

AN EXPERIMENTAL STUDY OF THE DEVELOPMENT OF CONCEPTS OF RELATIONSHIP IN PRE-SCHOOL CHILDREN AS EVIDENCED BY THEIR EXPRESSIVE ABILITY¹

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STATEMENT OF THE PROBLEM

Observation of verbal expression in the pre-school groups during times of free activity showed that most children were in possession of an adequate number of nominal terms with which to meet their needs. They seemed to have words expressing action or being, but there was an apparent lack in ability to express the relations between themselves and other persons or things, between things, and between ideas. As a result, the field of relations as employed verbally by groups of children in the pre-school laboratories of the Iowa Child Welfare Research Station was made the subject of this study.

The problem of this investigation is a study of the developmental trends in concepts of pre-school children at different chronological and mental age levels as portrayed by their verbal response to questions implying relationships of (1) time, (2) space, (3) part-whole, (4) cause, (5) discordance, and (6) number. These relationships were thought to be far-reaching in their effects upon the child's mental ability, without which the child would be handicapped. This general statement gives rise to the following problems: (1) the types of response characteristic of different mental and chronological age levels, (2) the relative influence of mental and chronological age upon maturity of thinking, (3) some of the sources of inadequacies of thought in pre-school children, (4) the estimate of vocabulary extent, and (5) the determination of patterns of development. A vocabulary test was given to determine if estimated vocabulary extent revealed presence or absence of ability to express certain relations coexistent with high or low vocabulary count.

Maturity of thinking in this study is interpreted to mean processes employed by the well-informed adult whose concepts are based on scientific but not always analytical

knowledge. For example, a mature response concerned with the nature, composition, and origin of snow would not necessarily mean a chemical analysis. Inadequacies in thinking arise when concepts diverge from those of the mature adult. Patterns of mental development are revealed in characteristics of thinking which undergo change as one proceeds upward in the mental or chronological age scale.

METHOD

It is difficult to obtain verbal response on matters about which the child has not concerned himself before. He feels the limitation in verbal expression, lack of knowledge, and aversion to the difficult, and is also limited by timidity, inferiority, boredom, and lack of experience with people. Physical fatigue or discomfort make a more difficult situation in securing verbal response. For this reason the clinical method was used. The experimenter acquainted herself with the children by actual association with them and through personality records which are kept for each child from the time of his entrance in the pre-school. Consequently rapport was established and all children were eager to participate in the study.

A rigid test procedure could not be employed for many reasons. The limited ability and limited understanding of certain children made it necessary to modify the wording of simple questions to enable them to comprehend the meaning. To secure a verbal response which indicated the results of the child's own thinking, it was necessary at times to converse with the child at some length. Their usual conversation during free play hours at the pre-school and their spontaneous questions rarely employed some of the relations studied here, either because they have never been conscious of the relations or they have accepted them uncritically.

1. This study was directed at the Iowa Child Welfare Research Station by Dr. George D. Stoddard.

An attempt was made through conversation to secure the true belief of the child unmodified by the adult's questions, remarks, tone of voice, or facial expressions. Six series of questions were asked; each series pertained to one of the six relations studied. The form of the questions was made similar to those spontaneous questions asked by children during the observation period. In every instance effort was made to avoid suggestion which would provoke a particular kind of response. For example, the question, "How did the snow get there?" was used in place of, "Who put the snow there?" as was done by Piaget¹ in some of his questions regarding the child's conception of the world.

Some of the relations used in this study were previously made the bases for investigations by Piaget. But his questions were framed in the form of questions he had collected from the spontaneous conversation of children. The form in which he asked them gave evidence of his underlying thought, as when he asked, "Who made the snow?" The form of the question distorted the response of the child whose real concept of the origin of snow was "crystallized moisture."

The six series of questions outlined for this study served only as a starting point in the conversation with the child. Other questions and remarks were added where needed to aid the child in the expression of his concepts. Though suggestion was reduced to a minimum, there was no positive proof that the concept expressed by the child to the experimenter represented that which the child holds when by himself. Neither did it reveal the constancy with which he held it. Similarities in trend both in correct and inadequate expression of the several relations studied may justify an interpretation of these more constant trends as indicative of the true nature of the child's thought.

APPARATUS AND TECHNIQUES

Recording Apparatus

All conversation of both experimenter and child, except a part of the questions dealing with the part-whole relationship and all

the questions pertaining to space and time, was recorded by an electric recording machine. The records of verbatim responses to the other questions were made by the experimenter on a prepared form.

The electric recording apparatus used was constructed by Betts² at the University of Iowa in an attempt to secure an efficient means of studying oral composition. This has been found a most effective and efficient means for securing an accurate record of the conversation between child and experimenter in this study. Betts found there were ninety-nine words, or .0024 per cent, of 40,214 words which were unintelligible when electrically recorded. The per cent accurately recorded by different techniques is:

Techniques	Per Cent
Electric Recording	99.7
Court Reporters	84.9
Shorthand Reporters	82.9
Longhand Reporters	83.9
Phoneticians	87.6

The recording apparatus consisted of a microphone circuit and a final amplifier circuit. The microphone circuit, set up in the testing room, was connected with a battery supply consisting of one six-volt storage battery and 180 volts of "B" batteries essential to the operation of the microphone transmitter unit and amplifier. The final amplifier had three stages of amplification, the power supply consisting of a plate supply and "c" bias unit and one eight-volt storage battery. The electric recording units consisted of the two loud-speaker units, the audio frequency of which was transferred to the dictaphone records by means of two small levers. The sound was recorded on standard cylindrical wax dictaphone records. A continuous record of conversation was made by starting one of the recording devices shortly before the other was finished. This gave a slight over-lap which was easily disregarded in the transcription. The conversation with most children necessitated two records, a few required three. An isolated amplifier of one

1. Jean Piaget, *The Child's Conception of the World* (New York: Harcourt, Brace, 1929), p. 5.

2. Emmett Albert Betts, *An Experimental Appraisal of Certain Techniques for the Study of Oral Composition*. Unpublished Doctor's dissertation, State University of Iowa, 1931.

stage amplification was used because of the distance of transmission.

