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The Problem of Social vs. Individual in Cognitive Psychology: Analysis-by-Synthesis and Group Problem Solving*

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The formulation and subsequent systematic elaboration of the methodological principle of unity consciousness and activity was one of the early achievements of Soviet psychology that still stimulates the progress of psychological science in the Soviet Union. (For more details on the theoretical and experimental aspects of the problem, see the works of S. L. Rubinstein, A. N. Leontiev, B. G. Ananiev, B. M. Teplov, A. A. Smirnov; more recently the research in this area has been conducted by B. F. Lomov, V. V. Davidov, C. A. Abulhanova-Slavskaya, V. D. Shadrikov and others.)

The original and most adequate formulation of the principle is as follows: though human psychological processes not only reveal themselves through activity but are developed (not created) in activity. Similarly animals' psychological processes are developed in their behavior. Psychological processes are from the very outset part of the continuous interaction between the man and his environment, i.e., the interaction between the subject and the object which ultimately is the whole Universe.

The subject (in the most precise and complete meaning of this word) is the whole of mankind, the latter being a contradictory but indissoluble unity of social groups and individuals interacting with each other. Therefore, psychological processes are the result of interaction between an individual and the world, and as such they represent the highest level at which the reality is reflected and the human's (or animal's) life is regulated.

Everything said above leads to the following general conclusion: continuous interaction between any individual subject and the object necessarily includes and is realized through the interaction with other subjects. Similarly, interactions among subjects necessarily include and are realized through the interrelations that exist among the subjects and the object.

The interrelations among individual subjects are realized in accordance with the principle: "everything common is at the same time personal but not private" (Rubinstein, 1959, p. 142). This principle defines the solution of the problem of correlation between social and individual in the human psychological processes. Further analysis of this problem requires that psychological processes be studied as processes of continuous interaction between man and the world (see Brushlinsky, 1979). One of the levels of this interaction is thinking, or cognition in general.

Objectivity of the world and subjectivity of cognition do not exclude, but, rather, necessarily imply each other. An object can be understood by a person, not by an animal or a computer (although the latter can be used as one of the means of cognition). In other words, subjective is the form in which the objective reveals itself.

In the human mind the objective reality is represented as a unity of sensual and "pretersensual" (K. Marx) qualities, i.e., cognized reality comprises not only what is given to man in his sensual perception but also the socially developed system of notions, knowledge or what is generally designated in philosophy by the term "ideal." This knowledge in which the historical experience of humanity is accumulated and which is acquired by the individual is a distinctive part of "objective reality." Therefore cognition is necessarily considered as "communication between man and mankind" (Rubinstein, 1959, p. 57). This indirect communication is realized through various forms of direct communication among people.

As B. F. Lomov emphasizes, detailed study of the problem of communication "becomes the most important prerequisite of further progress not only in special psychological disciplines but in the psychological science in general." Different forms of activity are always realized at different communicational levels thus giving evidence of different ways in which specific forms of social interaction effect the psychological development of an individual.

*Translated into English by Yan Yufik, San Diego, California.

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Different aspects of human cognitive behavior are affected differently by various social factors. The multiplicity of qualitatively different forms of interdependency between the social and individual is represented in psychology at different, although interrelated, levels of theory and experiment. Traditional experiments in cognitive psychology require two participants: the subjects and the experimenter who presents the subject with a problem (problem situation).[1] By observing the subject's cognitive behavior under these conditions one can study cognition as continuous cognitive interaction between the subject and the object (other people or material objects). The continuous nature of this interaction makes it impossible to replace the object (by its model, for instance).

A person can also play the role of an object in the experiment, e.g., his cognitive behavior in for example, problem solving can be observed by another person. It should be emphasized though that the experimenter can study cognition as a process if, for the subject, it is a form of activities (Brushlinsky, 1979).

Recently a more complex, more specific experimental set-up has been used, namely a group of subjects communicating with each other is presented with a problem. The methodological principle of communication formulated and developed by B. F. Lomov and his associates suggests systematic comparative study of human psychological processes in two different but interrelated situations: (1) in the process of *direct* interpersonal communication, (2) in the other communication interests (Lomov, 1981). Our current research is concerned with the realization of this important principle, namely we study how one and the same problem is solved under these two types of conditions.

All the subjects in our experiments were presented with the following problem: "Glue a little candle to the bottom of a glass jar. Light the candle and cover the jar with a lid. Observe the flame when (a) the jar is motionless, (b) the jar falls from the height of 2 - 3 meters. Explain the observed difference in the flame's form and intensity." (Answer: The difference is caused by the weightlessness and consequently the absence of air convection in the jar during the free fall.)

At different stages of the problem solving process the subjects were given some standard explicit or implicit "hint," i.e., supplementary, less complex, problems that also required consideration of the phenomena of weightlessness and air convection. The way these hints were used by the subjects indicated how far they advanced in their understanding of the basic problem.

These experiments were conducted (a) with one subject (by B. O. Esenagieva), and (b) with two subjects communicating with each other (by B. A. Polycarpov).

The major goal of these experiments was to find the differences and commonalities in the ways the basic cognitive process, i.e., analysis-by-synthesis, is realized in these two different situations. The experimental results can be summarized as follows. In the process of analysis-by-synthesis different qualities of the object are considered within different systems of interrelationships, these being organized differently by different subjects. The differences in view points result in disagreement between the subjects. In the course of subsequent problem solving and discussion the subjects were trying to bring into correlation different object qualities. In this way different systems of interrelations and the object qualities become "personalized" correspondingly by different subjects and are continuously correlated with each other. The above mentioned systems of interrelationships include, in particular, the interrelations between the person (subject) and the object of cognition. In the course of cognition the subject discovers new qualities of the object and achieves more adequate understanding of what role these qualities might play in his activities, e.g., communication. This is one of the ways in which the motivation for cognition is developed.

The experiments showed also that each of the subjects can be a potential source of explicit or implicit hints. In group problem solving as well as in individual problem solving the way the "hints" are used depends on the level of understanding achieved in the problem analysis (Rubinstein, 1959). At the same time, in group problem solving, different, more specific and complex types of interpersonal relationships are involved (e.g., "psychological defense" against the experimenter or another subject).

[1]Psychologists who use the method of hints exercise particular care in assessing the effect of experimenter's presence on the experiment's outcome.

References

Brushlinsky, A.V. *Thinking and prognosis.* Misl, Moscow, 1979.

Lomov, B.F. Specificity of cognitive processes in communication. *Psychological Journal,* 1980, *5,* 26-42.

Lomov, B.F. On the problem of activities in psychology. *Psychological Journal,* 1981, *5,* 3-22.

Rubinstein, S.L. *Principles and directives of progress in psychology.* Academy of Science of the USSR, Moscow, 1959.

Influences on Children's Narratives*

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Harvey Sacks suggested that stories are "sequenced objects articulating with the context in which they were told," that is, both influenced by and influencing the larger speech event itself (Jefferson, 1978, citing Sacks' lectures on stories). Most of the work of Sacks and his collaborators, as well as that of Polanyi (1978) and oth-

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ers influenced by this work, has dealt with stories embedded in informal conversation, and has documented the fact that norms of conversational interaction systematically influence the ways stories are introduced, structured, and brought to a close.

Complementing this work on conversationally embedded narratives is work by folklorists and linguistic anthropologists which has focused primarily on ritual storytelling contexts (Lord, 19960; Hymes, 1977). This work has shown that oral narratives are built around formulas of content, syntactic form, and meter which allow for the rapid and fluent production of sequences necessary in oral composition. This work has emphasized the importance of the paralinguistic presentation (rhythm, intonation, and pitch) in oral performance in marking the talk as part of a ritualized event, as well as in carrying essential information for the story's interpretation (McLendon, 1977, 1981).

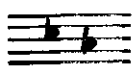
Both of these approaches have influenced my work on children's narratives. In this paper, I will be looking at children's oral narrative accounts told in a particular context -- the classroom, during a recurring speech event known as "Sharing Time" or "Show & Tell." Over the past year, Courtney Cazden, myself, and our research team at Harvard University have studied sharing time activities (henceforth ST) in four primary school classrooms in the Boston area. We have found in all four classrooms, that ST elicits talk that combines elements of face-to-face conversation with elements of prosodically marked, ritualized oral performance.

I will suggest that ST as a teacher-run school event is organized with certain institutionalized goals and interactive constraints which influence the stories that children tell, as well as the ways stories are heard and responded to, on the spot, by participating teachers. Because of these institutionalized constraints, all children do not gain equal access to the teacher's help at ST.

