STANFORD ARTIFICIAL INTELLIGENCE LABORATORIES
MEMO AIM-203

STAN-CS-73-369

THE DEVELOPMENT OF CONCEPTUAL STRUCTURES IN CHILDREN

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SUPPORTED BY

ADVANCED RESEARCH PROJECTS AGENCY
ARPA ORDER NO. 457

MAY, 1973

COMPUTER SCIENCE DEPARTMENT
School of Humanities and Sciences
STANFORD UNIVERSITY

STANFORD ARTIFICIAL INTELLIGENCE LABORATORY MAY 1973
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ABSTRACT: Previous papers by the author have hypothesized that it is possible to represent the meaning of natural language sentences using a framework which has only fourteen primitive ACTs. This paper addresses the problem of when and how these ACTs might be learned by children. The speech of a child of age 2 is examined for possible knowledge of the primitive ACTs as well as the conceptual relations underlying language. It is shown that there is evidence that the conceptual structures underlying language are probably complete by age 2. Next a child is studied from birth to age 1. The emergence of the primitive ACTs and the conceptual relations is traced. The hypothesis is made that the structures that underlie and are necessary for language are present by age 1.

This research was supported by the Advanced Research Projects Agency of the Department of Defense under Contract SD-183.

I.INTRODUCTION

This paper deals with the question of language learning by children from a perspective considerably different than the usual approach. We have claimed elsewhere [11], that it is possible to represent a great part of the meanings underlying natural language by use of a conceptual representation schema that includes only fourteen basic actions, an infinite set of objects, and a small number of states, in addition to about sixteen rules governing the combination of these items. It is the intent of this paper to show that an infant shows knowledge of the aforementioned fourteen primitive ACTs long before he begins to speak. In particular we shall claim that the conceptual apparatus that underlies adult language is present in a child before he has finished his first year of life. It is this conceptual apparatus that guides language learning and in fact facilitates the infant's handling of the world in general.

The main point then here is that in order to learn language it is necessary to learn the model of the world that underlies language. The Conceptual Dependency system is one model which has been proposed which is intended to represent meaning structures. This system has been shown to be an effective model with respect to the problems of computer paraphrasing of English sentences, and inference of meaning by computer. If this model accurately portrays the meaning structures that people use when speaking, it is appropriate to inquire how humans come to learn these structures.

Our first conjecture was that these structures were learned while language was being learned. Accordingly we spent three months with a child whose age was 2.2 to 2.4. We discovered from this work that the child had already grasped nearly the entire range of conceptual structures to which people refer in language. We next looked at a child from birth to age 1. We discovered that the conceptual structures underlying language were learned gradually during this period and nearly completed by age 1.

First we shall present the rudiments of the conceptual dependency system used here. Then we shall present a sample of the work involving the child of age 2. Then we shall discuss the problem of learning conceptual structures with respect to the infant.

il. CONCEPTUAL DEPENDENCY

The main point of this paper is this: THE CONCEPTUAL STRUCTURES THAT UNDERLIE LANGUAGE ARE PRESENT IN THE CHILD IN NEARLY COMPLETE FORM LONG BEFORE SPOKEN LANGUAGE IS PRESENT.

We shall present in this section the rudiments of the Conceptual Dependency system . We have claimed elsewhere ([9] ,[11]) that the Conceptual Dependency system can adequately represent the meaning that underlies natural language. This paper is not intended to be a justification or proof of our framework. Rather, it would be possible to use any meaning representation system to make the same points based on the data presented here, The point here is simply that the system that underlies natural language is present before language learning takes place, assuming that that system is at least something like the Conceptual Dependency system . As a corollary of this, it would therefore be the case that people who are deaf and dumb probably have this complete conceptual system as well.

The Conceptual Dependency framework is intended to represent the meaning structures that can be assumed to underlie natural language. The basic unit of Conceptual Dependency is the conceptualization. A conceptualization consists of an ACTOR (which must be human or a natural force) an ACTION (which must be a real world action that an ACTOR can perform) an OBJECT (which can be any physical object for physical ACTIONS and a conceptualization for mental ACTIONS), an INSTRUMENT (which must be a

conceptualization which has the same ACTOR as the main conceptualization) and either none or one of RECIPIENT (which must be a human) or DIRECTION (which must be a place).

