability to compute scalar pragmatics. There is some evidence from English that children at age five (even though not earlier) have mastered the semantics of degree terms. Wagner (1998) tested 2-, 4-, and 5-year-olds' understanding of completion/non-completion expressions (*all done, completely vs. partly done, in the middle of*). She used a sentence-to-picture matching task, in which children had to match a pair of sentences to two pictures, one of a completed and another of an incomplete event. What she found was that even the youngest children were successful with the completion terms; with non-completion expressions, 5-year-olds were successful (even though the two other age groups did not score above chance).

At this stage some evidence is needed that Greek-speaking preschoolers have acquired the truth-conditional semantics of degree and aspectual terms.

⁴ Interestingly, Noveck (2001) reports that children in his study were much more successful with the SIs of *might* than those of the closely related modal *could*. These findings also seem to be unexpected given the non-detachability requirement. On the subtle link between modality and uncertainty, see Papafragou (2000), among others.

A control task was designed which sought to separate the semantics from the pragmatics of scalar terms.

3 A Control Task

3.1 Method

3.1.1 Participants

Participants in this control task were a new group of 40 Greek-speaking children between the ages of 4;4 and 5;11 (mean age 5;6). They were recruited from the same Athens daycare as the children in the main study.

3.1.2 Materials and Procedure

Children were told that they would witness a drawing competition. Four animals, a lion, a bear, a giraffe and a horse, were given a sheet of paper and a pencil each and got ready to draw. Before the drawing started, children were informed of the terms of the competition, which were phrased in terms of one of the following statements:

- (11) Whoever starts drawing a star gets a prize.
- (12) Whoever begins drawing a star gets a prize.
- (13) Whoever draws half a star gets a prize.
- (14) Whoever draws a star halfway gets a prize.

The animals took turns in drawing but each one produced something different. The lion drew a star; the bear drew a circle; the giraffe drew half a star; and the horse drew nothing. Children, after being briefly reminded what the condition for winning a prize was, had to determine for each animal whether it should get a prize or not.

Notice that the aspectual/degree expressions in (11)-(14) appear in environments where scalar implicatures are canceled (cf. Chierchia, 2001): intuition confirms that all of the utterances in (11)-(14) allow for a prize to be awarded not only to contest participants who draw part of/half of a star but also to those who complete a star. In this situation, that is, the semantic content of the scalar expressions places a minimal requirement on the contestants (drawing part/half of a star) and is compatible with actions which go beyond that (completion of the star). The prediction then is that, if children know the semantics of degree/aspectual expressions, even if they are not sensitive to their pragmatic (SI-triggering) properties, they should award a prize to both the animal which produced half of the star (i.e. the giraffe) and to the animal which drew the whole star (i.e. the lion). Crucially,

this task from the beginning leaves open the possibility that the drawing competition will have more than one winner. First, many prizes (coins) were available in the scene and were ready to be distributed, if needed. Second, the formulation of the statements in (11)-(14) ('Whoever...') specifically allows for multiple winners.

There were four groups in the task, depending on the kind of scalar expression used ('start', 'begin', 'half', 'halfway'). Children were randomly assigned to one of these groups so that there were ten children per group.

3.2 Results

Across groups, it was found that children correctly awarded a prize to the animal which drew the target object and to the animal which drew half of the target object (92.5% and 97.5% of correct responses respectively). Children also rightly refused to give a prize to the animal which drew an irrelevant object and to the animal which drew nothing at all (90% and 95% of correct responses respectively). Overall, 85% of the children gave errorless responses, i.e. (a) they awarded a prize to both the animal which drew a star and to the animal which drew half of the star, and (b) they didn't give a prize to anyone else.⁵

3.3 Discussion

Results from the control task suggest that children around the age of five can assign the correct truth-conditional content to both aspectual verbs such as 'start' and 'begin' and to degree modifiers such as 'half' and 'halfway'. Specifically, children can give a lower-bounded interpretation of these terms in environments in which the upper-bounding (scalar) implicatures typically associated with these expressions are canceled. These findings from Greek are consistent with experimental results from English, which suggest that children at this age have mastered the semantics of degree expressions such as *in the middle of* or *partly* (Wagner, 1998). Furthermore, they give evidence that 5-year-olds can cancel implicatures which they can successfully generate: for instance, in this task children canceled the SI associated with 'half' which (as the first experiment showed) they can otherwise derive at this age.

⁵ Errorless performance was observed on 90% of the responses in the *ksekino* ('begin') group, 80% of the responses in the *arxizo* ('start') group, 90% of the responses for the *mexri ti mesi* ('halfway') group and 80% of the responses in the *miso* ('half') group.