The testing rooms in which the microphone unit was placed were in a building several blocks distant from the laboratory in which the recording units were set up. As a consequence, a private telephone wire was put in from the testing room to the main telephone office. By plugging in, this wire was connected with another private wire leading to the laboratory. Connection was then made to the recording units. The use of the apparatus necessitated the attention of a technician during the time of recording. Necessary communication with the technician was established by standard telephone service.

The services of the same dictaphone operator employed by Betts in his appraisal of different techniques were secured for this study. All transcriptions were checked by the experimenter and errors were negligible.

Experimental Room

The experimental room was small and contained only a low table, two low chairs, the recording apparatus, and the materials used in the experiment. The doors were closed to exclude noise and to limit the attention of the child to the experimental situation.

Materials

The only materials used in the test were a packet of thirty-seven Tinker Toy sticks (10 7/8 inches long); a box of fifty colored marbles; and a box of fifty "Old Hickory" blocks which were of various sizes, shapes, and colors. A prepared form was used in recording the responses to questions dealing with time and space, and with a part of the questions pertaining to the part-whole relation. The experimenter used a list of questions in an inconspicuous manner so as not to attract the child's attention to them.

Questions

The questions used in this study as a starting point in the conversation with the children are as follows:

Time:

1. When do you get up (out of bed)?
2. Is this morning or afternoon?
3. How do you know?
4. When is it time for school?
5. Who brings you to school and takes you home?

6. How do you know when your _____ will come for you?
7. When is it time to get a toy? To go outdoors?
8. When do you eat lunch?
9. When is it time for orange juice?
10. When do you put on your coat and hat?
11. When is it time for a story at school?

Space:

The child was first asked to place one block on top of the other then to place one beside the other.

He was asked where the block was when held in the following positions:

- | | |
|----------------|-----------|
| 1. Above | 5. Beside |
| 2. Below | 6. Inside |
| 3. In front of | 7. Under |
| 4. In back of | 8. Around |

Partitive relation:

1. Give me part of these blocks.
2. Put some of them in the box.
3. Put all the blocks in the box.
4. Some of the blocks were red. What color were the blocks?
5. A part of the sand in the pile is wet. Is the sand in the pile wet?
6. A part of my apple tastes good. How does my apple taste?

Causative:

1. Why do you put on your coat when you go outdoors?
2. Do you take a toy away from another child? Why?
3. Why does a ball roll?
4. Why does an airplane stay up in the air?
5. Where does the snow come from? How did it get up there? What makes it white? What makes it fall toward the ground? Why does it go away after a while?
6. What is rain? Where does it come from? Why? How?
7. What does mother use an umbrella for?
8. What makes the noise when I drop a block on the table? Does the block make it? How? Does the table make it too? How? Does the table know that it is making the noise?

Discordance:

1. Your mother says that you cannot go but --

2. Even though you do not like your food, you --
3. You get your clothes muddy in spite of --
4. Although this is big and heavy, I --
5. You ate all the candy except --
6. Though mother puts you to bed for a nap, you --
7. You want that toy, yet --
8. Though you do not eat your dinner, you ask if you may --
9. Even though it is bedtime, you --
10. You wanted to see Santa Claus but --
11. You would take a toy away from another child except --
12. Although you want to go home, you --
13. You want to get up out of bed in spite of --

Number:

1. Sticks How many?
2. Marbles How many?
3. Blocks How many?

The few materials used permitted the experimenter to renew interest in the task for the child from time to time. For the younger children, the experimental period was on the average about thirty minutes in length; the older children completed all questions in less time. The experimenter kept supplementary records of attitudes, personality traits, and other factors which seemed to have a bearing on the response.

The dictaphone records were transcribed by a typist, each record taking from twenty to forty-five minutes. All affirmative and negative sounds, hesitations, laughs, and exclamations were noted in the transcription. This typewritten record was then checked for accuracy by the experimenter who reread the record comparing it with the typed copy.

SUBJECTS USED IN THE EXPERIMENT

The eighty-three children used in this study were in attendance at the pre-school laboratories of the Iowa Child Welfare Research Station. They ranged in chronological age from two years, eight months to six years, four months. In computing age, days under a half month were dropped, days over a half were counted one month. The children were grouped first according to chron-

ological age and later according to mental age. The range and average age of each group with the corresponding average of mental and chronological age is given in Table I.

