UNITED STATES—ISRAEL BINATIONAL SCIENCE FOUNDATION (BSF)

APPLICATION FOR RESEARCH GRANT

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APPLICATION NO. _____ AOR _____

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RESEARCH PROPOSAL DETAILS

SHORT TITLE (DO NOT EXCEED 10 WORDS; DO NOT USE SYMBOLS)

THE DEVELOPMENT OF PRINCIPLES GOVERNING PRONOUNS IN GRAMMAR AND DISCOURSE

BUDGET REQUEST 1st YEAR US $ 48,140

STARTING DATE

September 1, 1990

TOTAL NO. OF YEARS 3

2nd YEAR US $ 46,875
3rd YEAR US $ 46,375
TOTAL SUM US $ 141,390

SUBMITTING INSTITUTION

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SECTION 1

FULL TITLE: The development of principles governing pronouns in grammer and discourse

studies in binding theory and pragmatic implicatures of quantity.

TITLE IN HEBREW (FOR ISRAELIS ONLY) התפתחות העקרונות החלים על שמות כינוי בדקדוק
ובשיח

PRINCIPAL INVESTIGATORS:

Yosef Grodzinsky, Kenneth Wexler, Tanya Reinhart.

ABSTRACT:

An abstract of about two hundred words should describe the (1) objectives, (2) methodology, and (3) significance of the proposed research.

The purpose of this grant is to investigate a number of live theoretical issues in the acquisition of langauge and linguistic theory through an experimental study into the developmental course of children's linguistic abilities. We seek to show that, consistent with claims made by linguists, children's ability to comprehend anaphoric relations that are determined by innate syntactic principles (i.e., Binding theory) appears at a very early age, whereas certain coreference relations that are governed by acquired pragmatic principles (Scalar Implicature) develop at a slow rate. To this end we have designed a set of comprehension experiments aimed at assessing children's abilities on a broad range of linguistic tasks (e.g., coreference, variable-binding, etc.), in order to show that the rate of development of seemingly unrelated abilities (i.e., the ability to understand intra-sentential coreference and to obey discourse rules of quantity) is the same, and is much slower than the development of the syntactic principles governing anaphora - the binding conditions.

DETAILED DESCRIPTION OF THE RESEARCH PLAN

Below is a numbered list of required information for this section. Please mark the headings accordingly.

1. Brief description of the subject and of the scientific and technological background
2. Objectives and expected significance of the research
3. Comprehensive description of the methodology and plan of operation
4. Detailed account of available resources, including all personnel and equipment
5. Relevant bibliography on research area
6. Time schedule and work plan

NOTE: Items 1 through 4 are limited to a total of 10 pages.

1. Brief description of the subject and of the scientific and technological background:

We intend to investigate a number of live theoretical issues in the acquisition of language and linguistic theory through an experimental study into the developmental course of children's linguistic abilities. We will focus on one of the most central areas in the study of grammar: Binding theory. Through a cross-sectional study of children from age 4 to 7 we will be seeking solutions to several puzzles that are currently a topic of heated debate in linguistics and in language acquisition. The particular hypothesis we seek to support is that, already at a young age, children command the Binding Theory (as formulated in Reinhart, 1983), and are deficient with pronouns whose distribution is governed by pragmatic principles. By charting the course of development in these two domains, we expect to show that syntax appears early on, whereas the rate of development of pragmatic knowledge is slow.

1.1 Syntactic and pragmatic principles governing pronouns We begin our presentation of the theoretical background by a short review of the syntactic and pragmatic principles that govern our domain of inquiry. This review is cursory, and definitions are given in an informal fashion. For elaboration, we refer the reader to other sources. We then provide a brief review of the relevant developmental literature, which leads naturally to a presentation of our research program, its motivation, and significance.