The findings from the control task enable us to reject lack of semantic knowledge of aspectual/degree expressions as a possible explanation of children's pragmatic failures with such expressions in the first experiment. Specifically, insensitivity to the scalar pragmatics of 'start'/'begin' cannot be attributed to poor grasp of the truth-conditional content of aspectual verbs. More importantly, perhaps, the fact that children are better at detecting the scalar inferences generated by 'half' than the SIs triggered by 'halfway' is probably not due to lack of knowledge of the semantics of the adverbial. I return to the issue of why children might generally fail with the SIs of degree/aspectual expressions but succeed with the scalar inferences of 'half' in the discussion below.

4 General Discussion

The experimental results reported here confirm - and empirically extend - previous experimental reports that scalar inferences are regularly computed, when appropriate, during adult language comprehension but are not consistently derived by otherwise linguistically savvy young children (Noveck, 2001; Papafragou and Musolino, 2002; Chierchia et al., 2001; Gualmini et al., 2001). Specifically, it was found that, even though 5-year-olds know the semantics of aspectual verbs such as 'start' and degree modifiers such as 'half', they are not able to consistently draw scalar inferences from these terms with the single exception of 'half'.

These results open up interesting issues in the semantics-pragmatics interface. We now need an explanation for why SIs with aspectual/degree expressions are generally hard to derive (and why 'half' is special in that respect). Furthermore, given these difficulties, we need to determine what possible cues children make use of in order to ultimately arrive at scalar inferences.

One reason why children may find the inferences associated with aspectual verbs such as 'start/begin' hard to compute is that such verbs are inherently vague. What counts as initiating a process is notoriously context-dependent. Consider when it is felicitous to say that the process of building a bridge has started: when the engineers started the sketches of the bridge? when the sketches were completed? when the first stone was placed? Since the conditions of appropriateness for inchoative predicates vary across contexts, children may be uncertain as to whether one of these verbs applies or not in a given situation. Some support for this hypothesis comes from a related finding in the earlier Papafragou and Musolino (2002) study which compared SIs triggered by numbers (e.g. 'two') and vague quantifiers (e.g. 'some'). In that study, preschoolers were much more successful with

numbers than with quantifiers (even though they both appeared in the same scenarios) for reasons that presumably have to do with the discreteness of number terms vs. the vagueness of quantifiers such as 'some'.

The lack of a specific cut-off point may explain why children find SIs triggered by aspectual verbs harder than SIs carried by certain more precise degree modifiers but cannot explain the difference between individual degree modifiers - hence the relative ease of 'half' compared to 'halfway'. One possibility is that children are much less familiar with the contexts of use of *mexri ti mesi* ('halfway'). This seems intuitively plausible for Greek and is certainly true for English, where *half* is massively more frequent than *halfway* (Francis and Kučera, 1982). The difference is reflected in production, too: Wagner (1998), on the basis of CHILDES data, reports that uses of non-completion adverbials such as *halfway* in English-speaking children's production are vanishingly rare, even compared to completion adverbials.

Another explanation is that different degree modifiers place different requirements on the conceptualization of the aspectual profile of events. Notice that the Greek PP *mexri ti mesi* ('halfway') modifies a measure provided by the direct object of the verb (i.e. the Incremental Theme), while *miso* ('half') modifies the object of the verb directly. If young language learners have difficulty understanding that Incremental Themes measure out events (e.g. that the progress of painting a star can be 'read off' from the state of the star at a given point in time),⁶ this would make the comprehension of *mexri ti mesi* more costly for them. Indeed, some recent literature takes the view that the Measuring Out function is not transparent for young children (Weist, Wysocka and Lyytinen, 1991; Weist, Lyytinen, Wysocka and Atanassova, 1997; van Hout, 1997; Wagner, 1998). A series of further experiments is planned to test the predictions made by this hypothesis (Papafragou, in prep.).

The present findings have broader implications about the nature of conversational implicature in child language. Interestingly, children can suspend SIs triggered by 'half' (which are within their computational reach) if such SIs are not contextually supported. Furthermore, in at least some clear cases, SIs survive across synonyms (such as 'start' and 'begin'), as Gricean non-detachability would require. The results reported here also raise the intriguing possibility that non-detachability might break down for young communicators (even in cases where the relevant semantics is in place). The

⁶ On the notions of Incremental Theme and Measuring Out, see Krifka (1989), Dowty (1991), Tenny (1994), Jackendoff (1996), Verkuy1 (1993).

precise processing demands which could be responsible for such asymmetries remain to be studied in more detail.

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