TABLE I
DESCRIPTION OF GROUPS USED

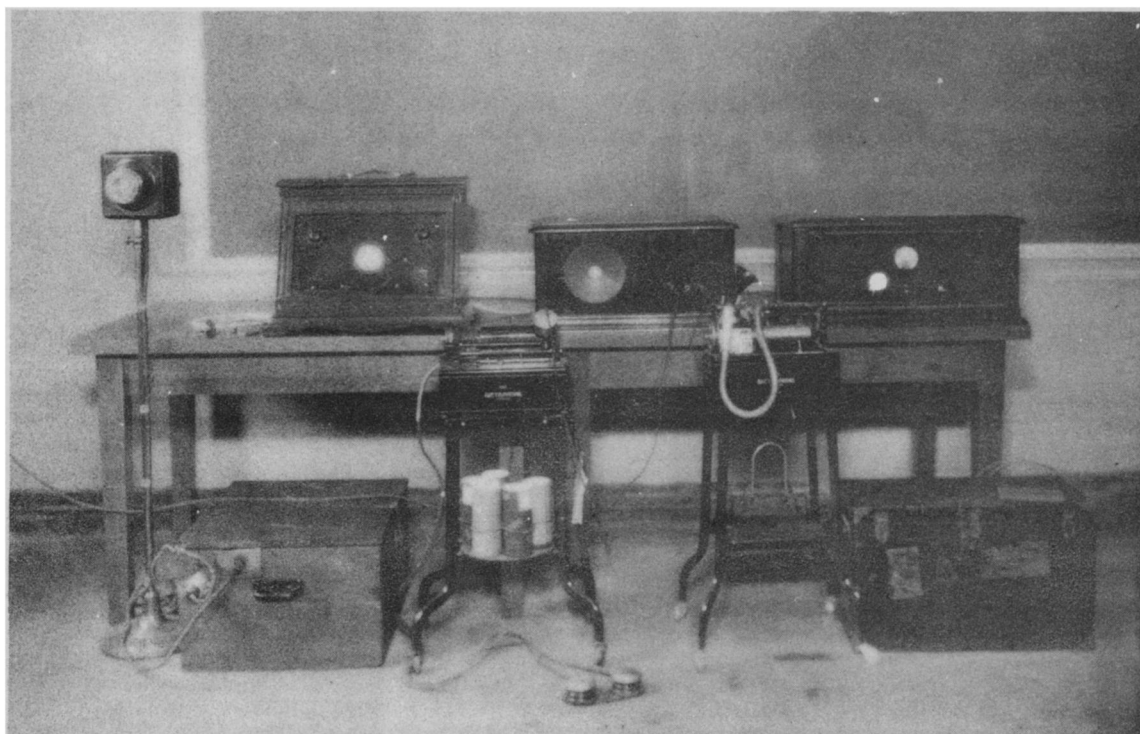
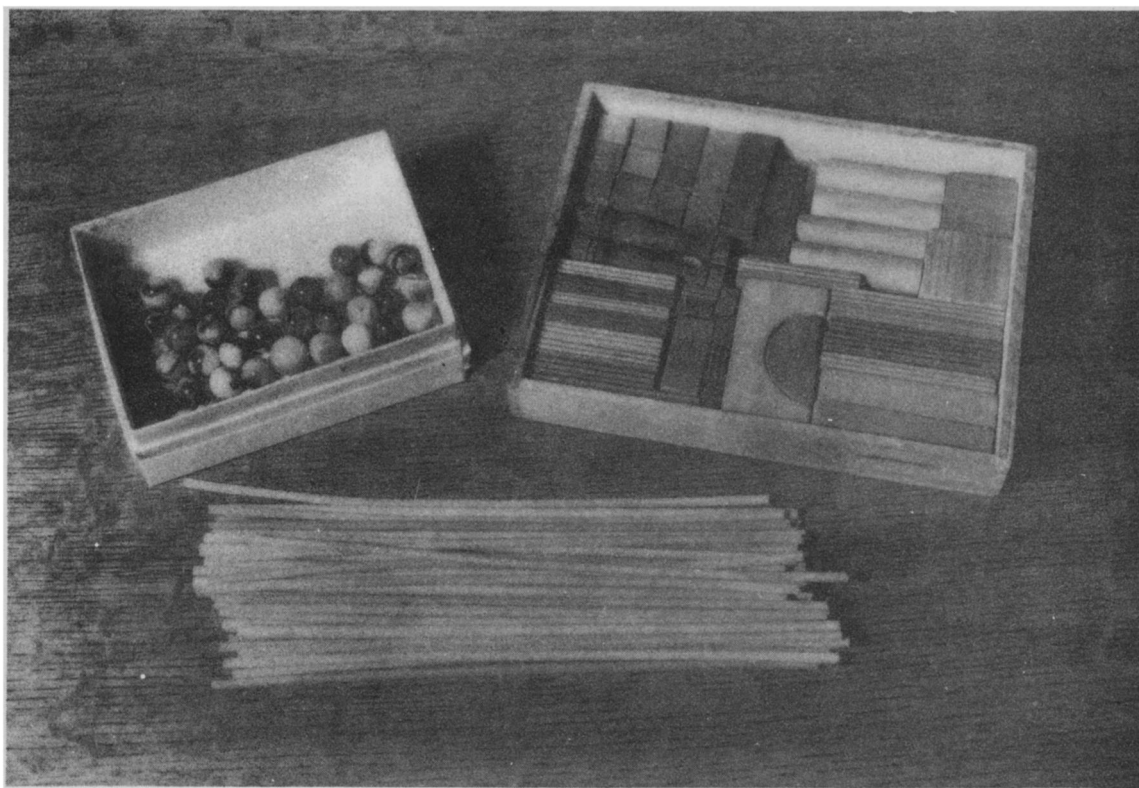
Group	Children	Age, Range		Mean Chronological Age		Mean Mental Age		Increase of Mental Age Over Chronological Age in Months	
		Years	Months	Years	Months	Years	Months		
Chronological Age Groups									
I	15	2	8 - 3	5	3	0	4	0	12
II	25	3	7 - 4	7	4	0	5	6	18
III	19	4	7 - 5	6	5	1	6	4	15
IV	24	5	7 - 6	4	6	1	7	3	14
Mental Age Groups									
I	13	3	2 - 4	6	3	1	3	11	10
II	15	4	8 - 5	6	3	11	5	0	13
III	24	5	8 - 6	6	4	10	6	1	15
IV	19	6	7 - 7	6	5	5	7	0	19
V	10	7	8 - 8	2	5	10	7	11	23

ANALYSIS OF THE RESULTS

Causal Relation

When formulating the questions regarding causal relations, an attempt was made to include questions which pertained to the child's own concrete experience, to an ethical principle, to physical phenomena; lastly a direct appeal was made to the possibility of animistic interpretation. It was necessary to treat the result of some of the questions separately as the concreteness of the relation involved and the degree of proximity to the child's individual experience altered the type of response given.

In the analysis of results, not all responses are of equal value in penetrating the nature of the child's concept of relationship. There were four types of responses found. For the most part, those causal relations which are somewhat removed from his immediate experience, as the cause of snow or rain, seem not to have occurred to him before, at least in verbal terms. These responses are the most valuable in determining the nature of the true child concept as it evolves from his experience. A



second type of response similar in nature is the expression of the conclusions he has previously reached. These, too, offer opportunities for study. The third type of response is the expression of ideas held by adults with whom the child has come in contact. These may be quite as far from the true nature of relationship as the child's own explanations. For example, one child said her mother had told her that rain was the weeping of the clouds resulting from the pain they experienced in bumping together. The fourth type is the irrelevant response wherein the child merely answers with the first thought that comes to him to avoid silence. At times he is frank in stating he does not know.