1.1.1. Syntax Binding theory is a module of Universal Grammar (UG) regulating the distribution of anaphors and pronouns, and their relation to their antecedents. The leading formulation, proposed in Chomsky (1981), and slightly modified in Chomsky (1986), is paraphrased in (1):

(1) The binding conditions
    A. A reflexive (e.g., herself) must be locally bound
    B. A pronoun (e.g., her) must be locally free
    C. An R(eferring)-expression must be free

By locally bound we mean having a local c-commanding antecedent (for definitions of locality see Chomsky, 1981; for c-command see Reinhart 1976, Aoun & Sportiche, 1981). One example to illustrate the notion of locality is (2).

(2) a. Joe believes that [Mary likes herself]
    b. *Joe believes that [Mary likes himself]

The ungrammaticality of (2b) is due to the fact that "himself", being a reflexive, must have a local antecedent (roughly, within the same clause, marked with parentheses), and, while in (2a) there is such an item, in (2b) the only potential antecedent is Mary, and if "himself" is linked to "Mary" an agreement violation follows. Crucially, "himself" cannot be linked to "Joe", because the latter is not within the local domain of the reflexive. For pronouns, the opposite is true (following condition B). They are barred from having a local c-commanding antecedent:

(3) a. *Joe believes that [Mary likes her]
    b. Joe believes that [Mary likes him]

   In a series of papers, Reinhart (e.g., 1983, 1986) has challenged these definitions. Since pronouns, when functioning as bound variables (e.g., with quantified NP antecedents), obey stricter conditions than regular pronouns (as evidenced by the contrasts in (4)), Reinhart argues that condition B is true only of bound variables, whereas the distribution of other pronouns is handled by a pragmatic condition.

(4) a. His mother loves John (he=John)
    b. *His mother loves everyone (he=everyone)
    c. A party without Julie upset her (he=Julie)
    d. *A every actress upset her (every actress=her)

The difference between Reinhart's and Chomsky's binding theories, then, is not in the formulation of condition B, but rather, in its scope. In the standard binding theory, a pronoun is bound if and only if it is either a bound variable (i.e., coindexed with a c-commanding antecedent), or coindexed with a (non c-commanding) antecedent. For Reinhart, only bound variables fall under condition B. Thus (4a,c) fall under Chomsky's condition B, whereas for Reinhart, they do not. Rather, they are handled by an inference rule, stated informally in (5):

(5) Rule-i: A pronoun can corefer with an antecedent within the same
    sentence only if it cannot be substituted by a reflexive

This rule ensures that examples like (6) are ruled out.

(6) *John touched him (John=him)

The precise formulation of this rule dispenses with the need to state condition C. Rule-i is hypothesized to follow from general pragmatic considerations. Specifically, it may be a special case of the conversational implicature of quantity (Levinson, 1985). We will now review pragmatic issues pertaining to our investigation.

1.1.2. Pragmatics Reinhart (1983) considers rule-i to follow from general Gricean requirements on rational linguistic exchange. In particular, she proposes a maxim of manner: "be as explicit as the conditions permit". She then provides an approximation of the pragmatic strategies governing speaker's and hearer's decisions about

Note: Please use additional pages of identical size for headings 2 to 5.

coreference. Levinson (1985) claims that Reinhart's rule-i is in fact an application of an implicature of quantity and not a maxim of manner. Q-implicatures derive from Grice's (1975) theory of conversation and implicature. Grice proposed a basic principle underlying rational verbal exchange - the cooperative principle. He also identified four guidelines for efficient use of language which jointly express the cooperative principle. These are the maxims of conversation. Here we focus on the maxim of quantity:

(7) i) Make your contribution as informative as required for the current
        purpose of the exchange.
    ii) Do not make your contribution more informative than is required.

Horn (1972) and Gazdar (1979) offer a detailed account of the implicatures which are based on this maxim. Horn introduced the notion of a linguistic scale which consists of a set of linguistic alternates of the same grammatical category, arranged linearly by their relative degree of informativeness or semantic strength. According to this scale, "all" is more informative than "most", which is more informative than "some". That is, placing a stronger quantifier in a sentence entails the sentence containing the weaker (but not vice versa):

(8) All the students are in the class >>> some students are in the class

Horn has proposed a list of scales, where the leftmost item within a bracketted sequence is the more informative (or stronger).