The data I will report on here are taken from a second grade, ethnically mixed classroom, one of the four classrooms studied in the Boston area ST project. The analysis is based on 131 ST turns recorded during 15 ST sessions over the course of the 1981-82 school year. In this classroom, ST was a daily activity in which children were called upon (by a child-leader) to give an account of some past or future event, or talk about an object brought from home. The teacher played an active, pivotal role as listener/responder, addressing questions and comments to the child sharing or to the audience at large, trying to help the child clarify and expand his or her discourse, or to link the child's personal topic to more general classroom themes or experiences. ST turns thus had both a monologic (child-structured) and dialogic (collaborative) component.

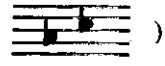
Sharing time as a unique speech event

ST in this classroom was marked as a routinized activity in several ways. It was opened formulaically by the child-leader (a different child each week), who stood in front of the class and said:

Sharing Time (e.g., )

using sustained level tones at an interval of a minor third, a stylized contour that has been traditionally referred to as the "calling contour" (as in "dinner time"). Ladd (1978) has recently put forward an alternative analysis of this contour, saying, "what is signalled by this intonation is the implication that the message is in some sense predictable, stylized, part of a stereotyped exchange or announcement" (p. 137). Such an analysis accounts well for its use in this context where children are already present and attending to the speaker when the contour is used.

The child-leader also nominated children to share with a stylized contour, saying:

Jer ry or San dy (e.g., )

which, as it turns out, is the stylized "sharing time" countour played upside down. Interestingly, the teacher did not use this contour in calling on children at ST or other times of the day.

That the children sharing saw this activity as a completely unique speech event was evidenced by their use of a formulaic intonation patterns which clearly marked their discourse as "sharing time talk." This "sharing intonation" (henceforth SI) was an integral feature of their discourse and occurred in no other classroom speech activity.[1] The intonation contour, in its most pronounced form, is a high rising tone with vowel elongation, stretching over the last word or two of a tone group (or complete intonational phrase), resulting in sharp pitch modulations, and a slowed, rhythmic tempo. The accompanying utterance is often a syntactically complete independent clause where an adult would more likely use falling intonation. The following ST turn illustrates the melodic contour of ST intonation.[2]

Sandy:
1 Um . . . tomórrow / my sister's gonna have her birthdaý party: /
2 it's gonna be at Arlington Boys' Club /
3 'cuz they have a swimming poo:l /
4 and we're gonna rent́ it /
5 'n . . so we can use it́ /
6 and . . and . . . there's gonna be a lot of . . . people /

[1]The exception to this general rule was one occasion where a child told a narrative account to the whole class and shifted into SI, thus seeming to reinterpret the context as a kind of sharing time.

[2]Prosodic and paralinguistic cues are transcribed using a system developed by John Gumperz and his collaborators, based on the work of John Trim. In this system, speech sequences are first divided into tone groups or intonational phrases. A phrase can be marked by a minor, non-final boundary "/" (indicating "more to come"), or a major or final boundary "//." Within a tone group we indicate: 1) location of the tonal nucleus (that is, the syllable or syllables marked by change in pitch) as: "ˎ" low fall, "ˊ" high fall, "ˏ" low rise, "ˋ" high rise; 2) other accented syllables in the tone group: "ˈ" high, "ˌ" low; 3) paralinguistic features such as a pausing: ".." indicating a break in timing and ". . ." indicating a measurable pause, b) speech rate: "acc." indicating accelerating tempo and "ret." indicating slowing down, c) shift to high pitch register "⌈" or shift to low pitch register "⌊" (both applying to entire tone group). Doubling of one of the above symbols indicates extra emphasis.

7 and so my sister /

8 we're gonna have . .b-be able to use the game roo:m /

9 and . . my mom said . . . she left all her bathing suits /

10 down the Cape / so she's gonna have to go buy one /

11 and my mom said / um . . . um . .

it's a heating swimming pool /

12 and she'll be in there a:ll / . . ɪa:ll da:y //

Rising arrows indicate the SI contour. As the transcript indicates, SI does not accompany each tone group. It does however segment the text into a series of information units of varying complexity, ranging from a single word, "tomorrow," in a single tone group, to the larger, syntactically complex information unit "and . . my mom said / . . . she left all her bathing suits / down the Cape / so she's gonna have to go buy one/" (containing 4 minor tone groups, each ending in a rising tone).

In this classroom, black and white children used the same stylized rise at sharing time. There were however, ethnic differences with respect to how extensively this marked contour was used and where it occurred in the narrative account. SI accounted for over 60% of the tonal contours in white children's narratives and was used by some white children in over 80% of all tone groups, often in its most exaggerated form. This stylized rise was generally found marking off information units throughout the account with no falling tones occurring until the closing (as was the case above). In contrast, SI contours accounted for only 37% of the tones in black children's ST accounts, and in longer turns (of a half minute or more), the contour was likely to be used at the beginning, then fall away, replaced by contoured or falling tones, and then resume at various places in the story.

Children's narrative styles

Related to these differences in intonation were notable contrasts with respect to black and white children's preferred strategies for structuring a narrative account. The example above is representative of the style used predominantly by the white children, a style I have called "topic centered," accounting for 96% of the white children's turns. This is tightly structured discourse on a single topic or series of closely related topics, with lexically explicit referential, temporal, and spatial relationships. The ST turn above, for example, evidences a high degree of lexical cohesion through nominal and anaphoric chains ("swimming pool," "rent *it*," "use *it*," "heating swimming pool"). In addition, there is a high degree of thematic cohesion in that key nominals relate to a familiar cultural institution and its sponsored activities ("Boys' Club," "swimming pool," "game room," "bathing suits," etc.). Thematic progression is achieved through consistent topicalization of key nominals (e.g., "birthday party" in line 1 becomes "it's" in line 2; "Arlington Boys' Club" in line 2 becomes "they" in line 3, and so on). The discourse also evidences internal patterning of segments, punctuated syntactically by units of "and. . with SI contours throughout the account until the closing which is marked by lowered pitch and falling tones.

Characteristically, topic centered turns begin with temporal grounding (here, "tomorrow"), a statement of the focus ("my sister's birthday party"), and some indication of spatial grounding ("the Arlington Boys' Club"). This information is made salient through tone grouping and pausing, highlighted prosodically with marked SI, and generally appears in the first 4 tone groups. This patterned format accounts for approximately 92% of all topic centered turns. Several other examples of this formatted opening follow:

Carl: well / last night
my father /
he was at work /

Jerry: well when I slep' over my mother's /
the ca:t /
in the middle of the night she w- /
she went under the covers /

Sandy: last year /
my mother and father /
well they went to Portugal /
and uh they brought us back a lot of presents /

What follows this orientation is some sort of elaboration on the topic (which provides complicating action, or additional descriptive information), with no major shifts in temporal orientation or thematic focus. SI intonation marks continuity, signalling "more to come" (and does indeed, in most cases, ward off comments from the teacher), and then leads directly to a punch line sort of resolution, signalled by markedly lowered pitch and falling tones.

SI for these children serves to highlight key orienting information and mark thematic continuity prosodically. These stylized tonal contours serve as a melodic structure for the child in organizing a narrative account. At the same time, they serve as a reliable interpretive guide for the listener -- provided the listener has certain *conventionalized* expectations about ST narrative structure, i.e., is expecting orienting information at the beginning and brief thematic elaboration which leads quickly to a resolution. As it turned out, this conventionalized format closely matched the teacher's expressed concerns for ST accounts, and was reflected in her questions asking for temporal clarity and spatial grounding when that information was not explicitly provided at the outset. With children who used this style, the teacher was very successful at picking up on the child's topic and extending it through questions and comments.

In contrast, only 34% of the black children's ST turns could be characterized as topic centered (and only 27% of the black girls' turns). These children were more likely to tell narratives using what I have called a "topic associating" style. By this I mean discourse consisting of a series of implicitly associated anecdotal segments, with no explicit statement of an overall theme or point. Temporal orientation, location, and focus often shifted across segments but the segments themselves were linked implicitly to a topical event or theme. Linguistic analysis has shown that segmental shifts were signalled prosodically through shifts in pitch contouring

and tempo, often accompanied by a formulaic time marker. "Yesterday," "last night," "tomorrow" -- could occur more than once in the same turn -- each time accompanied with stylized SI. While segmental shifts *were* systematically signalled, this kind of discourse was difficult to follow for those who, like the teacher, expected the narrative to focus on a single topic. These turns gave the impression of having no beginning, middle, or end, no obvious structure, and hence no point. The structure was there of course, if one were expecting and listening for multiple segments.