There are only fourteen allowable actions in Conceptual Dependency. Each action (ACT) requires either three or four conceptual cases (i.e. OBJECTIVE,INSTRUMENTAL and either RECIPIENT or DIRECTIVE), These cases are governed by the particular ACT. That is, the ACTs that can be classified as physical require physical objects in the OBJECTIVE case,

The fourteen ACTs are:

ATRANS The transfer of an abstract relationship such as possession, ownership, or cont roi.

PTRANS The transfer of physical location of an object.

PROPEL The application of a physical force to an object.

MOVE The movement of a bodypart of an animal,

GRASP The grasping of an object by an actor.

INGEST The taking in of an object by an animal,

EXPEL The expulsion of an object from the body of an animal into the world.

MTRANS The transfer of mental information between animals or within an animal. We partition memory into CP (conscious processor), LTM (long-term memory), and sense organs. MTRANSing takes place between these mental iocat ions.

CONC The conceptualizing or thinking about an idea by an animal.

MBUILD The construction by an animal of new information from old informat ion,

SMELL The action of directing ones nose towrds an odor.

SPEAK The action of producing sounds from the mouth.

LOOK-AT The directing of ones eyes towards an object.

LISTEN-TO The directing of ones ears towards an object.

Conceptual Dependency uses a limited set of conceptual rules which are considered to be the syntax rules for conceptualizations. There are about sixteen of these rules. These rules are responsible for linking together all the concepts in a meaning structure. The most important of these rules are:

ACTORS perform ACTIONS

ACTIONS have OBJECTS

ACTIONS have INSTRUMENTS

ACTIONS may have RECIPIENTS

ACTIONS may have DIRECTIONS

OBJECTS can relate to other OBJECTS
these relations are: POSSESSION
LOCATION
CONTAINMENT

OBJECTS can have ATTRIBUTES

ACTIONS can have ATTRIBUTES

ATTRIBUTES have VALUES

CONCEPTUALIZATIONS can have TIMES

CONCEPTUALIZATIONS can have LOCATIONS

CONCEPTUALIZATIONS can CAUSE OBJECT'S ATTRIBUTES to CHANGE VALUE

CONCEPTUALIZATIONS can ENABLE other CONCEPTUALIZATIONS to occur

CONCEPTUALIZATIONS can serve as REASONS for CONCEPTUALIZATIONS

This conceptual framework is useful for representing the meaning of sentences. We have not presented all the pieces of the system, just the most important ones. This system serves as the basis for computer programs that understand natural language well enough to make meaning paraphrases[4] and inferences [12] from input sentences.

We have left out of this discussion much of what is important about Conceptual Dependency theory because that information has been presented elsewhere. As a result, this paper is not entirely self-contained. We refer the reader to [9] and [11] for better discussion of the issues involved. We should mention here however that there are a large number of states used in Conceptual Dependency in addition to the ACTs. Much of what are considered to be actions by people working on semantics are considered to be states here. We do not consider something to be an ACT unless it can be done by somebody. Thus, for example, 'touch' and 'sleep' are considered to be states. In order to be in a touching state it is necessary to MOVE (or have something else PTRANSed towards you.) Sleeping is not something one can actually do. There are however, things you can do which might cause you to get in a sleeping state. Thus it can be seen that there is no one to one correspondence between verbs and ACTs. The verb 'hurt', for example, refers

to an unknown ACT that somebody did which resulted in a 'hurt' state for somebody.

ill. GABBY, AGE 2.2 -2.4

in the course of our research with Gabby, we intended to watch her learn concept uai syntax rules and conceptual primitive act ions. We discovered however, that we would not hear anything like the beginning of the appearance of the directive or instrumental case, or the occurance of the learning of a new primitive ACT.