(9) <and, or>, <hot, warm> <love, like>, <must, should>, <n,...3,2,1>

This work serves as a basis for Levinson (1985), who defines a Scalar implicature related to those scales as in (10), for which examples are given in (11):

(10) Given a Horn scale <S, W>, where the stronger expression substituted
     in an arbitrary sentence A entails the same sentence with the weaker
     expression, A(S):- A(W), and S and W are expressions of roughly equal
     brevity, then the use of W implicates the denial of the applicability
     of S: A(W) >>> S knows ~A(S).

(11) a. Lisa has three children >>> not more than three
     b. The boys will get either tea or coffee >>> not both

Applying the Scalar implicature to the interpretation of pronouns, Levinson (1985) and Reinhart (1988) point to a contrast set <herself, her> for which the use of the weaker implicates the negation of the stronger. Thus rule-i can be derived from the Scalar implicature (with the addition of the pair <herself, her> as a Horn scale), which now explains the contrast between (12a) and (12b). The idea is that the speaker, by using the weaker member of the pair, meant to negate the stronger, hence in the context (12) a pronoun cannot corefer with a local antecedent because, given the availability of a reflexive - a "stronger" alternative, such coreference would violate the Scalar implicature.

(12) a. *Felix touched him (Felix=him)
      b. Felix touched himself

The pragmatic principle governing the distribution of pronouns, then, is a special case of a general coversational implicature that applies throughout the linguistic domain.

1.2. The acquisition of pronouns Already at a fairly young age, children master the conditions governing the interpretation of pronouns as bound variables. The clearest instance is condition A, governing reflexives, since lexical anaphors are interpreted only as bound variables (Chomsky, 1982). All the studies have shown that children know this condition - both its c-command and locality aspects - as early as age 5 (see Wexler & Chien, 1985, 1988; Chien & Wexler, 1987a; Jakubowitz, 1984; Chien & Wexler, 1987b for Chinese; Deutch, Koster & Koster, 1987 for Dutch; McKee, 1988 for Italian; Sigurjonsdottir, Hyams & Chien, 1988 for Icelandic; see also Lust 1986, 1987).

As for condition B, the majority of the studies (Wexler & Chien, 1985, Cairns & McDaniel, 1987; Grimshaw & Rosen, in press, among others) have focused only on coreference tasks and found that in sentences like (13a), children choose the coreference option at about 50% of the time, i.e. they perform around chance level. These performance levels contrast with the children's high scores on the condition A cases.

(13) a. Oscar touches him
      b. Every boy touches him.

These findings have led to the conclusion that children do not know condition B. However, later studies by Wexler and Chien (1988) discovered a distinction between children's performance on its coreference aspects and its variable-binding aspects. It was found that when variable binding is tested, as in the case of (13b), children disallow anaphora, performing essentially as well on condition B as they do on condition A cases. The same results were obtained through the use of various experimental methods. In a typical experiment (such as Wexler & Chien's (1988) and Grimshaw & Rosen, in press) the child hears a sentence such as (14a), and sees a picture, or a video clip depicting a scene such as in (14b) or (14c),

(14) a. This is a. This is B. Is A washing him?
      Pictures: b. A washing A
               c. A washing B

The child has to decide whether the picture matches the content of the sentence he heard, and perform some task that indicates his abilities. Crain & McKee (1986) have demonstrated the importance of the choice of task to the child's performance, and developed a highly reliable task, which we intend to employ. The findings of these two studies, then, lead to the conclusion that children know condition B, if this condition is viewed, following Reinhart (1986), as a condition on variable-binding and not on coreference. Exactly the same results - a distinction between variable binding and coreference - were found in the case of language-loss by Grodzinsky, Wexler, Chien & Marakovitz (1989). As for condition C, most (though not all) studies obtained the same results as the studies on the coreference aspects of condition B. We can conclude, then, that there is a clear distinction that children make: while performing

4-2

well on bound variables (i.e., reflexives - falling under condition A, and pronouns - falling under condition B under Reinhart's construal of it), there is virtually no evidence that they know the coreference aspects of pronouns.