One such story follows:

Leona:

1 ,on ,George ,Washington's birthday /
2 I'm goin' / ice: / my gra:ndmother /
3 we never um / ,haven't seen her
since a long ti:me /
4 and / . . . and she lives right (n) nea:r u:s /
5 and / . . . she: / and she's gonna /
6 I'm (acc.) gonna spend the night over her house /
7 and / . . . 'every weekend / she comes to take me /
8 like on Saturdays and Sundays /
awa:y / from ho:me /
9 and (acc.) I spend the night over her house /
10 and one day I spoi:led her di:nner /
11 . . . um and we was having um / we was / um
12 'she 'paid ten dollars /
13 and I got eggs / . . . and ' stuff /
14 and I ,didn't ,even ,eat ,anything //

Leona begins with a temporal indicator and a future tense orientation, using SI tempo and contours. She marks the end of this segment with increased tempo in line 6, "I'm gonna spend the night over her house." The second segment begins with a shift in temporal perspective -- from the future to the iterative -- with a resumption of SI tempo and continued SI contours. This segment ends with increased tempo in line 9, a lexical and prosodic repetition of line 6 "spend the night over her house." Played side by side, these two phrases are indistinguishable, an implicit signal of the association across these segments. What they have in common is the fact that on both the holiday *and* the weekend, Leona spends the night at her grandmother's. The third segment shifts to a particular occasion, and shifts focus to dinner, rounding the story out to a close, again highlighting Leon's relationship with her grandmother by recounting an episode in which there was a breach in the relationship. The closing is marked with staccato rhythm and falling tones.

Two things about this story are notable. One is that temporal markers with SI contouring reoccur at the beginning of each segment. In topic centered accounts, there is an average of 1 temporal indicator per turn. In topic associating accounts, there is an average of 3.9, ranging from 2 to 8. Secondly, and this is even more obvious in some of the longer topic associating turns, SI (tempo and contouring) is used not to mark continuity, but to highlight discontinuity, marking the separation of narrative segments and a shift in temporal orientation, location, or focus.

Adult's responses to children's ST narrative accounts

In order to study these differences in a more systematic fashion, Courtney Cazden and I recently conducted a pilot experiment in which mimicked versions of children's topic centered and topic associating turns were played to black and white adult informants, all graduate students at Harvard. These mimicked versions maintained the child's rhythm and intonation contours, while systematically changing Black Dialect grammatical features to Standard English, and changing obvious social class indicators (like "down the Cape") to neutral ones. The adult informants were asked to comment on the well-formedness of the story, and make evaluative statements as to the probable academic success of the child telling the story. One of the stories used was Leona's "Grandmother" story, and black and white informants responded very differently to it. White adults' responses were uniformly negative with comments such as, "Terrible story; incoherent." "Hard to follow." "Mixed up." "Not a story at all, in the sense of describing something that happened." "Doesn't connect." "This kid hops from one thing to the next." When asked to make a judgment about this child's probable academic standing, they uniformly rated her below children who told topic centered accounts, saying, for example, "This child might have trouble reading if she doesn't understand what constitutes a story." Some referred to "language problems" affecting school achievement and others suggested that "family problems" or "emotional problems" might hold this child back.

Black informants (a restricted sample of 5 at this point) reacted very differently, finding the story well-formed, easy to understand, and interesting, "with lots of detail and description." Three selected it as the best story of the five they heard. All 5 commented on "shifts," "associations," or the "non-liner" quality of the story, but none appeared to be thrown by this. Two of the informants explicitly expanded on what the child meant, saying that the holiday is *just like* the weekend because there's no school and it's an occasion when she gets to visit her grandmother -- the implicit point here being that her grandmother is an important figure in her life. In addition, all but one of the black informants rated the child as highly verbal, very bright, or successful in school. One informant commented on her "good language skills" which should provide "good language experience for writing."

The differences between the black and white adults' evaluations of this child as a *student* are especially striking in light of the fact that the informant's judgments were based solely on a ST narrative, which contained no features identifying the child as black or white. It is also worth noting that the black informants positively evaluated both topic associating and topic centered stories, something that should be investigated further, both experimentally and in the classroom with black teachers.

Returning now to the classroom teacher at ST, she, more like our white informants, had difficulties making sense out of topic associating narrative accounts and responding appropriately, both in timing and in content.

There were more interruptive overlaps and probes as to the facts of the account, often serving to cut short rather than build upon the child's narrative intentions. In interviews, the teacher referred to one black child in this classroom as a "tall tale teller on the basis of her very long and complex ST accounts, and because, in response to the teacher's challenges about the "facts," she would on occasion contradict herself. The teacher noted that many of these turns left her wondering who did what when, and that she found it "hard to make connections."

Conclusion

While both black and white children in this class used sharing intonation strategically, the teacher was better able to follow these cues in topic centered discourse because these turns met her expectations about where certain information would be located and how a topic would be developed. And as the pilot experiment suggests, it is harder to hear and appreciate the structure in discourse if it is not the kind of structure you are expecting.

The problem, though, has institutional implications. ST activities are generally set up so that the teacher's expectations and evaluative criteria for what counts as good ST talk prevail. Because of the teacher's evaluative role as well as her asymmetrical relationship with the students, ST turns come to be heard from the teacher's perspective. In order to be considered competent, children must conform to the teacher's implicit expectations as to how information should be organized and presented. Competence then becomes narrowly defined. And if teachers can't hear the structure or logic in a child's story, they are generally inclined (as we all are) to assume it isn't there, that the talk is rambling, unplanned, or incoherent. Such negative judgments and the academic inferences that often follow can lead to differential treatment and misevaluation of children in this and other classroom activities.

References

Hymes, D. Discovering oral performance and measured verse in American Indian narrative. *New Literary History,* 1977, *8*(3), 431-457.

Jefferson, G. Sequential aspects of storytelling in conversation. In, J. Schenkein, (Ed.), *Studies in the organization of conversational interaction.* New York: Academic Press, 1978

Ladd, R. *The structure of intonational meaning.* Bloomington: Indiana University Press, 1980.

Lord, A. *The singer of tales.* New York: Atheneum, 1960.

McLendon, S. Cultural presuppositions and discourse analysis: Patterns of presupposition and assertion of information in Eastern Pomo and Russian narrative. In M. Saville-Troike (Ed.), *Linguistics and anthropology, Georgetown University Round Table on Languages and Linguistics.* Washington D.C.: Georgetown University Press, 1977.

McLendon, S. Meaning, rhetorical structure, and discourse organization in myth. In D. Tannen (Ed.), *Analyzing discourse: Text and talk, Georgetown University Round Table on Languages and Linguistics.* Washington, D.C.: Georgetown University Press, 1981.

Polyani, L. False starts can be true. In, *Proceedings of the Fourth Annual Meeting of the Berkeley Linguistics Society,* Berkeley, California, 1978.

The Development of Inductive Strategy in Children's Early Thought and Language*

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One basic component of both scientific and everyday thinking is to generalize from what is known about one thing to what is true of some previously unexamined group of things. This is how children construct their reality, a reality that includes physical, social, and linguistic objects.

We have preliminary evidence from a study involving children's manipulation of physical objects that children begin to generalize their knowledge in a new way at around 3 years of age. I will present these results below, I will then discuss possible extensions of the findings to children's language learning and to their spontaneous "unpacking" of other realities.

A Preliminary Finding

We gave 40 children between 1 ½ and 3 ½ years of age two tasks of graded complexity. In each task the children were to determine which objects from a large array had a sticker hidden underneath. The first, and simpler (Nonoverlapping), task used four nonoverlapping classes of four identical objects each: discs, squares, columns, and trees, with each class a different color. Stickers depicting apples were attached to the bottoms of all the discs and squares. The second (Overlapping) task used four crossed classes of four objects each: green brushes, yellow brushes, green triangles, yellow triangles. A fifth "unrelated" class of blue columns was added to those. Stickers depicting cats were attached to two disjunctive classes, the green brushes and yellow triangles (see Figure 1).

Each set of objects was presented in a scrambled array, one exemplar from each tagged class was turned up, and the child was told to find "the other apples/kitties." Tasks were terminated after three minutes or when the children signalled that they would search no further.

The children made an average of 20 discrete selections in the Nonoverlapping task, and 21 in the Overlapping task. Selection frequency did not vary with age in the Nonoverlapping task, but increased with age in the Overlapping task (p .03). It did not correlate with our dependent measures in either task, however, and thus should not have produced age-related artifacts on these measures.

The major finding is that as the children got older they selected and organized the *untagged* objects with increasing frequency:

1. In each task, the proportion of selections involving untagged, as opposed to tagged, objects increased from one-fourth at 18 months to fully half at 42 months.