An attempt was made in conversing with the children to bring forth responses which indicated the results of their own thinking, but distinction could not always be made with the older children. The frequency with which the older children attributed the cause of rain and snow to a deity leads one to see the result of teaching. Closer analysis of the data, however, reveals that it cannot be wholly a matter of acceptance of the adult explanation.

Piaget, in studying the child's conception of physical causality, found that the fine shades of meaning expressed by children revealed seventeen different types of causal relation. Although this seems an exhaustive list, there is little doubt but that discussion of other phenomena would lead to other types of relationship.

In this study the classification of Piaget was used because of its completeness and because its use affords opportunity to compare the results obtained with those of the French-speaking children in the Maison des Petits. The classification used by Piaget was as follows:

1. Psychological motivation or precausality
2. Finalism, in which no motive is involved
3. Phenomenistic causality or contiguity in space and time
4. Participation of two like but unrelated factors
5. Magic in which there is no possible relation yet effect is produced

6. Moral causality implying compulsion
7. Artificialism or the production by personalities and things
8. Animism
9. Dynamism, implying internal force
10. Action of the surrounding medium
11. Mechanical causality through contact and transfer
12. Generation, two factors born of each other
13. Substantial identification implying the making from substance--not being born
14. Existence through condensation and rarefaction
15. Atomistic composition
16. Spatial cause
17. Logical deduction or inference

To these seventeen division five were added for use in this study. One, "cause and effect," was inserted before Piaget's logical deduction to denote a fine distinction between a concrete causal relationship and a mental inference. Others were "origin" and "composition" to care for the responses to the questions, "What is rain?" and "Where does it come from?" "inconsistencies and contradictions;" and "irrelevant responses."

All responses fell within these twenty-two divisions. There were instances of fine shades of meaning which made classification difficult. Inasmuch as the meaning of the concept was derived wholly from the verbal expression, incomplete and incorrect sentences, especially of the youngest children, at times gave rise to some uncertainty. On the whole, these cases were few in number as conversation with the child was continued to the point where the expression of his meaning seemed adequate. The responses of the children to some of the questions are given in detail below:

Question 1, "Why do you put on your coat when you go outdoors," suggests a situation entirely within the immediate repeated experience of the pre-school children used in this study. It would, therefore, seem that responses would be of a much more mature type than would those responses in which there had been only remote experience, as in the causality of rain or snow. The second factor which would seem to contribute to maturity of expression was that the situation involved the child's own sensations, his self. This was precisely what happened. Responses on the whole from the four groups of children tended to show an increase in frequency in series from personal desire or purpose to contiguity in time and space, to cause and effect.

There was a comparatively high frequency falling under mental inference, but inasmuch as all responses were "So I won't catch cold," a mere imitation of adult form, these need not be considered. What is interesting is the development from responses issuing completely from the self, its desire and purpose, to the consciousness of an external phenomenon coincident with the comfort of the self. The words of F643, "Cause it's cold," are typical. The third stage in development shows the relation of an external factor to the conscious self in the typical statement of M757, age two years, eight months, "Cause I get all cold and wet."

It is significant also that there is a decrease in frequency in expressions of desire and contiguity with increase in age, whereas the reverse is true in expressions of cause and effect --the percentages rising in the latter from 6.7 in Group I to 47.8 in Group IV.

Question 4, "Why does an airplane stay up in the air?" presents interesting transition from desire, finalism, and contiguity in space and time to the transference to an external power (moral causality) or a personality (artificialism). The most mature responses are found in the high per cent present in Groups II, III, and IV who attribute cause to the presence of mechanical contact. This last type of cause is found to increase with age. In no instance was the function of the mechanical part explained, its presence was merely noted.

Illustrating the type of response in which desire is predominant M640 says, "Because I want an airplane--I want it down." The experimenter then says, "What makes it stay up?" and the child replies, "I don't want it down."

Finalism is the note in the words of F677 who says, "Cause it goes up in the air"; of M728, "Cause it stays up in the air." Contiguity in space and time is found in M713, "Because some mail is in it." The terminology pertaining to airplanes is well developed, for even in Group I, with the average chronological age of three years, the term "pilot" is used. In the older groups "aviator" is not uncommon. For example, illustrating an artificialistic explanation M721 says, "Yes, the reason the mail in the thing start it--"; F737 says, "They come down and get people, then drive it up again. Santa Claus does it." Another interesting explanation employing a thing as cause rather than a personality is found in the response of M472. He says, "It does it all by itself. When it gets up in the sky, the sky holds it up. The sky lets loose but the plane pulls down on the sky and just goes down."

In all questions there was resort to personal desire, finalism, and contiguity in space and time, more marked among the younger children than among the older. It is rarely found in Group IV and not often in Group III. A low per cent utilize moral causality whereas a somewhat higher per cent employ an action of the surrounding medium as cause. Very few responses are found to give explanations indicative of cause and effect.

The greater number of responses was in the category of artificialism. This means that a large per cent of the children think

of the phenomena of snow and rain and the characteristics and activities pertaining thereto as being caused by someone or something. The percentages rise with age in attributing the cause to personality, whereas they decrease in attributing it to things. Question 8 presents the exception, for the older child attributes cause to things. This, as before stated, is due to the fact that the situation lies in the child's immediate experience and consequently he has a much more mature concept of the relation involved. Inasmuch as he knows that the sun, heat, and shovels are effective in the going away of snow, the percentage pertaining to things increases with age. It is interesting to note, however, that in Groups I and II, desire, finalism, contiguity in space and time, and to a slight degree moral causality plays a part.