1.3. The development of pragmatic knowledge Not much information is available about children's knowledge of the Gricean implicature of quantity. Jackson and Jacobs (1982) evaluated children's use of a strategy when they respond to an ambiguous message. The sentence "I am thinking of the happy clown" counts as ambiguous when the task is to select one picture from a set of 6 pictures containing, among other things, a picture of a happy clown with a blue flower, one with a red flower, and one with no flowers at all (the other three showed sad clowns). The maxim of quantity, requiring the speaker to provide exactly the amount of necessary information, should lead to a choice of the happy clown with no flowers. It was found that 3rd graders (8-9 year olds) behave in this fashion (similar results have been obtained for 2nd graders (Bredart, 1989) and adults (Bredart, 1987; Surian and Job, 1987)). Yet 1st graders (6-7 y.o.) demonstrate a different pattern of response (Jackson and Jacobs, 1982; Surian and Job, 1987). Their selection of referent is guided by the maxim of antecedent (Clark and Haviland, 1975), which guides them to choose the card previously mentioned in the discourse. These results provide no compelling evidence that young children possess pragmatic abilities of the type relevant to our interests.

2. OBJECTIVES AND EXPECTED SIGNIFICANCE OF THE RESEARCH

In the introduction we have reviewed the main issues concerning binding theory, as well as its developmental aspects. It seems uncontroversial that knowledge of condition A (governing the distribution of anaphors) is innate, as attested by the various studies we have cited. With respect to condition B things are more complex. The position we have taken, following Reinhart (1983), Montalbetti & Wexler (1985), Chien & Wexler (1988), Grodzinsky & Reinhart (1989) and Grodzinsky, Wexler, Chien & Marakovitz (1989) is that if this condition is stated such that its scope is restricted only to pronouns having a bound-variable intepretation, then it, too, is innate. The rest of the pronouns fall under rule-i - a special case of the Scalar implicature (Reinhart, 1988; Levinson, 1985). If this view is correct, then one would expect to find that children's performance on structures that fall under the binding conditions would be good, whereas their performance on cases that are governed by the Scalar implicature would be poor. Moreover, we would like to show that once they start performing well on the pragmatically governed cases, they also perform well in other pragmatic domains. We thus expect to find a strong correlation between the course of development of their abilities in seemingly unrelated areas - all the instances that are governed by the Q-inplicature. Given the limited data base, we would like to extend it in both directions: we intend to show that even young children are as able as adults in the domain of variable binding, whereas they are deficient when the case they are given is governed by the pragmatics. If a difference in developmental rate is shown, such that syntax is mastered early, and pragmatics late, our claims will be significantly strengthened.

Below we describe the details of our planned experimental program. We first outline each study, its materials, methods, and procedures. Due to space limitations, we can only give few of the many experiments we plan to execute. All the methods we employ were successfully used in the past by both the American and Israeli laboratories participating in this proposal, as well as by others. We have improved the method, in

several respects, e.g., by increasing the number of trials per child, to allow for individual subject analysis. Since the subjects for all experiments will be the same ones, we describe them at the end of the section. As a final preliminary, we note that all experiments will be conducted in Hebrew. Yet since in all relevant respects the syntactic and discourse properties of Hebrew is identical to English, we present our materials in the latter, with one parenthetical Hebrew example for each experiment.