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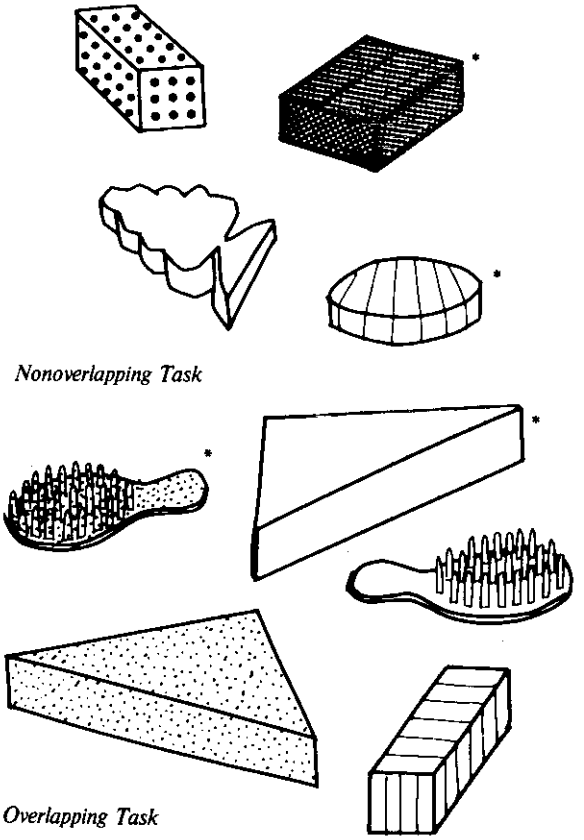

Nonoverlapping Task

Overlapping Task

*Every item in designated class has a sticker attached underneath.

NOTE: Each class is represented by four examplars.

Figure 1. Task Stimuli.

The heavy line in Figures 2A and 2B shows this trend.

2. Again in both tasks, there was a reversal with age in the conditions under which the children sequentially selected identical objects. In each task, the 1 ½- to 2 ½-year-olds were more likely to choose an identical object if they had just chosen a tagged object than if they had just chosen an untagged object. By 3 ½, however, the children were more likely to choose an identical object after selecting an *untagged* object than after selecting a tagged object. These results are graphed in Figures 3A and 3B.

Our secondary finding has to do with differences among the younger groups, the children who were selecting mainly tagged items. As it turns out, the very youngest children were not only selecting and classifying tagged objects, but were selecting and classifying only *one* of the two classes of these objects:

1. Figures 2A and 2B show that in each task the 18-month-olds selected one of the two tagged classes twice as often as they selected the other: discs were favored in the Nonoverlapping task, and brushes in the Overlapping task. By 30 or 36 months, the children selected from the two tagged classes equally often.

2. Figures 4A and 4B show that until 30 months the children were more likely to select an identical object after having selected an object from their more frequently used tagged class than they were after having selected an object from the other tagged class. So, in the Nonoverlapping task, these younger children were more likely to select an identical object after having selected a disc than after having selected a square. In the Overlapping task they were more likely to select an identical object after having selected a (green) brush than after having selected a (yellow) triangle. The older children did not show this discrepancy: they were as likely to select an identical object after having selected an object from one tagged class as they were from the other.

The data thus contain two trends. One is from the selection and classification of one class of tagged objects to the selection and classification of two classes of tagged objects. The other is from the selection and classification of *tagged* objects to the selection and classification of both tagged and *untagged* objects.

We need a control analysis before we can interpret these trends. The children did not check the bottom of every object they chose. Roughly half of the moves at every age consisted of displacements without checking. Accordingly, we reanalyzed the data using checked moves only, on the assumption that maneuvers following these moves were more likely than maneuvers following unchecked moves to be related to subjects' notions about where the stickers were. This analysis strongly confirms the initial one, in two ways. First, the two developmental trends I have described were replicated for checked moves only. The only difference is that children at every age checked tagged objects more often than untagged objects. Thus, for example, the oldest children checked the untagged objects more often than the younger children did, as before, though they checked more tagged than untagged objects (they *selected* equal numbers of each)). Second, and more impressively, the interaction we found for identical-object selections following tagged vs. untagged selections was accentuated when we considered only checked moves. When the oldest children had checked an untagged object, they were extremely likely (that is, after an average of 80-90% of these moves) to select an identical object next. When the younger children happened to check an untagged object, they rarely went on to select another object from the same class (they did so on no more than a third of these moves).

The behavior of the younger children seems reasonable. They sought out those things that, on the basis of the evidence they were given, were likely to have stickers. The 1 ½-year-olds used just one criterion (one class) to do this, while by 2 ½, the children selected objects by two criteria. This trend is consistent with our earlier results on free classification (Sugarman, 1982).

However, the youngest children not only sought one class, they all sought the same class. This group bias toward one particular class of tagged items suggests that something was especially salient to these children about these objects, other than the stickers. This feature, in turn, helped the children distinguish these objects from the rest of the array. That is, to the extent that they were looking for something like an element they knew to have a sticker, that element was not hard to find. This finding, too, converges with earlier results: Object grouping seems to be associated initially with the decided salience of one class over the other available objects (Starkey, 1981; Sugarman, 1981).

But why should the oldest children both sample and

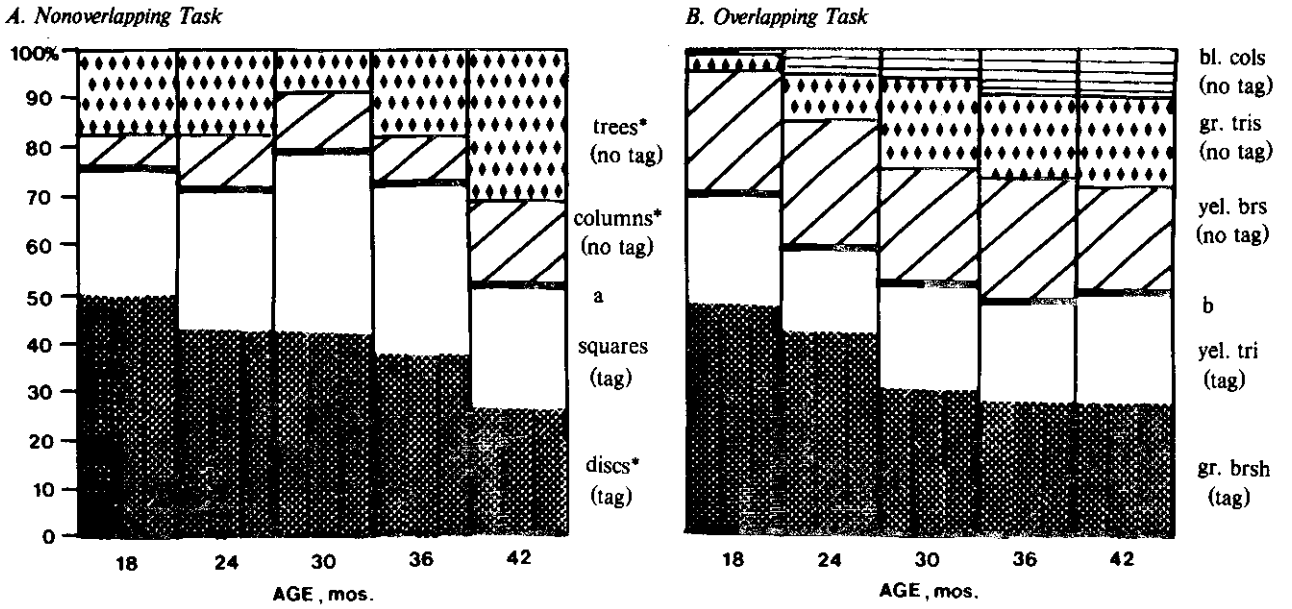

Figure 2. Mean Per Cent of Selections from Each Class.

*The increase or decrease in use of these classes was significant ($p < .05$) by a linear trend F test. *Note,* trends within the same graph are not independent.

[a]Linear trend on age for % of selections involving tagged, as opposed to untagged, objects:
$F(1,35) = 8.01$, $p < .008$.

[b]Linear trend on age for % of selections involving tagged, as opposed to untagged, objects:
$F(1,35) = 8.63$, $p < .006$.

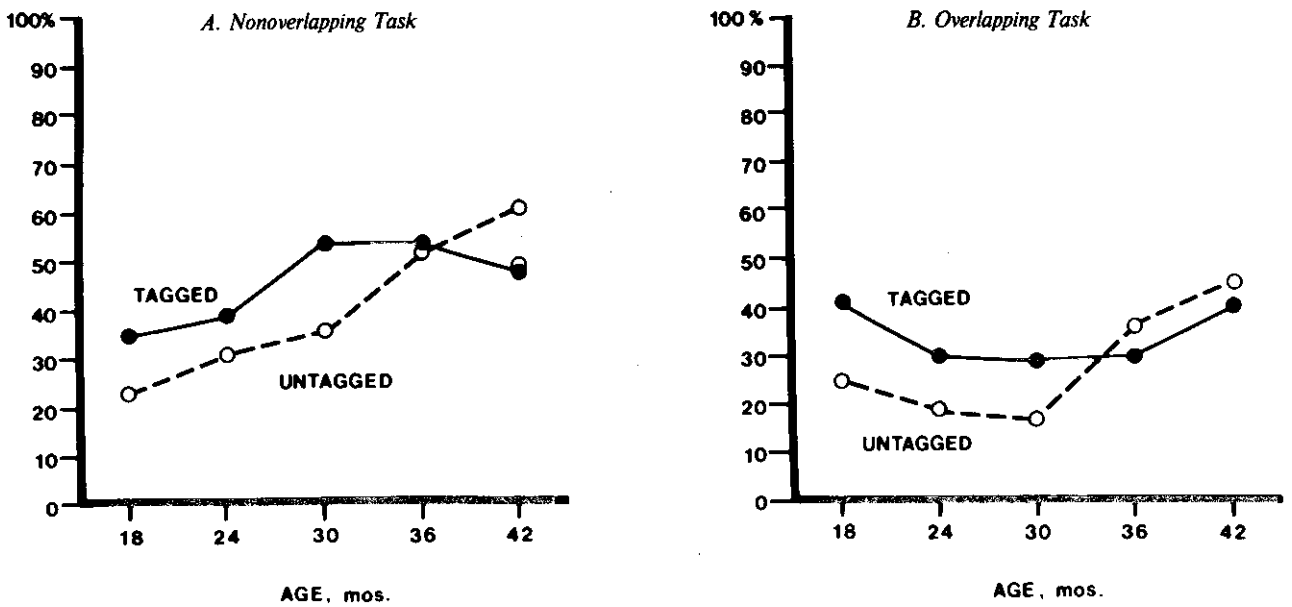

Figure 3. Per Cent of Target vs. Nontarget Selections.