It is hard to know what goes on in the mind of a child of age 2.2., but it is really not a great deal harder than knowing what goes on in the head of an adult speaker. An adult will respond more readily to questions about his internal make up or his reasons for doing certain things, but often his answers are not very much more accurate. Accordingly, we will take as evidence for an ACT being present, in this section,the presence of a verb that represents that ACT if given in the appropriate context. Ail we have said about primitive ACTs is that it is possible to use them to represent the meaning of an action underlying a verb or noun in a language. We assume that they are present in the minds of speakers , but we have no clear evidence of this. (Except see [13] for a description of an experiment that shows that the level of complexity posited by the use of the primitive ACTs shows up in reaction times in recognition .)

Thus, we shall make the same assumptions about the language that chiidren use. If we can represent what they say with the same set of ACTs and conceptual relations that adults use we shall say that it is likely that

these exist in the head of the child and that they are the same as the ones adults have. If some of these ACTs are not present, then it will indicate that the child has not yet learned them.

We did not initially intend to watch Gabby learn primitive ACTs as we had not devised that notion at the time. We were interested in watching her learn conceptual relations. We also wanted to see what Gabby thought about the world and her language in so far as that was possible. Had we intended to look for primitive ACTs we probably could have gotten better data than that shown here. A report was written [10] that describes all the information that was gathered. We shall skim some of the data from that report here,

What follows is a list of conversational sequences in which Gabby said things which we feel indicate knowledge of some underlying conceptual structure. The primitive ACT or conceptual rule that her sentence illustrates is presented alongside in capital letters.

I(Interviewer): Did you go in there?
G (Gabby): No, I go my room. PTRANS
DIRECTIVE CASE
POSSESSION

I:Whats in your room?
G: Toys. LOCATION

G: Eat
M(Mother):What do you want to eat?
G: Cereal. INGEST
OBJECTIVE CASE

M:What does Becky do for you?
G:Becky feed Gabby. ENABLE CAUSATION

M: Get a ball.	
G:Want play catch.	VALUE CHANGE CAUSATION
M;You get it.	
G. I get it.	ATRANS
G. Here, throw my ball.	PROPEL
M. Catch again.	
G. I get it. I hold it.	GRASP
I. He can't get out?	
G: I didn't say 'can'.	MTRANS
	SPEAK
I. Should I push the stroller with my knee?	
G: No, I push it.	
I: What do you push it with?	
G: My hand.	INSTRUMENTAL CASE
	PROPEL
	MOVE
I: How do you get the butter on to the bread?	
G: On knife.	INSTRUMENTAL CASE
M: Which bike did you bring?,	
G: Red bike.	PTRANS
	ATTRIBUTE-VALUE
M: O.K. get me a spoon	
G: (handing spoon) That mine.	POSSESSION
That Mommy's	RECIPIENT CASE
I eat.	INGEST
Want my plate	ATRANS
I: What kind of hat is that?	
G: Blue	ATTRIBUTE-VALUE
I: Who's in the boat?	
G: Cat	CONTAINMENT
I: What do you do with butter?	

G: Eat it. — OBJECTIVE CASE
I: How do you eat it ?
G: On a spoon. — INSTRUMENTAL CASE

I: Can you use that pumpkin as a house?
G: You can't get in it. — ENABLE CAUSATION

M: What's happening to this egg?
G: Broken, — VALUE CHANGE CAUSATION
M: Yes its falling down and its going to get broken.