A closer analysis of the things and personalities reveals most interesting trends in the child's concept of cause. In the different age groups the objects that are considered causal in explanation of snow and rain are:

Group I	Group II	Group III	Group IV
chain	clouds	rain	rain
heat	rain	clouds	sun
sack	sun	sun	engine
clouds	sugar		snowflakes
shot	houses		earth
rain	chimneys		spring
sun	smoke		heat
it	snow		water
snow-	trees		warm
flakes	airplane		weather

It will be seen in Groups I and II that there is variety in objects and personalities employed in explanation. The objects named in Group I show that analogies have been attempted, whereas contiguity has played an important part. In Group II the participation of two like but unrelated factors are used to explain the causal relation. Piaget found among the French children this same attempt to consider snow as coming from smoke which issues from chimneys of the houses. The similarity of smoke to clouds is evident and consequently the two are used to serve the same purpose. Contiguity here also plays a major part. In Group III only a limited group of phenomena related to snow and rain are used, whereas in Group

IV the things conditioning snow and rain are more numerous but bear closer relation to the question. The personalities, on the other hand, reveal a slightly different trend.

The personalities held responsible for the phenomena of snow and rain by the children in each of the four groups are given below. The number following the work refers to the number of times it is mentioned.

Group I	Group II	Group III	Group IV
teacher someone man Jesus God mother I they	Santa Claus Jack Frost person God (2) people he man they	God (7) Jesus (4) Santa Claus they he	Jesus (12) God (20)

In Group I we find God and Jesus each mentioned once as a causal factor. There is little doubt but that these concepts embody some of the characteristics described by parents and that the employment of these terms is but imitation of what is heard in the environment.

In Group II where we find God mentioned twice, there is present also Santa Claus and Jack Frost. It seems possible that these names represent mythical persons endowed with power which the child little understands, but which he needs in his transition from the stage of desire, finalism, and contiguity in space. That the personality which he endows with power to produce rain and snow is given the name God, means no more than Santa Claus or Jack Frost. The child has passed the stage where all things have consciousness and draws an analogy from his environment in attributing most things done to a doer. The animistic relation may be thought of as the projection of the child's conscious experience into inanimate objects. Consequently, when he is capable of perceiving a relation apart from self-reference, a degree of maturity has been achieved.

In Group III there is increased emphasis upon God and Jesus as causal factors, and in Group IV these are the sole personalities involved. In employing God and Jesus among other personalities (Santa Claus and Jack Frost) as explanations of cause, the younger children called upon those endowed with extraordinary powers to explain phenomena which seemed not to be caused by ordinary human

activity. This is merely an outgrowth of the children's stage of development. But with increased emphasis upon divine power, the force of education shows itself. There is no doubt but that relations involved in the phenomena of snow and rain are more difficult than those in the more immediate concrete experiences of the child's everyday life, and it is not strange, therefore, that he uses a less mature type of response. But when two-thirds of the responses are similar, one is led to the conclusion that a far-reaching principle has found its way into the education of the child. One of two things has happened. Either he has been taught that God and Jesus do all things, with the result that this has a very general carry-over in his new experiences, or in his environment all things not understood are explained by positing a deity as cause. Such an explanation requires no thinking and is satisfactory for the child until additional experiences force him to modify his concepts. Then this mystic power explanation hinders the development of mature modes of thought.

Increase in mental age is accompanied by maturity of response, the more mature types having, with few exceptions, the higher percentages. Table II, on the following page, gives a summary of the per cent of responses found in the different types of cause, the per cent being based on the total number of responses given in the six questions pertaining to the causal relation. The thought that the responses all fall definitely into some one of the categories must be avoided. There were many instances where a single response contained more than one type of cause, in which instance each was included in its respective category. Others, contradictory and inconsistent, were recorded as such. The greater number of responses, on the whole, are found in artificialistic interpretation. No general conclusion can be drawn from this as to the approximate level of the causal concept of the pre-school child for such numbers are influenced by distance, concreteness, mental and chronological ages, and education. There is no doubt but that underlying attitudes of timidity, aggressiveness, boastfulness, security, and curiosity are likewise of influence but they fall outside the scope of this study.

TABLE II

PER CENT OF THE TOTAL NUMBER OF RESPONSES TO ALL QUESTIONS APPEARING IN THE DIFFERENT TYPES OF CAUSES WHEN THE CHILDREN ARE CLASSIFIED ACCORDING TO MENTAL AND CHRONOLOGICAL AGES

Group	Psychological Motivation	Finalism	Phenomenistic Contiguity	Participation	Magic	Moral Causality	Artificialism Total	By Thing	By Divine or Human Power	Animism	Dynamism	Surrounding Medium	Mechanical Causality	Generation	Substantial Identification	Condensation Rarefaction Atomic Composition	Spatial Cause	Cause and Effect	Logical Deduction, Inference	Origin	Composition	Inconsistency, Contradiction	Irrelevance
Chronological Age Groups																							
I	6.1	12.1	7.0	.5	.5	3.3	17.7	10.3	7.5	4.6	.5	3.3			.9			12.1	10.7	2.8			17.7
II	7.3	5.3	7.0		.5	2.8	19.7	12.7	7.0	3.6	.8	5.4	1.3		1.6	.3		13.7	2.9	11.4	5.4	.5	10.9
III	4.1	4.5	4.5	.3		2.1	21.0	11.0	10.0	1.7	1.0	5.2	4.8		2.1	.7		20.0	5.9	13.8	3.4	1.0	3.8
IV	2.3	2.1	2.8			1.5	26.3	12.1	14.2	1.3	3.6	3.6	5.9		2.3		.3	22.0	5.4	11.1	4.4	.8	4.1
Mental Age Groups																							
I	6.1	8.4	8.9			3.3	23.4	7.5	16.0	3.3	1.4	1.9			1.9			9.4	10.8	1.4			19.2
II	10.4	7.2	5.0	.9		1.8	21.3	12.7	8.6	5.0	1.8	2.7	.9		1.8			8.1	3.2	13.1	3.2	.5	13.1
III	4.2	2.8	3.9			2.8	25.8	5.1	20.8	2.5	4.2	4.8	2.8		1.4	.8		12.5	4.5	12.6	4.8		3.4
IV	.3	3.8	2.4			1.7	29.2	8.9	20.3	.7	6.2	.3	8.6		1.4	.7		20.6	6.2	11.0	3.8		3.1
V	3.0	1.2	1.2			1.8	30.8	7.1	23.6	.6	6.5		6.9		4.7			20.4	7.2	12.8	4.2		2.4

Summary. The causal relation as expressed by children of pre-school age offers insight into the different stages through which a child's thinking passes in reaching a correct explanation. Those situations involving relations of cause which lie very close to the child's own perceptual or sensory experience are adequately expressed even by some of the children from two years, six months to three years, six months, and by most of the children in the older groups.