Linear trend on age X % of tagged vs. untagged selections followed by identical object:
$F(1,35) = 4.75$, $p < .04$.

$F(1,35) = 4.10$, $p < .051$.

Linear trend on age for % of tagged selections followed by identical object:
$F(1,35) = 4.71$, $p < .04$.

$F(1,35) = .006$, $p < .9$.

Linear trend on age for % of untagged selections followed by identical object:
$F(1,35) = 9.98$, $p < .004$.

$F(1,35) = 7.82$, $p < .009$.

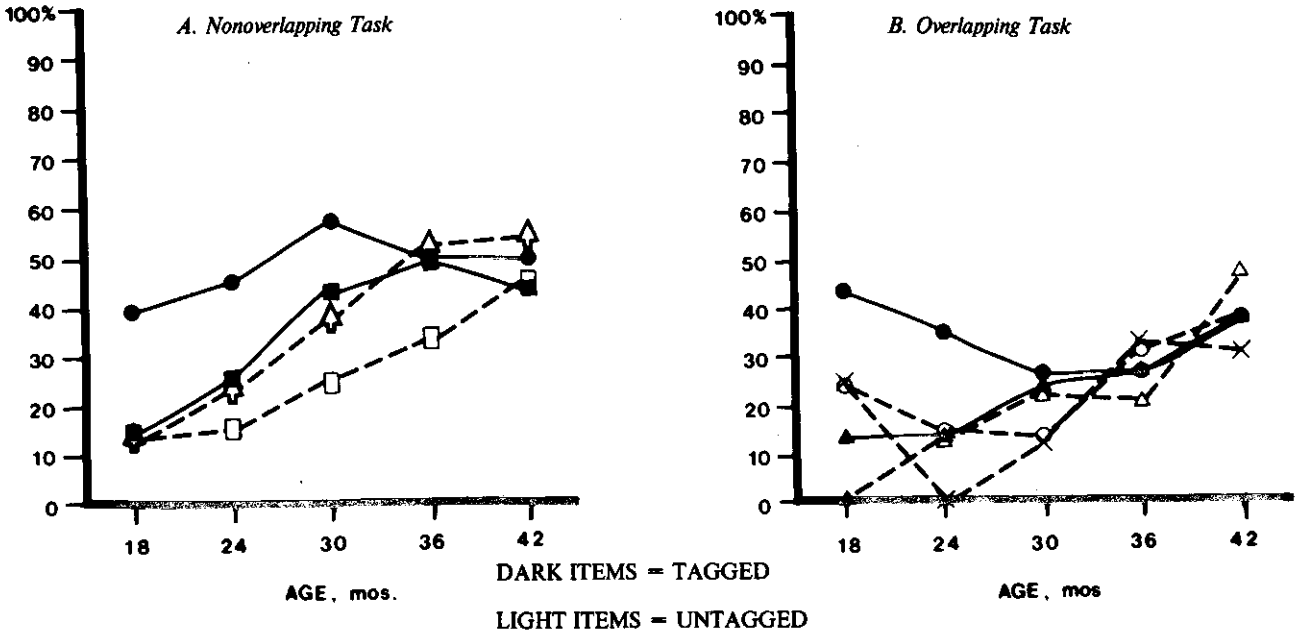

Figure 4. Per Cent of Each Class Selection Followed by Selection of an Identical Object.

- discs: linear trend on age for % followed by identical object, $p > .2$
- squares: $p < .001$
- columns: $p < .03$
- trees: $p < .003$

Linear trend on age X % of discs vs. squares (tagged objects) followed by identical object: $F(1,35) = 4.34$, $p < .05$.

- gr. brsh.: linear trend on age for % followed by identical object, $p < .4$
- yel. tri.: $p < .02$
- yel. brsh.: $p > .08$
- gr. tri.: $p < .003$
- bl. col.: $p > .3$

[a]only two 18-month-olds selected blue columns and thus contribute to this score.

Linear trend on age X % of gr. brshes vs. yel. tris. (tagged objects) followed by identical object: $F(1,35) = 6.06$, $p < .02$.

classify the untagged objects, especially after having ascertained that these objects were in fact untagged? At least in the Overlapping task, they were proceeding by a process of elimination. If a green brush had a sticker showing, for example, they would check a yellow brush. Finding no sticker on it they would remove all the yellow brushes from the array and then (or at some later point) turn up all the green brushes. They would then subdivide the green and yellow triangles the same way, perhaps checking some blue columns along the way:

TU, 42 months. T checked a yellow brush (no sticker) and then a green brush (sticker). She moved all four yellow brushes to the left of the array: "OK, all these have to line up." She checked a yellow triangle (sticker) and then a green one (no sticker). She lined up three green triangles (no stickers) to the left: "All these. . . ." She turned over the last two yellow triangles (stickers): "This have. . .there it is." She checked one blue column (no sticker) and then moved three of them, without checking, to the left. She checked the last yellow brush (no sticker) and left it in place. Then, with very deliberate motions, she turned over the remaining green brushes, displaying the stickers on them.

In this task, then, it appears that the oldest children were selecting untagged objects primarily because they were sorting among closely related items to find the ones that had stickers. But they also checked less related untagged objects: the blue columns in the Overlapping task, and the untagged objects (columns and trees) in the Nonoverlapping task:

TU, 42 months (Nonoverlapping task). T turned up a disc and a square, revealing the sticker on each one: "-- two, three." She turned up another disc, and grouped it with the other three discs: "Now one more of these" (by this point she had three discs and three squares upturned, and had grouped all four discs). She turned over a tree: "And maybe try one of these." She checked a second tree and then put three trees together, although she had checked only two of them: "*I think we should get rid of these. No smiling faces.* (the apples had faces on them." (emphasis added). She turned over two columns and grouped them: "No." She turned over the fourth square, which had a sticker: "These." She put a third column with the column group, again without checking. Lastly, she turned over the fourth column and put it with the other columns: "Not even these."

The children had in fact received no positive indication that the objects that were unlike the upturned exemplars did not have stickers. It was reasonable for them to check -- and eliminate -- these objects, as well as the untagged objects that were more similar to the tagged items.

Note, however, that the (oldest) children treated these near and distant untagged objects differentially: They checked the distant (less related) objects less often than they checked the near ones (though they still

checked objects of both types more often than did the younger children). Moreover, when they did check the distant items, they did so nearly always after they had finished checking the tagged objects. They checked the near, or "overlapping," untagged objects right from the start, that is, during their search of the tagged objects. We have suggested that in inspecting the near untagged objects, the children were trying to *discover* where the stickers were. In inspecting the distant untagged objects, they may have been attempting rather to *verify* their hypotheses.

In any event, the younger children differed sharply from the older children in the way they treated untagged objects of either variety. They did in fact check some untagged objects, especially those that overlapped with the tagged objects. This can be seen in Figure 2B: as early as 18 months children were selecting the untagged objects (in this case the yellow brushes) that were the same form as their favored tagged class. But until 3 or 3 ½ years of age, the children simply eliminated these bad *objects* when they encountered them. Having chosen an untagged object, they did not choose another one like it, but went on to choose something else instead. The older children, by contrast, eliminated bad *classes*. Having chosen an untagged object, they retrieved the others like it and quite literally got them out of the way.