M: What does Mommy do when you jump on Mommy?
G: Caused her get mad.
I hit you, you get mad. — REASON CAUSATION

1: What do you want to do?
G: I want to watch TV. — MTRANS
LOOK-AT

I: What did you do?
G: I turned it on, — MOVE
VALUE CHANGE CAUSATION

G: Read a book. — MTRANS
I: Where should I read from ?
G: That book. — RECIPIENT CASE

I. What is the fox doing?
G: Falls the corn, — VALUE CHANGE CAUSATION
I: What does it have over there?
G: (garbled)
I: I don't understand.
G: I get my mom. — REASON CAUSATION

M: What do you do with a piano?
G: Make music. — LISTEN-TO
VALUE CHANGE CAUSATION

I:Does Gabby pee on the toilet?
G: No
M: Where does Gabby pee?
G: I pee my diapers. EXPEL
DIRECTIVE CASE

M: What does Grandma send you?
G: hat, jacket RECIPIENT CASE
OBJECTIVE CASE

M: What else?
G: Sent cookies. ATRANS
M: What kind of cookies?
G: Gabby's cookies. POSSESSION

M: Do you know why these guys are here?
G: They're-my friends, mama. ABSTRACT RELATION
M: They want to find out how Gabby talks.
G: (laughs)
M: Does Gabby talk a lot?
G: 'yes
M: How much?
G: (she screams) SPEAK
ACTION ATTRIBUTE

The utterance sequences listed above are quite typical of Gabby's speech from age 2.2 to 2.4. There are numerous instances of all of the conceptual ACTs and conceptual relations listed above. We listed here all the sentences where the context made it clear that Gabby meant by them what we would ordinarily assume an adult would mean by them. This was not true of all her utterances of course. For example, she used the word 'pray' where it was quite clear that she meant 'sing'. We have left such uses out of the above list. In addition, we have made certain interpretations that might not be

immediately obvious. We consider her screaming in the last sequence to be an ACTION ATTRIBUTE because she intended it to demonstrate the volume attribute of the ACT SPEAK.

It seems clear that the only thing that one can conclude from the above data is that Gabby has the full range of conceptual relations and ACTs that adults have. Arguments about children's causality not ion being different than adult's (i.e. [8]) are not to the point here, Although a child may have a different idea of what causes what, he still distinguishes the same kinds of causation as an adult does. Thus, we are saying nothing about the conceptual semantics of child language here (that is, the knowledge of the world that he has) . Rather, we are saying that the types of relations are the same.

Of the fourteen primitive ACTs, Gabby used no words to refer to SMELL,CONC, or MBUILD. One possible reason for this is that there aren't all that many words (percentage wise} in English to refer to the first two ACTs. We assume that she was aware that she could SMELL but there is no obvious evidence that she was aware of her ability to CONC and MBUILD (although she was quite obviously doing those ACTs.)

If there is some development to be done in a child with respect to the learning of ACTs then, it would be the realization that she is capable of CONCing and MBUILDing. But all the other ACTs would seem to be present by age 2.4. Furthermore, every single conceptual relation is present by 2.4.

IV. HANA , AGE 0 - 1

In the previous sect ion, we listed alongside Gabby's utterances the conceptual rule or conceptual primitive ACT that appeared to be underlying the sentence that was said. We can estimate that Gabby has those conceptual rules or ACTs since she said the words that indicate them in normal adult speech. However, it should in principle be possible to demonstrate that a person has a given concept or conceptual rule by what he DOES in addition to what he SAYS. That is, a person who seems to intend throw a ball can be said to understand the primitive ACT PROPEL at least as well as a person who says the word 'throw'. In fact , an argument could be made that there is more evidence in the former case. Thus, it probably was not necessary to listen to Gabby's words as much as it was to observe her actions and her understanding of other people's words in order to hypothesize what her conceptual structures might be like.

We have taken the above approach in our attempt to watch a child learn the conceptual rules and ACTs which may be said to govern the language and probably the world in which she must operate. The child that was chosen for study had to be watched much more closely over a longer period of time than Gabby, so I waited until my own daughter Hana, was born.