Concrete relations which have been repeatedly experienced by the child, yet do not affect his sensory experience so intimately, are more difficult. As a result the child employs immature explanations. A transition with increase in age is seen to pass through successive stages of personal desire, finalism, contiguity in space and time, and to a lesser extent, moral compulsion.

The developmental pattern of thought manifested in the attempts of pre-school children to express causal relation is roughly conceived in four different phases:

1. Explanation is given by the younger children in terms of the content of their perceptual or sensory field.
2. A later phase is characterized by the projection of the child's consciousness upon an external factor whether

this be an unseen power as in moral causality, a mystic personality, or an inanimate object.

3. The third phase represents in temporal sequence an enumeration of the possible related elements. Here is found mechanical causality, composition, etc.
4. In the fourth phase the correct causal relation is expressed.

In all four phases the trend is away from the self; first by projection, next by the conception of the relation between concrete factors, and finally by relation in the abstract. All phases show increase in maturity with advance in chronological and mental ages.

Because of the fact that artificialism is so definitely a part of this scheme, it seems fair to conclude that it is a stage in the transitional growth of causal concepts. So long as a deity is enumerated among other personalities having unusual powers, they fit in the category of artificialism. Later, however, when practically all children resort to the concept of God or Jesus as causal, it may no longer be wholly a matter of a subjective scheme but one of education. Inasmuch as these same children are quite capable of more mature concepts, as is shown by responses to other questions, it is not

unlikely that were the true relations substituted for the illogical, irrational concept of a divine power intellectual growth would be enhanced.

The results of this series of questions are in agreement with those of Piaget. There is a most striking similarity between many of the expressions of the children in this study and the French speaking children Piaget used. There are two differences, however, in conclusions drawn from the data. First, Piaget did not determine the mental age of his children. He drew his conclusions from the age at which 75 per cent gave correct responses. Second, Piaget considered these developmental phases the outgrowth of gradually increasing contact with the outer world, not innate in the nature of the child. He placed little stress on the factors of mental age, concreteness, distance, and education found in this study to influence so markedly the maturity of response. An objection to Piaget's conclusions lies in his stating so specifically the age at which the child correctly conceives the causal relation. There are so many variations that it would seem safer to conclude that these are phases through which a child passes in arriving at a true causal concept, the age depending on a given set of conditions.

The Relation of Discordance

The term discordance is used to imply the exception to a causal relation as it presents itself in experience. It is used by Piaget¹ who gives credit to M. Bailev for its original use in this sense.

Inasmuch as the discordant expressions occur infrequently in the child's vocabulary, the children were asked to complete sentences containing the words, but, even though, in spite of, although, except, and yet. The question may be raised as to the justifiability of using terms which occur infrequently in the child's vocabulary. It will be admitted, however, that children hear these terms in adult vocabularies yet do not acquire them, not because of the terminology used but because the relations they imply are not understood except under very limited conditions.

Several factors influence the child's ability to express this relation correctly.

Among these is the verbal terminology which is not always understood. The second factor is age, both mental and chronological. There is an increase in ability to correctly express the relation as chronological age rises and as mental age rises above chronological age. The third and most important factor is the degree to which the statement to be completed is consistent with the child's own experience.

The influence of these factors will be seen from an analysis of the results. The comparison of the correct expression of the discordant relation employing the different terms is given in the following tabulation:

Term	Per Cent
But	57.0
Except	45.0
Though	44.0
Although	42.7
Even though	38.0
Yet	30.0
In spite of	22.0

In the thirteen questions presented to the children, there are two statements employing each term except for the word "yet" which is given once. If percentage of correct responses is obtained for each separate expression, the following results are found:

Term	Question	Per Cent Correct
But	1. Your mother says you cannot go but --	44
	10. You wanted to see Santa Claus, but --	70
	5. You ate all the candy except --	43
Except	11. You would take the toy away from another child except --	45
	6. Though mother puts you to bed for a nap, you --	38
Though	8. Though you do not eat your dinner, you ask if you may --	50
	4. Although this is big and heavy, I --	45
Although	12. Although you want to go home, you --	39
	2. Even though you do not like your food, you --	59
Even though	9. Even though it is bedtime, you --	18
	7. You want that toy, yet --	30
Yet	3. You get your clothes muddy sometimes in spite of --	24
	13. You want to get up out of bed in spite of --	20
In spite of		

1. Jean Piaget, Judgment and Reasoning in the Child. (New York: Harcourt, Brace, 1928). p. 37.

It is here evident that the difficulty in the management of the correct relation is not only a verbal one, but that there is something inherent in the statement which determines the difficulty of the expression apart from the discordant term. The source of this difference ought to be revealed by comparing statements 2 (Even though you do not like your food, you--) and 9 (Even though it is bedtime, you--), in which there is greatest discrepancy in the percentage of correct completions. Although the same term is used, the difficulty is revealed not in the statements themselves but in the types of incorrect completions. From the incorrect completions are excluded all irrelevant responses in which the child just says something to be answering, and those in which he states he doesn't know. These incorrect completions yield one outstanding source of error, the inability to think from the conditions laid down by the discordant conjunction. Their response is consistent with their own experience, but not with the supposed conditions of the minor premise.