3. COMPREHENSIVE DESCRIPTION OF THE METHODOLOGY AND PLAN OF OPERATION

3.1. SYNTAX: Experiment 1 - a replication of Wexler & Chien (1988)

The most salient result leading to our conclusion comes from an experiment conducted by Wexler & Chien. In fact, their finding motivated a large portion of our program. This experiment discovered that children make a surprising distinction between different uses of pronouns: when used as bound variables, children carry out coindexing operations between them and their antecedents; yet when they are not (i.e., when they have a non c-commanding antecedent) children do not reliably interpret them as coreferring with their antecedents. It is prudent, we believe, to begin our investigation with a replication of this finding (although Grodzinsky, Wexler, Chien & Marakovitz have already done so for agrammatic aphasic patients). Similar to Wexler & Chien, we will use the sentence-verification task. Children will hear a sentence (question) and will be requested to decide whether or not it adequately describes a picture they will be shown. To avoid response biases, the child's answer will not be given to an adult, but rather, to Kermit the frog who will be the character reading the sentence aloud (rather than the experimenter). If Kermit is right, the child will feed it a cookie; if he is wrong, he will be fed a rag (see Crain & McKee, 1986 for an analysis of this task and a demonstration of its benefits). The sentence types will be as follows:

(15) a. This is Mama Bear. This is Goldilocks. Is Mama Bear touching her?
      b. This is Mama Bear. This is Goldilocks. Is every bear touching her?
      c. This is Mama Bear. This is Goldilocks. Are all bears touching her?
      d. This is Mama Bear. This is Goldilocks. Is Mama Bear touching herself?
      e. This is Mama Mear. This is Goldilocks. Is every bear touching herself?
      f. This is Mama Bear. This is Goldilocks. Is Mama Bear touching Goldilocks?

Hebrew: zot ima duba. zot zehava. ha'im ima duba noga'at ba?

Sentences (15a) and (15b) are intended to test whether children are aware of the distinction between R-expressions and quantified expressions as antecedents. According to Reinhart, coreference between Mama Bear and her in (15a) is disallowed by both condition B (for a bound variable interpretation) and rule-i (for a coreference interpretation). (15b), by contrast, fall under condition B only, rule-i being irrelevant for it. If children do not know rule-i, but know condition B, they would be good at ruling out coreference in (15b), but deficient with respect to (15a), because knowledge of the condition B there would not suffice. The children should thus make a distinction in their performance between the two cases. It has been found that they do, and we seek to replicate this finding. Sentence (15c) is there as a quantifier-control, to ensure that knowledge of quantifiers is generalized. The rest of the conditions are controls: (15d-e) is there to demonstrate that children are

aware of condition A with and without a quantified antecedent, and (15f) is there to demonstrate that children are able to handle the rest of the sentence. Each sentence will be presented twice, Once with a picture that fits it (e.g., Mama Bear touching Goldilocks for (15a)) - the "match", and once with a mismatch (e.g., Mama Bear touching herself for (15a)). There will be six tokens for each sentence type, resulting in 12 presentations (matches and mismatches). The total number of sentences here will be 72, and they will be presented to the children in a random order in one testing session, after short training. Previous experience with such experiments (e.g., Wexler & Chien, 1985, 1988) indicates that children have no problems with this task.

Experiment 2 - quantified NPs in embedded clauses

Experiment 1 is intended to show that children use condition B in order to reject a bound variable interpretation when is is disallowed (where Mama bear and her corefer in (16a)). Here we would like to demonstrate how they are also able to compute variable binding, and establish intra-sentential coreference relations when it is possible. Sentences that contain potential antecedents for pronouns (i.e., outside their local domain) are a relevant case. Just like (15a), the interpetation of the pronoun in the embedded clause in (16a) is ruled out by condition B, whereas the coreference interpretation is handled by the inference rule. Thus, children are expected to make errors in this condition, if they do not know the inference rule governing coreference. This is not the case, however, for (16b). There, a coreference intepretation is impossible semantically due to the identity of the antecedent, hence children's lack of knowledge of the inference rule should not interfere with their performance. They are predicted to handle this sentence type without errors, and have the pronoun corefer with the antecedent in the matrix clause. The logic here is identical to that of experiment 1, except here we provide a potential antecedent within the same sentence, to see whether the children can use it. The rest of the constructions (16c-f) are controls similar to experiment 1.