The assumption in this section is that the mere demonstration of a given action does not constitute evidence that that action has been conceptualized by the actor if the actor is an infant, In other words, while we can infer

intention on the part of an adult actor when he performs an action, such an inference could possibly be quite erroneous when observing an infant, Assuming this then, in our study of Hana, we tried to differentiate the performance of an act ion from the intention to perform that action. For example, all newborn infants will grasp something when it is placed in their hands if it is small enough. We would not consider a child to have the concept GRASP until it deliberately reached out for something and grasped it. One problem here is that it is very hard to know for sure when an action was intended or not. There are some ways however. If the action is repeated frequently enough and has a positive result for the child, or the child shows signs of anticipating the positive result, we can say with more certainty that the child intended to do what it did and thus has the concept of the ACT involved,

We should say here that a lot of work has been done on the problem of action in infants (for a discussion of the problem of sequential action see [1]). We are not trying here to state what physical actions or sequences of actions an infant is capable of performing. Rather, we have a set of ACTs that can adequately represent adult language. These ACTs do not represent the totality of ACTs that people actually perform, but rather they are intended to represent the meanings that people refer to when they use language to refer to their actions. What we are saying here is that the disposition to see things in this way precedes language. The only way we can attempt to verify this is by studying infants to ascertain whether there

exists any evidence at all that infants have mastered the concepts to which these ACTs refer. If such evidence is found then we have the basis for making an hypothesis.

We shall seek to show here then that such evidence does exist and that there is thus reason to believe that the conceptual structure underlying adult language might well be present before language learning takes place.

We shall present the data here temporally, but it should be noted that we are not making any claims about when things first appear in infants. It is not important for our purposes exactly when a concept first appeared in Hana. It only matters that it appeared before age 1. We have no interest here in challenging the developmental literature one way or the other.

At the age of two weeks, Hana could be legitimately be described as performing four of the primitive ACTs, while probably conceptualizing none of them. She MOVEd her bodyparts, GRASPed objects placed in her hand, INGESTed milk and EXPELed excrement. There is no reason to believe that she intended to do these things and then did them. Although there is a sense in which it could be said that she intended to INGEST, this is probably best ascribed to instinct.

At age three weeks, Hana stared at her stuffed dog for about five minutes. She reached out to it and touched it repeatedly after about five minutes. When I took it away she did not appear to be bothered but continued to stare in that direction while no longer reaching out. The next day,

when placed in her crib in a different position she looked at her stuffed owl for about twenty minutes. When I moved her away from the owl she cried, but returned to staring and reaching for it and feeling it when I placed her back in the crib. This occurred three times.

At age three weeks then , it is probably safe to say that Hana has got ten the idea that there was something out in the world besides her. Furthermore, it is not unreasonable to suppose that she understood that she could MOVE a bodypart (her arm) towards an object. Thus, she had the ACT MOVE as well as OBJECTIVE (arm) and DIRECTIVE CASE (to the object). Furthermore, it would appear that she intended to LOOK-AT an object. It is also probable that she had 'wants'. That is, she seems to be aware that she wanted to do an action (as evidenced by her crying when she was impeded from doing an action). We say therefore that she was aware that doing something caused her pleasure. Thus we claim that she had the idea of VALUE CHANGE CAUSATION. From this it follows that she has learned that at least one OBJECT (herself) has changing VALUES (pleasure). While it is also true that she had CONCed all of these things, there is no evidence that she was aware of that CONCing (nor is their likely to be without speech).

At the age of five weeks, Hana began to actively look for her stuffed animals and became distraught when they were taken away. She reacted to the sound of a music box by quieting down from her almost constant chatter of sounds. She seemed to suck at her pacifier with great desire and developed a

specific cry for it. She began to look for things to suck on her stuffed animals (like the ear of the dog and the foot of the owl). Also at this age she began to stare at her parents for a minute at a time or so.

We would say then that Hana, seems to have added at age five weeks, the ACT LISTEN-TO to her repetoire. LOOK-AT is quite clearly present as can be seen from her looking around for things. We would also claim that she has at this point the concept MTRANS where the information is sense data and the donor of the information is a sense organ of hers and the recipient is her own conscious processor (CP). She does not really seem to be aware of MTRANSing informat ion to others. However, she did seem to be trying to look at things and feel things and the reason for this could only be her awareness that she would get some new information (i.e. what something looks like or feels like) by doing this. Since this idea is MTRANS, we can safely say that she understands this concept at this point..