In the second statement (Even though you do not like your food, you--), where 59 per cent of the responses are correct, 30 per cent are incorrect completions of this type. A few examples are cited: In completing the statement, F725 says, "I like food"; F726, "I can't do it"; M639, "Put it out, throw it out doors"; F732, "Go away from the table"; F417, "Don't eat it." These may be contrasted with those comprehending the correct relation: F752 said, "You have to eat it. I don't like spinach but I eat it"; F572, "Eat it"; M753, "Have to eat it."

In the ninth statement (Even though it is bedtime, you--), routine seems more rigidly observed by parents, for 18 per cent of the responses are correct, 70 per cent incorrect, the error being due to the inability to think correctly in relations inconsistent with experience. Completing the statement F725 incorrectly says, "Go to bed"; F682, "Have to go to bed"; M733, "Mama puts me to bed." All of these are in keeping with the child's experience but bear little relation to the statement upon which the completion is dependent.

From these results two conclusions may be drawn: Responses may be correct or incorrect not because the child understands or does not understand the relation, but because it is consistent with his experience. Secondly, even in incorrect response the child may understand the relation involved but not comprehend the hypothetical nature of the situation and hence not wish to convey a false idea. The writer is convinced from

tone of voice, hesitation, and apparent attitude that this was the case in several instances, yet the responses on the whole do not reveal this intervening thought in the child's expression. Further study and finer techniques will have to be employed to determine without doubt just when the correct relation is understood.

Let us return to a closer analysis of why correct responses are given. In completing statements 2 (Even though you do not like your food, you--), and 9 (Even though it is bedtime, you--), 59 per cent and 18 per cent respectively of the responses were correct. Among these none could be interpreted from statements obtained as being inconsistent with the child's experience. These were interpreted as consistent because the younger children translated the "you" of the statement into an "I," indicating individual experience; and because among the older children the compulsory element "have to eat it" or the personal desire "want to play a little longer" was introduced.

All of this leads to the conclusion that the child correctly conceives the discordant relation only when it is consistent with his own individual experience, whether that experience be an incident in memory or a regard for truth. One may justly ask if this is comprehension at all. Certainly it forms the roots of the ability to manage the relation of discordance without which the ability to generalize or to conceive of the relation in the abstract could not develop. A similar analysis of the responses to the other statements yields the same results.

Another factor which influences correctness in the expression of the discordant relation is mental age. Table III, on the following page, gives a comparison of the percentage of different types of response given when the children are grouped according to chronological and mental ages. This table indicates two things: first, the children with mental age in advance of chronological age give a greater number of correct responses; and second, the greater this difference, the more it influences the correct expression of the discordant relation.

From the preceding discussion it is evident that there was some difficulty in terminology as there were 57 per cent of

TABLE III

COMPARISON OF PERCENTAGES OF DIFFERENT TYPES OF RESPONSE GIVEN ACCORDING TO MENTAL AND CHRONOLOGICAL AGE GROUPS IN EXPRESSING THE DISCORDANT RELATION

Group	Children	Mean Chronological Age		Mean Mental Age		Correct Use	Incorrect Use	Doesn't Know	Irrelevant	No. Response
		Years	Months	Years	Months					
Chronological Age Groups										
I	15	3	0	4	0	21	35	12	10	22
II	25	4	0	5	6	32	37	17	4	10
III	19	5	1	6	4	48	30	7	2	10
IV	24	6	1	7	3	53	28	3	.3	11
Mental Age Groups										
I	13	3	1	3	11	29	33	15	9	14
II	15	3	11	5	0	29	36	16	2.5	19
III	24	4	10	6	1	41	34	8	2	9
IV	19	5	5	7	0	53	24	7	1.3	13
V	10	5	10	7	11	69	24	3	1.3	3.8

the responses correct when "but" was used and only 22 per cent in the case of "in spite of." The greater difficulty is due to the type of situation in which the discordant term is used, that is, whether or not the discordance is consistent with truth in the child's experience. This error was practically the only type occurring in any of the responses even among the fifth group, whose average chronological age was five years, ten months and average mental age seven years, eleven months. The only difference between this group and others of lower mental age was that the errors occurred less frequently.

The Concept of Number

Little work has been done on the development of the number concept, the most extensive being the studies of Baldwin and Stecher¹ and Bradbury.² In the present study the children were asked to point to Tinker Toy sticks, marbles, and blocks as they counted. After the child counted correctly as far as he could, the experimenter took away the objects and replaced them one or more at a time as the child again counted to the limit of his ability. This was continued until there was consistency in the upper limit, then the number was recorded. No

consideration was given ability to count beyond thirty-seven.

The aim of the test was: (1) to find the upper limit of the child's ability to count, if this fell under thirty-seven; (2) to determine the effect of materials on his ability to count; and (3) to discover the trend in growth underlying the number concept as one proceeds upward in the mental and chronological age scales.

The results of the experiment are given in Table, on the following page. This experiment is similar to that of Baldwin and Stecher in which the children counted marbles as they dropped them from one box to another. The comparison between the two tests may be seen in the average upper limits achieved by children of the same age in counting the same objects.

Chronological Age, Years	Baldwin and Stecher	Present Study
2	Less than 1.	
3	2.1	1.64
4	9.2	12.44
5	21.3	19.05
6	27.6	26.50

1. Bird T. Baldwin, and Lorie I. Stecher, *The Psychology of the Pre-school Child*. (New York: D. Appleton, 1924).
2. Dorothy E. Bradbury, *An Adaptation of the Descoedres Performance Tests to American Four- and Five-Year-Old Children*. Unpublished Master's thesis. State University of Iowa, 1929.