(16) a. Donald duck says that [Mickey mouse should touch him]
     b. Donald duck says that [every mouse should touch him]
     c. Donald duck says that [Mickey mouse should touch himself]
     d. Donald duck says that [every mouse should touch himself]
     e. Donald duck says that [Mickey mouse should touch Dumbo]
     f. Donald duck says that [all the mice should touch him]

Hebrew: donald duck omer she-kol axbar zarix laga'at bo

One part of this experiment has already been carried out by Wexler & Chien (1985), but there, only (16a) and (16c) were tested. As our hypothesis predicts, children performed at chance on (16a) and above chance on (16c) in an act out, "do-what-I-say" task. Yet in the present context, the most important distinction is between quantified and non-quantified antecedents, and it is this distinction that we intend to test.

The task we will be using here is an interpretive one: an act out task. Children will be participating in a "Simon says" game (a method successfully utilized in the past, e.g., by Wexler & Chien, 1985), and will be requested to act out a scene described by a sentence they will hear: Donald duck will be there (for a male subject,

and a female cartoon figure for females to ensure that agreement does not give away the correct answer), and upon hearing the sentence the child will have to take a mouse (or 3 mice in (16b,d,f)) and have it touch Donald for a correct response, or itself for an incorrect one. We will be using 6 token sentences for each construction, with different dolls and actions - a total of 6 X 6 = 18 sentences.

Experiment 3 - Binding in ellipsis

The previous experiment is aimed at demonstrating the children's ability to establish intra-sentential coreference, and rule out interpretations by the application of condition B of binding theory. Once we have established the children's abilities to compute coreference, we would like to see how well they do when the only permissible relation they can represent is variable binding. To this end, we will present them with ellipsis structures in a sentence-verification task, similar to experiment 1.

(17) a. John walked his dog, and Bill too
         i)   for X=John, Y=Bill/ X walked X's dog, Y walked Y's dog
         ii) for X=John, Y=Bill/ X walked his dog, Y walked his dog

     b. Every boy walked his dog, and Bill too
     c. The woman near John walked his dog, and the woman near Bill too

Hebrew: ha-'isha leyad dan holixa et ha-kelev shelo, ve-ha-'isha leyad ran gam

Sentence (17a) is ambiguous. One reading, (17ai) - the bound variable intepretation - means that each person walked his own dog, whereas (17aii) - the coreference interpretation - means that they both walked John's dog. (17b) allows only the bound variable reading, and (17c) only the coreference reading. While presenting the children with a verification task (similar to experiment 1), these constructions will enable us to give them minimal pairs that will tease apart directly they binding abilities from their knowledge (or lack thereof) of rule-i, since the interpretation (17ai), as well as (17b) are governed by condition B according to Reinhart's theory, whereas interpretations (17aii) and (17c) are determined by rule-i. We will give the children pictures that depict bound variable, as well as coreference readings for each, and in some of the cases ("mismatches") they will have to reject the examples. Thus, for instance, in (17b) they will get one picture that will show three children walking their dogs, and Bill, a fourth child, walking his own dog, and one picture with Bill walking everyone's dog (the mismatch, since this interpretation is unacceptable). The children will first be acquainted with the characters, then have a short training session with simpler constructions, and only then will they start the experiment itself, and go through the constructions in a random order. These constructions are fairly complex, and the children may run into difficulties that are not necessarily related to binding. On the other hand, recent findings, using methods similar to ours (Crain, 1989; de Villiers & Roeper, 1989) suggest that children are able variable binders, and in fact, are capable of handling sentences that are as complex as those in (17). Like experiment 1, we will be using an interpretive task where the child will either reward or punish Kermit the frog. We will have 6 tokens of each sentence type, and since our 3 conditions entail 2 presentations per item ("match" and "mismatch"), we will have a total of 6 X 2 X 3 = 36 different items, presented in one testing session.