At age .2 (two months) , I was playing with Hana, trying to quiet her while she was making what appeared to be hungry noises. Her mother entered the room at this point and Hana immediately quieted down. When her mother left the room a few seconds later without paying attention to Hana, she started screaming again. This was the first evidence that we had that Hana was aware of the fact that her desire to eat was going to satisfied. Since she was fed by the breast, we would guess here that Hana recognized her mother as a source of food and quieted down. It is impossible to be sure of this, but we can hypothesize for the moment that Hana at age .2 had the concept INGEST.

A few days after this, Hana was given her first piece of food besides milk (a banana). She ate it with great excitement and eagerness. It seems that she did have the realization of the ACT INGEST at this point.

Thus by age .2 the ACTs, LISTEN-TO, LOOK-AT, MOVE, MTRANS, and INGEST would appear to have been known by Hana. There was cont inuous evidence of these consisting of her looking around for a sound, swinging her arms at interesting things placed near her, and feeling and looking behavior which can be interpreted as a desire to gain information on her part,

At age .4, Hana had mastered some more of the ACTs. She reached for and grabbed her pacifier as well as the cradle gym that hung over her crib. She definitely tried to GRASP these things and we would say that she had that concept at that point. Furthermore, she has the idea of an INSTRUMENTAL action at this point. When she wanted to GRASP something she knew that it was necessary to MOVE her arm to that thing. Thus, we claim that she had INSTRUMENTAL CASE at this point.

There was at this point further evidence for the presence of the ACT INGEST. When she was taken swimming, although she was not hungry, whenever her mouth would come in cont act with the water, she would drink it. After a while she would consciously try to drink the water from the pool by straining from the arms of whoever was holding her until her mouth was in contact with the water. She would then begin to drink. Here again we have an INSTRUMENTAL action as well.

By this time it was also clear that she recognized faces. If someone new was holding her she would stare at the new face for a long period of time. If the holder was one of her parents she would pay no attention to the face at all. This is evidence of a different kind of MTRANS. Namely, at this point she seemed to be capable of MTRANSing old information within her head and comparing it with new information. It would seem then that since this process is what we call MBUILD in adults that Hana could MBUILD at age .4 as well. However, as we have stated before,there appeared to be no evidence that she was aware of MBUILDing. In other words, we know she could think to some extent, but it is not obvious that she thought that she could think. (As with Gabby, we cannot really know this unless she would express her thinking about her own thoughts in language.)

By age .4, it would seem that the concept PTRANS was present as well. Hana would often GRASP things so as to bring them to her. In addition, she would manage to move herself over to things that she wanted to play with. She did not move things from place to place, but it is hard to imagine what would motivate such an action. Thus, we can say that PTRANS is present, but the direction always involves her, that is,thing to her, or her to thing. In addition we can claim that ENABLE CAUSATION would seem to be present. That is,whenever she PTRANSed herself anywhere it was always to do something with the thing that she had PTRANSed herself to. Thus she understood that doing one ACT(PTRANS) would enable another ACT (GRASPing for example).

Furthermore she has grasped the idea of REASON CAUSATION. That is, she does this ENABLING action because she knows it will get her what she wants. This serves then as a REASON for doing it.

By age .5, Hana began to intentionally transfer objects from one hand to the other. This is yet another type of PTRANS.

At age .7, Hana got a walker. In the beginning she would inadvertantly push it and follow where it went by holding on and moving her feet. After two days of this, she got the idea that she could PTRANS herself by pushing the walker in a direction where she wanted to go. At this point we would say that she had gotten the idea of PTRANS pretty well completed. In addition she seems to have mastered PROPEL as well.

She had up until this point , frequently hit at things, particularly toys that were hung above her crib for exactly that purpose. But it was never obvious that she was moving her arm towards them in order to apply a force to them. It was possible that she just wanted to touch them (although this is not very likely). She learned that applying a force to the walker in the direction that she wanted to go could be a means of PTRANSing herself. Thus she began to use the concept PROPEL.