We may note in passing that the 3 ½-year-olds' behavior is much like that of eight adults we tested on the same tasks. All eight adults checked at least one untagged object in the Overlapping task, and all but one did so in the Nonoverlapping task. Within this context, they gave precedence to the tagged objects, as did the 3 ½-year-olds. Most of the adults checked all the tagged objects before checking any untagged objects. They also distinguished among untagged objects that were more or less related to the tagged objects. They checked more of the related ones. And, on the rare occasion when they did check an untagged object early in the task, they always checked an object that was more, rather than less, related to the tagged objects. (N.B. In the Nonoverlapping task, there was a greater tendency among adults and children alike to check columns than trees, among the untagged items. The columns were closer in size to the tagged objects than were the trees.) Finally, like the 3 ½-year-olds, but not the younger children, the adults were more likely to handle untagged than tagged objects in class order. As with the children, this may have been tied to the eliminative function these maneuvers served. Since the untagged objects were unmarked, there was no way to remember which ones they were, save to use their physical identity to get from one to the other.

The import of the adult patterns, along with the developmental trend *toward* this behavior is this: A subject who samples both tagged and untagged classes need not be someone who has no idea where the stickers are, but could be someone with a very good idea, who is also aware of other possibilities.

To summarize, our preliminary findings suggest that by 3 ½ years of age, children may begin to consider what things are *not-A* as they try to establish what things are *A*. Younger children consider only additional likely instances of A. For them an encounter with an instance of not-A, when it occurs, is an "error." For 3 ½-year-olds and adults, it becomes an elaboration of the search for *A*.

Possible extensions to spontaneous discovery procedures

There is no explicit discussion of a development of this type in the literature covering the period from 1 to 4. Analyses of children's syntax are a possible exception, and I will discuss them shortly. Otherwise, the tendency of adults and older children to better appreciate positive than negative instances in concept formation is well documented (e.g., Bruner, Goodnow, & Austin, 1956). It makes sense, then, that the children in our study began to examine things that were unlike the initially marked "positive" exemplars only after a period during which they checked only like items.

But what we really need is evidence that a strategy of the sort I have described does emerge in children's navigations about the world at around the time we have observed it: between 3 and 4 years of age. In the remaining time I will argue that there is such evidence in children's spontaneous analyses of language and other realities. I will argue further that children would be unable to construct these realities -- specifically, to converge with the conventional wisdom on them -- without something like the process we seem to have tapped here.

I draw my account principally from Kornei Chukovsky's (1968) miraculous book, *From 2 to 5*, which contains children's spontaneous comments about language and other things. It seems to me that the volume is replete with examples of children's concern with 'what is not but could have been,' as they try to figure out what *is*.

To begin with, Chukovsky notes, as have others, preschoolers' compulsion to connect everything with everything else:

> So much confusing and fragmentary knowledge is heaped upon the young child that if he did not have the fortunate desire to resolve this chaos he would surely lose his mind by the age of 5. Necessity compels him to conduct a tireless classification of all phenomena. (p. 104).

And so, in scrutinizing language and other "facts," children draw out the implication of one utterance or event by analogy to a past, related one. From language: a child hears that somebody's "dog is trained," and sometime later, that someone's father is well-trained. The child then asks whether this father is a dog. From the world of events: a child who sees a train kill a pig sees a new pig a few days later and reasons that "the pig glued herself up again." Or, a child sees her grandmother remove her artificial teeth and says, "Now take out your little eyes, Granny." These analogies are farfetched, but the important point is that the child is generalizing from the old to figure out the new.

Knowledge would be in a sorry state, however, if this were all these children did. But what Chukovsky's record so tellingly reveals is that it is not all they do. The children are not just making analogies. They are noting when these analogies do not work. They are seeing that something could be other than the way it is, through the analogy they have *attempted* to make, but that has partly failed.

> "The sun sets in the sea. Why is there no vapor?" (p. 21)
> (Other things produce vapor in water. Why not the sun?)

"Where does the smoke fly?" (p. 29) (Other things that fly go somewhere. Where does the smoke go?)

"Do chickens go out without rubbers?" (p. 29) (Chickens look like they're in rubbers. We go out without rubbers. The chickens are out, but always in rubbers.)

In each of these examples the children are thinking about what observed things are not. They are comparing them with things that are like them in some respects and unlike them in others, and are wondering about what they have not observed in the present instance. On other occasions children go so far as to directly examine the consequences of what does not obtain:

"Mommies give birth to boys too? Then what are fathers for?" (p. 34) (Mommies give birth to girls and boys. Fathers are like mommies (on whatever grounds). If mommies produce all children, then what are fathers for?)

"Mommy, who gave birth to me? You? I knew it! If Daddy had given birth to me, I'd have a mustache." (p. 34) (Mommy gave birth to me and I look like Mommy. If Daddy gave birth to me, I'd look like Daddy. Daddy didn't give birth to me, so I don't look like him).

Finally, children may deny something they know to be true, or that someone else claims is true, and then examine the consequences of the denial:

"The rooster, could he completely, completely, completely forget that he is a rooster and lay an egg?" (p. 34) (To lay an egg you couldn't be a rooster. If the rooster [thought he] weren't a rooster, could he lay eggs (viz., not not lay eggs)?)

Mother: "Don't you hear? The roll begs you to eat it." Child: "The roll can't talk. It doesn't have a mouth." (p. 28) (Things talk if they have mouths. The roll has no mouth. How can it talk?)

Mother: "I'm gonna get you." Child: "You can't. My hands are caught." (from Sugarman, 1983, Ch. 13) (To get me you need my hands. You can't get my hands, so you can't get me.)

A 3 year-old has heard that a large cloud traversed the sky: "How can a cloud walk when it has no legs?" (Chukovsky, p. 104) (To walk means one has legs. If a thing does not have legs, then how can it be walking?)

In this last example, especially, we see the child reasoning from one thing that something is not to something else about it. She does this by reference to something else that has the property in question. Prompted by the use of (the Russian equivalent of) 'traverse' in reference to the cloud, the child thinks of other things that walk, observes that these have legs, observes that the cloud does not have legs, and concludes that it cannot walk. The logic is impeccable. But the reality is that things can 'walk' if they have no legs. What better way to discover the richness of language, the tricks it can play -- the way it maps onto reality -- than as the child has done here?

On a more solemn note, the process we see unfolding in these examples is one that some investigators seem to have invoked in their accounts of children's construction of a grammar. Along these lines, Maratsos and Chalkey (1980) divide later grammatical acquisition into two phases. Initially, children could develop a productive grammatical system by an on-the-spot process of analogizing between individual lexical entires: they would form the past tense of one word, for example, by seeing how the past is formed with another word that they treat the same way as the first in other contexts (e.g., in forming the progressive). This 'unchecked' analogizing from one expression to another would account for the long period of overgeneralization of regular forms that precedes the (stable) learning of exceptions. But later on children must learn these exceptions. They must learn when *not* to apply a rule or not to look for an analogously treated form to express some function, namely, when the term in question has a competing form to express that function.

Notice how this account dovetails with our manipulation search data. Initially children establish where the stickers are by looking for things that are *like* the objects that have stickers. Then they seem to recognize the relevance of negative instances -- in this case, dissimilar objects -- to their search.

All these observations suggest that by the middle preschool years, children begin to consider what things are *not* in the process of trying to figure out what they *are*. Or, in determining to what instances a given procedure, attribute, outcome, etc. applies, they consider other instances to which that procedure, etc. does *and does not* apply. This is a noteworthy development, in addition to the reasons we have already given, because the environment does not usually present tasks in the form 'determine *not-x*'. It presents them in the form 'determine *x*': find *x*, figure out what *x* is or is associated with. One has to *think* to look where *x* is not, to consider what it is not, or is not associated with.[1]

This is a preoccupation of preschoolers that as astute an observer as Piaget (1962) seems to have overlooked. He dwelled instead, for his own reasons, on the highly "assimilative" and particularistic nature of young children's analogizing. We have seen, though, that in drawing the analogies they do, children start to see where these analogies don't work. They may then, as Chukovsky's examples suggest, draw conclusions or raise questions about the thing for which they drew the analogy in the first place.

This is a sensible way for knowledge to develop. One could start anywhere, including with the "fantastic deductions" (Chukovsky, 19968, p. 20) that children make by virtue of their "priceless urge to establish. . . .connections between separate facts" (p. 20). As long as they constantly balance what something is like against what it is not like, they may eventually get to the truth, or at least to the conventional wisdom.

References

Bruner, J. S., Goodnow, J., & Austin, G. *A study of thinking.* New York: Wiley, 1956.

Chukovsky, K. *From 2 to 5.* Berkeley: University of California Press, 1968.

Maratsos, M., & Chalkley, M. A. The internal language of children's syntax: The ontogenesis and representation of categories. In K. E. Nelson (Ed.), *Children's Language.* Vol. 2. New York: Gardner Press, 1980.

[1]One may note that prohibitions take the form, "You may not do *x*," or perhaps, "You may not do *x*, but you may do *y*." Whatever form injunctions and (and this, as evidence of what adults think children understand, might provide some clues as to what they do understand), we would argue that children would not begin to use their concept of what they may not do to delimit what they may do (or vice versa) until around 3 -- or, more positively, they might do this as early as 3.