3.2 PRAGMATICS: Experiment 4 - numerical scales and connectives

The most direct test of the Scalar Implicature is in the domain of numerical scales. In the Horn scale for this domain larger numbers are to the left of the sequence, containing more information. We will thus test the children's comprehension of the implicated meaning of expressions including members of such sequences. We will present such sentences to the children, and follow them with an acted-out event. The child's task will be to indicate whether the statement accurately describes the event. Examples are given in (18)-(19).

(18) a. Dan is holding either a cup or a glass   <and, or>
      b. Dan is holding a cup and a glass

(19) a. Linda is hugging three dolls   <n,...4,3,2,1>
      b. Linda is hugging four dolls

For each pair of sentences the child will see two scenes: after listening to (18a), for instance, he will see one acted-out event where Dan will be holding a cup (or a glass), and another event where Dan will be holding both. He will have to tell Kermit who had uttered the sentence whether he described the scene correctly. We will thus have a counterbalanced test which will demonstrate whether the child can make use of the Scalar Implicature. A similar procedure will be used for (19), as well as other cases.

Our primary concern here is to establish a generalization across the set of expressions (i.e., scales) as instances of the same pragmatic principle. Nevertheless, it is still possible that some differences between sets will be discovered and that a sub-classification will emerge, as discerned by an item analysis. Prior to the experiment, we will have to demonstrate the child's understanding of connectives and number. This will be done in a screening test, preceding the actual test, that will include direct requests such as (20).

(20) a. Give me the pen and the pencil
      b. Give me the pen or the pencil

For each scale we will be using 5 pairs of sentences referring to different objects and actions, each presented twice (with a "match" or a mismatch"), randomly ordered. With the 10 pretest items, this will include 10 + 5 X 2 = 30 token presentations.

Experiment 5 - Modifiers

This experiment will be an improved version of the Jackson & Jacobs (1982) study, whose method is open to various criticisms, yet its domain is directly relevant to the Q-implicature. We will present children with a picture selection task. The will hear a story, as in (21), followed by a request - to point to the correct picture among three options (22).

(21) The boy with the blue pants went to the store. He took a cookie and
      left without paying. The shopkeeper went looking for him. Help him
      find the boy with the blue pants. Who is he?

(22) Pictures: a. A boy with blue pants.
               b. A boy with blue pants and a red cap
               c. A girl with blue pants

The Q-implicature should lead the speaker to (22a), not (22b). Lack of knowledge of this principle should lead to chance performance between these two pictures (the third being a lexical foil). We will counterbalance these cases with instances where the child will be presented with the story containing "more" information (i.e., referring to a boy with blue pants and a red cap), with the same pictures, where performance should be perfect. We will have 6 test items, and another 6 for counterbalance - a total of 12 items in this experiment, presented at random order.

3.3. Subjects

The subjects in this program will consist of four age groups (3-4, 4-5, 5-6, 6-7 y.o.) recruited from several schools (see Resource section below), in order to chart the course of development of the syntactic and pragmatics principles we are about to study. In each group there will be 12-15 subjects, and each subject will be tested in all the experiments sequentially - a total of about 5 sessions per subject within a short period of time. The order of presentation will be varied systematically, to avoid biases.

4. RESOURCES

The Israeli part of this grant proposal has available to him all the facilities provided by the Psychology Department of Tel Aviv University - office space, some computing facilities (1 IBM/PC, a VAX mainframe), a departmental xerox machine, and a departmental technician. There is a group of graduate students, and a large undergraduate population, from which the auxiliary staff for this grant will be drawn. Both the American and the israeli parties have access to e-mail, through which they can communicate.

  We have established strong contacts with several schools listed below, where subjects will be available for testing, and an on-site testing space will be provided to us. Our graduate students will serve as auxiliary staff.

Participating Schools:
The Kibbutz Gan Shmuel Nursery School (ages 3-5)
The Levinsky Teachers College kindergarten (ages 4-6)
The Kibbutz Gan School Primary School (age 6-7)

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