At age .9, Hana was taught to play catch. After about a minute of demonstration she was able to roll a tennis ball back to me every time that I rolled it to her. When she missed it she would crawl after it and attempt to bring it back to me. Often she would throw it to me from the point to

where it had rolled. (She rarely succeeded in directing the path correctly on these occasions however.)

It would seem that her learning of PROPEL earlier facilitated her ability to pick up this new form of PROPEL so easily. It is also the case that this was probably an instance of ATRANS and RECIPIENT CASE for her as well. This set up the following circumstance at age 10 months.

At age . 10, Hana was taught to give objects to people by handing them to them. She learned as a part of this new game that often the people would hand the item back to her. In this case the game was 'on' and she wouid hand the it em back again. This continued until one of the participants got tired. The cue for this game was both visual and verbal ('give to Papa' usually being said at the time).

Although it is clear from this that Hana had learned the concept of PTRANS, this had been shown to be the case earlier. We would claim that this was the first instance of her use of the concept ATRANS (abstract transfer of a relationship such as CONTROL or POSSESSION). It is not obvious though, as with our discussion of GRASP, above, that Hana had at this point understood the concept ATRANS as opposed to just having performed the instrumental ACTs associated in adult minds with this ACT. In addition, Hana had learned the English name ('give') for ATRANS.

At about age .11,Hana played the above game slightly differently. She nearly always handed items that she found interesting to other

people that were around (other infants and strangers included). However, when the item was something she desired, after handing the item to another person, she would cry (her 'want' cry) until it was handed back to her. From this we can make the following conclusion. Hana saw this giving behavior as a game which she liked to play. However, she also came to understand that the possession of the ATRANSed item had been changed by her actions. Soon, she began to do the instrumental ACT of moving her hand with the intention of ATRANSing the item. Sometimes this ATRANS was done as part of a game , in which case she required that the game be played so as to allow her to retain control. Othertimes she deliberately ATRANSed an item because she did not want it any more. On these ocasions she would hand it over and then leave.

She obviously saw this as being different than PTRANS because her reaction to the final state was different. When she PTRANSed an item she was aware that she still had control over it. This was manifested by her simply going to where the item now was and reclaiming it. But when the item in question was ATRANSed, she recognized it as being out of her control even though it may have been only inches from her. It was only when she had performed an ATRANS that was for game purposes that she would cry. That is she perceived her action as PTRANS over which she had control. Upon discovering that she had done ATRANS (acts which are not physically different but only socially different) she was upset. Thus we conclude that Hana had , at this time understood both ATRANS and PTRANS.

At age .9, Hana first began to understand words that were said to her. The first two words she learned were 'cat' and 'potch' (a Yiddish word meaning 'to hit lightly'). After we knew that she knew these words I told her 'potch cat'. She proceeded to hit the cat. A few days later, she was standing on the other side of the room from the cat and I again said 'potch cat'. She then walked across the room (by holding on to the furniture) and proceeded to hit the cat. Out side of what we might speculate about the cat's feelings at this point, it seems that the following was true of Hana at age .9. She could readily understand that 'potch' meant to PROPEL her arm in a direction and could figure that the cat must be that direction . Wanting to get approval she saw that she had to be near the cat in order to hit it. Thus, we can say that she not only understood that particular ACT and its associated cases, but understood REASON CAUSATION (she did it for approval), ENABLE CAUSATION (in order to do it she had to move to the cat), and VALUE CHANGE CAUSATION(she knew that the approval would make her happy(and it did). This is,of course, an extremely complicated conceptual structure. We are claiming that there is every reason to believe that she is capable of using and understanding structures of just such complexity.

By age .1 1, it was obvious that Hana had become aware of SPEAK and with it the idea of MTRANSing information between herself and others. She would imitate sounds that were made to her and she had developed a set of special sounds that were different for each of her needs. She could, by this time seek and find her parents in order to communicate to us what her need was.