Piaget, J. *Play, dreams, and imitation in childhood.* New York: Norton, 1962.
Starkey, D. The origins of concept formation: Object sorting and object preference in early infancy. *Child Development,* 1981, *52,* 1172-1178.
Sugarman, S. Developmental change in early representational intelligence: Evidence from spatial classification strategies and related verbal expressions. *Cognitive Psychology,* 1982, *14,* 410-449.
Sugarman, S. *Children's early thought: Developments in classification.* New York: Cambridge University Press, 1983.

"Then, as ever since, the small holder was the man who had the greatest struggle. The plight of those who, by a narrow margin, had contrived to survive enclosure as independent cultivators was well described by Arthur Young. 'The small farmer,' he wrote, 'is forced to be laborious to an extreme degree; he works harder and fares harder than the common labourer; and yet with all this labour and all his fatiguing incessant exertions, seldom can he at all improve his condition or even with any degree of regularity pay his rent and preserve his present situation. He is confined to perpetual drudgery, which is the source of profound ignorance, the parent of obstinacy and blind perseverance in old modes and old practices, however absurd and pernicious. He is in a manner shut out from that intercourse with the world, which enlarges the mind and improves and increases knowledge. His understanding and his conversation are not at all superior to those of the common labourers, if even equal to them, as the latter, by sometimes changing their masters and working in different situations, extend the sphere of their observation and experience and make some little accession to their narrow stock of ideas."

Arthur Young. *General Review of Agriculture in Essex,* 2 vols., London, 1807:I, 65. Quoted in E. W. Bovill. *English Country Life,* 1780-1830. London: Oxford University Press, 1962, p. 29.

Facilitating Transfer of Learning: The Influence of Environmental Setting

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The automatic transfer of learning -- of skills and knowledge -- to appropriate new situations is an implicit assumption pervading many of our activities. The concept of schooling itself is founded on the premise that the skills taught in school will transfer to real-life situations. We take it for granted that children will apply what they have learned in school to settings and tasks that differ in many aspects from the original learning context. Yet, in reality, children, as well as adults, often fail to transfer their learning, their knowledge.

The failure to apply skills learned in one setting to another setting has been of concern in many areas of psychology. It is given intensive attention in behavior modification (e.g., Drabman, Hammer, & Rosenbaum, 1979; Robinson & Swanton, 1980; Wahler, Berland & Coe, in press). It is exemplified by the production deficiency phenomenon, a phrase coined by Flavell (c.f., Flavell, Beach & Chinsky, 1966) to describe young children's failure to use their knowledge in solving a problem unless explicitly shown, or instructed to do so. It is reflected in Piaget's term décalage to account for the observation that the acquisition of a concept may occur at different rates across different task domains.

Two types of inquiries would seem to be of importance in the transfer of learning: (a) How to structure learning so that it will generalize appropriately and as widely as possible; to find instructional procedures that will minimize failures to transfer; (b) When failure of transfer has occurred, to see whether and how transfer can be elicited. Findings on how to elicit transfer after a failure to transfer has occurred might well throw light also on the first question on how to structure learning.

The present study addresses the second point. Specifically, kindergarten children were taught to label distinctive features of letter-like symbols with the expectation that their newly acquired skill would transfer to real letters and facilitate the acquisition of reading. However, the children initially failed to transfer the labels they had learned. This failure to transfer was interpreted as resulting from differences between training and transfer settings. Subsequently, stimuli present during acquisition were introduced sequentially into the testing setting to facilitate transfer.

This is not a definitive study of variables affecting transfer from one setting to another. Its importance lies instead in the demonstration that an initial failure to transfer learning from one setting to another can be overcome by introducing cues present during learning into the transfer setting. This study also shows how a theory, developed to explain variability of performance on seemingly esoteric paired-associate, word-list-learning tasks, can be applied to problems of transfer of learning on classroom tasks.

Method

Subjects. Twenty kindergarten children, who were just beginning to learn initial consonant sounds, participated in the experiment. The children were enrolled in a research and development school, an institution whose purpose is the development of teaching methods and curricula for lower-income Hawaiian youngsters to promote their school success.

Materials. A letter discrimination labeling test was used both as a pretest and as a transfer test of the training given. The test consisted of 10 pairs of letters which

assessed a total of 12 different types of discriminations, such as number of units, ("m" has two humps, "n" has one hump) or orientation ("d" faces one way, "b" faces the other way). The letter pairs were printed on index cards. There were three possible scores for each discrimination depending upon the quality of the description given: A score of two was given for a succinct and well-formulated description of the difference, a score of one for an acceptable, but poorly-formulated description, and a score of zero for an incorrect response or no response.

The training materials used for teaching the children the discriminations were letter-like stimuli. For example, to train directional differences between "b" and "d" stimulus pairs such as ɟ and ɓ, or ɗ and ƅ were used, while for teaching the discrimination of number of repeated units, such stimuli as ᴡ and ᴡᴡ, or ᴡ and ᴡ were used.

Phase One: Training and Initial Failure to Transfer

Procedure. The children were pretested individually on the LDL test by a research assistant. For each letter pair the child was asked, "Tell me, how are these two different from each other?" The children were randomly assigned to labeling training or no-training conditions.

The children in the labeling training condition were placed in three homogeneous training groups for instructional purposes. The instructor for all three labeling training groups was the children's classroom teacher. Each group was trained on the critical discriminations until every child had learned each of the discrimination labels. The groups required from 11 to 17 ten-minute training sessions. The untrained group of children received no special treatment.

Upon completion of training, all children, trained and untrained, were given the LDL test again by the research assistant and this administration constituted Posttest 1.

Results and discussion. A mixed analysis of variance with one between-subjects variable, training condition, and one within-subjects variable, pre- or posttest administration, showed that both groups increased significantly from pre- to posttest (F (1, 18) = 9.63, p < .01). The increase found in both groups may have been the result of nonspecific training in the classroom, increased familiarity with the test, or other unspecifiable administration (F (1, 18) = .27), indicating that the labeling trained group did not perform any better than the untrained group on the first posttest (See Figure 1).

In light of the fact that the labeling-trained group had been trained to criterion on the letter-like stimuli and had demonstrated earlier their ability to label differences between the letter-like stimuli, we interpreted the above findings to reflect a failure by the children to transfer their newly acquired labeling skills from the letter-like stimuli to the real letters on the LDL test. In the second phase of this study an attempt was therefore made to discover what cues, what changes in the testing situation might facilitate generalization in the labeling group.

Phase Two: Eliciting Transfer

In this phase the administration conditions of the LDL test were altered. Two changes were made in succession:

1. The children were tested by the same adult who had conducted the training for the labeling group rather than by the research assistant. This change was made because previous research (Day, 1975) with a similar group of children had suggested that they would transfer their knowledge more easily if the teacher of the skill and the evaluator of the skill were the same person.

2. The training stimuli were introduced into the test setting by having the teacher-tester review the training materials with the labeling group immediately before administering the LDL test.

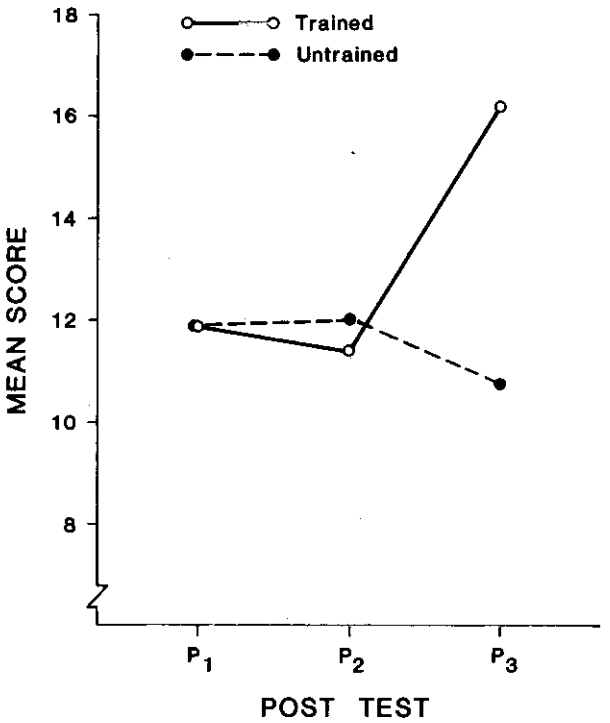

Figure 1. Performance on the posttest administration of the letter-labeling test.

Procedure. Approximately two weeks after Posttest 1, both groups of children studied in Phase 1 were given the LDL test again (Posttest 2), this time by the teacher who had conducted the labeling training sessions. She was as familiar to the untrained control group as she was to the labeling group since she was their classroom teacher for a major part of the school day.