We can conclude from all this then that before the age of 1 year, Hana had come to understand and use at least ten of the fourteen ACTs and every single conceptual relation (or conceptual syntax rule). She had the ACTs: INGEST, ATRANS, MTRANS, PTRANS, GRASP, PROPEL, LISTEN-TO, LOOK-AT, MOVE, and SPEAK. There was no evidence that she was aware of EXPEL or SMELL. We can assume that she did MBUILD and CONC but as with Gabby there is no obvious way to tell this. It is interesting that except for EXPEL, Gabby and Hana are identical with respect to their observable use of ACTs.

V. CONCLUSION

This paper has been of a highly speculative nature. It is import ant then to point out just what we feel we have shown here. We were not intending to produce evidence that Conceptual Dependency theory is psychologically valid. What we were trying to show is that if you assume Conceptual Dependency theory to be a reasonable model for the conceptual structures that underlie natural language then there is evidence to suggest that such conceptual structures are nearly completely formed before language is actually present in the child. Furthermore, it is reasonable to suppose that these conceptual structures form the basis for language learning when it does take place.

Part of the problem with this paper is that does not take into account very heavily what is known from developmental psychology about cognitive structures in children. One reason for this is that the perspectives of the usual studies in that area are considerably different from that taken here. For example, the fact that children see inanimate objects as intending to do t hings,or that at certain ages they are not concerned if objects disappear and reappear should not concern a discussion of this kind. This is because, those facts relate to what we have called [9] the conceptual semantics as opposed to the conceptual syntax of conceptual structures. By these terms we mean that there is a distinction to be made between learning the rule that OBJECTS can ACT and learning which objects can do which acts. The former is

conceptual syntax, the latter is conceptual semantics. In the same way, Piaget's [8] studies of causality are about the conceptual semantics of causality. We have claimed here that children have virtually the same conceptual types of causality rules as adults before the age of one. We make no such claim about the semantics of what can cause what. There is certainly plenty of evidence to suggest that it takes children a long time to learn such rules.

Thus, although we have a different starting point here, we are not making a point so very different from Bruner [2] when he argues that the capacity for intentional behavior is present from birth. Bruner sees intent ion as including 'anticipation of the outcome of an act','selection among appropriate means for achievement of an end state" and 'sustained direction of behavior during deployment of means'. These correspond to the notions of REASON CAUSATION,VALUE CHANGE CAUSATION, ENABLING CAUSATION, INSTRUMENTAL CASE.

Furthermore Bruner [1] divides the physical actions that a child is capable of during the first year of life into the following five categories: feeding,perceiving, manipulating the world,locomot ing, and interacting with members of the species. We would note that these correspond quite closely to the following primitive ACTs (respectively): INGEST,MTRANS(LOOK-AT, LISTEN-TO),GRASP,PTRANS and MOVE, and MTRANS and ATRANS.

Thus there is some evidence apart from that presented here that what we have said here is not entirely unreasonable. We have presented this work

within the context of a theory of language however, where Bruner does not have those considerations.

There have been researchers whose goals are more linguistic in nature, who have begun to consider the idea that language learning consists of more than just beginning to learn syntax at age 2. Kaplan and Kaplan [6] assert that there is no such thing as a prelinguistic child. They cite evidence to show that certain aspects of language are learned long before age 2. Halliday [5] has noted that certain linguistic types appear as early as age .9 and that these are precursors to regular linguistic types.

What we are saying here then is that the structures that underlie language are learned almost from birth. Thus, in a sense the nature of language learning must be redefined so as to begin with the problem of learning conceptual structures and then proceed to the problem of the linguistic realization of those structures.

But it is important to emphasize that the nature of the structures that are learned from birth should by no means be assumed to be grammatical structures. Far too much work has stressed the predisposition towards learning syntax (e.g. Fodor[3]) or has relegated the entire problem of language learning to one of testing out grammars (e.g. McNeill [7]). What we are saying here is that complete conceptual structures are present by age 1 and that these structures strongly affect how language is learned. Early language is quite similar semantically regardless of the particular

language being learned. Certainly syntax learning is an important part of language learning, but it is important to emphasize that it is the last part of a long process that has its initiation at birth.

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