Immediately following Posttest 2, the teacher presented the children in the labeling group with the original training stimuli. The children received no feedback regarding the accuracy of their responses. This review took approximately four minutes. The untrained children spent the same amount of time after Posttest 2 chatting with the teacher about vacation plans. Subsequently, all children were given the LDL test once again by the familiar teacher. This last administration constitutes Posttest 3.

Results. The performance of the two groups of children on Posttests 1, 2, and 3 are shown in Figure 1. A mixed analysis of variance with one-between subjects variable (training condition) and one within-subjects variable (posttest administrations) was conducted on the scores from the three posttest administrations.

The comparison of critical interest for this study is the interaction effect between treatment group and test administration, since it shows whether any changes in the testing conditions facilitated transfer of learning by the labeling group. This comparison was significant was significant ($F(2,36) = 5.07$, $p < .025$). *Post hoc* statistical comparisons of the means indicated that the scores in the labeling-training condition increased significantly from Posttest 2 to Posttest 3, while those in the control condition remained essentially unchanged.

Discussion

The labeling group and the untrained control group performed similarly on all posttest administrations of the LDL test until Posttest 3. Although one may wish to attribute the increase shown by the labeling group on Posttest 3 to practice effects, such an interpretation does not appear to be tenable since the no-training condition received the same number of test administrations but showed no increase in performance on this posttest.

The labeling training apparently had an effect but the children did not generalize their labeling skill; generalization from the letter-like training stimuli to the real letters on the LDL test did not occur until the teacher as tester reviewed the training materials in the test situation with the children. In other words, the labeling group failed to make use of previous learning in the test situation until they were cued to do so by the juxtaposition of the training and the test stimuli. From the present experimental procedure it cannot be determined whether simply having the child respond to the training stimuli in the testing situation would have been sufficient to activate the learned discrimination labeling responses or whether the review, in order to be effective, also had to be conducted by the former instructor. However, we can conclude that using the instructor as tester without allowing review of the training material did not facilitate transfer of the responses trained.

The present findings -- the initial failure to transfer and the subsequent transfer upon the introduction of cues from the training setting -- can be accounted for by the contextual elements hypothesis of learning, which was originally proposed by Bower (1972) to explain the variability in recall on such verbal learning tasks as paired-associate list learning.

He proposed that the stimulus presented by the experimenter -- the nominal stimulus -- occurs in a context. The context can include a variety of stimuli: physiological, such as a dry throat; situational, such as the room or the type of people present when learning occurs; and psychological, such as what the subject is thinking about at the time of learning. These contextual stimuli influence the probability with which specific encoding processes are activated, and also the occurrence of the responses associated with the particular encoding process. The probability of correct responding on a transfer task is then a function of the proportion of elements active in the test or transfer trial that have been associated with the correct response during training. If an individual in transfer or in recall does not recognize the nominal stimulus it may be because there are insufficient original context cues present: "A retrieval attempt with cue A alone may fail initially, but then succeed later if sufficient context cues are reinstated. . . ." (Bower, p. 116).

In the present study the transfer task requires a shift of responses not only from one set of stimuli (Set A -- the letter-like training stimuli), to another set of similar stimuli (Set A' -- the letters on the LDL test), but also to a very different setting from the one in which the responses were originally trained. For instance, all testing was done individually, all training occurred in groups; the tester and trainer were different individuals; the testing and instruction rooms were different. When the letters on the LDL test (the Set A' stimuli) were presented during posttesting, they simply provided insufficient cues to elicit the correct labeling responses. Adding one salient cue from the initial training setting, the teacher as the tester, was not sufficient to facilitate transfer. However, the subsequent introduction of further training cues -- the teacher, and the training stimuli -- into the testing situation produced sufficient contextual cues so that the Set A' transfer stimuli now elicited the correct response.

Campione and Brown (1974) have applied the contextual elements hypothesis to predict differential transfer on tasks requiring intra- and extra-dimensional shifts and transfer requiring changes in the stimulus presentation or the response format. In Campione and Brown's study the setting, the apparatus, the room and so forth remained the same on the transfer tasks. The present study suggests that the contextual elements hypothesis can also explain variability of performance on transfer of learning from one setting to another.

The influence of environmental stimuli on recall and on memory was demonstrated by Smith, Glenberg, & Bjork (1978) who found that college students' recall on a verbal learning task was better if it occurred in the same environment in which learning had taken place, than if there was a mismatch between learning and recall environments. Our study lends additional support to this finding and suggests that it can be extended to young children on a classroom learning task.

The observations reported in our present study have implications for educational assessment as well as for instruction. Regarding instructional procedures, the findings suggest that concepts and skills should be taught in a variety of contexts to facilitate their generalization and wider application. Along with a carefully chosen assortment of task stimuli, differing presentation formats and environmental contexts should be used so that a variety of situational cues will be encoded with the response, producing greater stimulus generalization. In short, this is "training in multiple settings" (Brown & Campione, 1978). Perhaps after repeated experiences of such a varied nature, a child might learn to apply newly learned skills more readily and in a wider range of situations. From these types of experiences a learning to generalize or learning to transfer skills might develop.

With respect to assessment, both informally in the classroom as well as more formally on tests, the findings suggest various considerations. When a teacher notices that her children appear not to have learned what she had taught, she should not be discouraged. The children may have learned but may not be transferring. An analysis of the changes from the specific instruction setting to the setting in which she is assessing the effects of her instruction might suggest ways in which she can facilitate the children's recall and transfer. There is also the other side of the coin to consider: A teacher needs

to be aware that successful performance in one specific setting does not guarantee successful performance in another setting.

The finding that failures to transfer can be overcome by the introduction of cues present during learning, also has relevance to more formal educational assessment. Most assessment devices assume an all-or-none form of learning: Either a child knows the answer or s/he does not. However, the results presented here suggest that the introduction of cues present during training may expedite the use of a particular cognitive strategy or facilitate transfer of a skill, resulting in higher test performance.

This point is particularly relevant to minority children from low income backgrounds. Cole and Bruner (1971) in their very astute analysis of cultural differences, write ". . . .those groups ordinarily diagnosed as culturally deprived have the same underlying competence as those in the mainstream of the dominant culture, *the differences in performance being accounted for by situations and contexts in which the competence is expressed*" (p. 870). Thus, frequently observed poor performance of low-income, minority children on achievement tests or other tests standardized on the majority may reflect not an ability to perform the necessary task, but rather a lack of experience in applying what they have learned to a testing situation.

In summary, the influence of the environmental setting on the transfer of learning has been demonstrated by the study. How specific features of a setting are implicated in facilitating transfer of learning from one setting to the next now needs to be explored. We suggest that the contextual elements hypothesis is a useful framework for integrating this research.

References

Bower, G.H. Stimulus-sampling theory of encoding variability. In A.W. Melton & E. Martin (Eds.), *Coding processes in human memory.* Washington, D.C.: V.H. Winston & Sons, 1972.

Brown, A.L., & Campione, J.C. Permissible inference from the outcome of training studies in cognitive development research. *The Quarterly Newsletter of the Institute for Comparative Human Development,* 1978, *2,* 46-53.

Campione, J.C., & Brown, A.L. The effects of contextual changes and degrees of component mastery on transfer of training. In H.W. Reese (Ed.), *Advances in child development and behavior* (Vol. 9). New York: Academic Press, 1974.

Cole, M., & Bruner, J. Cultural differences and inferences about psychological processes. *American Psychologist,* 1971, *1,* 203-219.

Day, R. *The acquisition of plurality and tense by pidgin speaking children.* (Technical Report No. 30). Honolulu: The Kamehameha Early Education Program, The Kamehameha Schools, 1975.

Drabman, R.S., Hammer, D.H., & Rosenbaum, M.S. Assessing generalization in behavior modification with children: The generalization map. *Behavior Assessment,* 1979, *1,* 203-219.

Flavell, J.H., Beach, D.R., & Chinsky, J.M. Spontaneous verbal rehearsal in a memory task as a function of age. *Child Development,* 1966, *37,* 283-299.

Robinson, V., & Swanton, C. The generalization of behavioral teacher training. *Review of Educational Research,* 1980, *50,* 486-498.

Wahler, R.G., Berland, R.M., & Coe, T.D. Generalization processes in child behavior change. In B. Lahey & A. Kasdin (Eds.), *Advances in child clinical psychology.* New York: Plenum Publishing Corporation, in press.

Smith, S.M., Glenberg, A., & Bjork, R.A. Environmental context and human memory. *Memory & Cognition,* 1978, *6,* 342-353.

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The enormous advantage is that world doubles.
In the absence of words, humans would have to deal only with those things
which they could perceive and manipulate directly.
With the help of language, they can deal with things which they have not perceived,
even indirectly, and with things which were part
of the experience of earlier generations.
Thus, the world adds another dimension to the world of humans.
It enables them to deal with things without having those things present.
Animals have one world,
the world of objects and situations which can be perceived by the sense.
Humans have a double world. . .

A.R. Luria

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