TABLE IV

RANGE AND MEAN NUMBER OF OBJECTS COUNTED, AND THE PER CENT OF CHILDREN CAPABLE OF COUNTING ABOVE THIRTY-SEVEN IN MENTAL AND CHRONOLOGICAL AGE GROUPS

Groups	Mean Age		Children	Sticks			Marbles			Blocks		
	Years	Months		Range in Number Counted	Mean	Per Cent Counting Above Thirty-Seven	Range in Number Counted	Mean	Per Cent Counting Above Thirty-Seven	Range in Number Counted	Mean	Per Cent Counting Above Thirty-Seven
Chronological Age Groups												
I	3	0	15	0 to 3*	1.21	0	0 to 4*	1.64	0	0 to 4*	1.50	0
II	4	0	25	1 to 37	12.28	24	1 to 37	12.44	16	1 to 37	12.24	24
III	5	1	19	4 to 37	24.47	42	5 to 37	19.05	52	5 to 37	19.21	52
IV	6	1	24	6 to 37	29.29	75	6 to 37	26.50	75	6 to 48	23.04	75
Mental Age Groups												
I	3	11	13	0 to 7	1.58	0	0 to 10	2.08	0	0 to 12	2.33	0
II	5	0	15	1 to 20	6.00	2	1 to 23	7.33	13	1 to 26	6.52	7
III	6	1	24	4 to 37	17.00	33	4 to 37	16.75	33	5 to 37	17.75	29
IV	7	0	19	4 to 37	30.42	68	14 to 48	28.00	79	14 to 35	25.79	79
V	7	11	10	29 to 37	32.40	90	29 to 37	30.60	90	29 to 37	30.10	90

*Excluding one child counting to 14.

The per cent capable of counting beyond thirty-seven is noted in Table IV. When considering the four chronological and five mental age groups, the marbles are seen to have the highest count three times, lowest count three times; the sticks highest four times, lowest three; and the blocks, highest twice, lowest three. The figures bear no consistent relationship with age.

Among the youngest children there were only two who could not count; others were capable of counting to one or two, but when attempting larger numbers said, "A whole lot." When asked how many were in the entire packet of sticks, the older children gave such responses as "a thousand" or "a hundred." These terms represented a continuous quantity as definitely as the "whole lot" of the younger children. It seems, then that the young child perceives undifferentiated quantity which later becomes discontinuous at increasingly high levels with rise in mental and chronological ages. It was also evident that the child could repeat the number names before he attached to them the meaning of a designator or of abstract "manyness."

In summary, the pre-school child is able in using objects to count to 1.64, 12.44, 19.05, and 26.50 on the average, at three, four, five, and six years of age respective-

ly. Objects differing in color, form, size, and position have little effect upon children at these mental and chronological age levels. The concept of number is in the beginning consciousness of continuous quantity which is differentiated at higher levels as chronological age and mental age increase. The abstract concept of "manyness" which is applicable to all experiences is the true number concept. So long as number names attach to specific objects more easily and frequently than to others, the true concept has not yet developed.

Relation in Space

The term space in experimental literature has a wide range of meanings--from the ability to estimate the number of blocks in a pile to the comparison of geometric areas. Space as used in this study implies relationship in space. The attempt was made to determine the nature of the concept of this relationship in space through the verbal expression of the children.

A block with which the child had been playing was held in different positions with reference to the child, to the table, to other blocks, to a small box, and to a box lid. The child was asked to respond to the question, "Where is it now?"

In order to determine if the child could understand what would be asked of him, he was first requested to place one block on top the other and then to place one block beside the other. Of the eighty-three children, only two in Group I and three in Group II failed to place one block beside the other. All children successfully placed one block on top the other. Any difficulty, therefore, in these simple relations in space lay not in understanding but in the ability to verbalize. The children expressed the relation as the block was held in the following positions:

Position	Relation
Above the child's head	Above
Below or beneath the table	Below
In front of the child	In front of
In back of the child	In back of
Beside the child	Beside
Inside or in a box	Inside
Under a box lid	Under
A number of blocks placed in circular form around another block	Around

Table V gives the per cent of specific responses occurring in each relation when the children are grouped according to mental and chronological ages. The relations are not all of equal difficulty for any single group, nor is the range the same for all relations between Groups I and IV or Groups I and V in the mental age distribution. Under, beside, in front of, and in back of show highest increase in correctness with advance

in chronological age. In front of, beside, under, and around have the greatest increase for mental age.

Those relations in which the block was not in the field of vision at the time of responding, though the child had seen where it was when first placed (above him, in back of him, under the table), were more difficult than other relations. As in the relations of discordance and cause, the concrete visual perception of the situation offers less difficulty.

In the beginning, the relations of near and nearer, far and farther were used by holding two blocks simultaneously near and nearer and far and farther from one another. The child was then asked where the two blocks were. With children two years, six months to three years, six months, this was extremely difficult and the only response obtained was "here--here" and "there--there," showing that the child at this age did not conceive of the relation between the two blocks but only considered each in relation to himself. The younger children also stated the part of the body near which the object was placed, but used no term expressing the relation.

In Group I, ranging in age from two years, six months to three years, six months with an average mental age of four years, all the different relations in space are frequently referred to as "here" and "gone" or "here" and "there." These terms are found also in Group II, average chronological age four

TABLE V

PER CENT OF CHILDREN GIVING SPECIFIC RESPONSE TO QUESTIONS OF RELATION IN SPACE

Group	Children	Above	Below	In Front	In Back	Beside	In-side	Under	Around	On Top	Beside
Chronological Age Groups											
I	15	46	66	33	40	40	60	13	60	100	86
II	25	48	64	28	44	36	84	28	52	100	88
III	19	50	62	67	78	62	88	52	41	100	100
IV	24	54	62	87	79	85	87	79	75	100	100
Mental Age Groups											
I	13	38	69	38	38	54	61	23	54	100	77
II	15	46	60	13	40	20	79	7	53	100	93
III	24	54	58	62	66	58	87	45	41	100	100
IV	19	50	67	78	88	83	100	83	73	100	100
V	10	70	80	90	70	100	80	70	90	100	100

years with a mental age of five years, six months, although less frequently. In Groups III and IV they are found in only one or two instances.

The question, which implied in its answer that several blocks were placed around another one, gave rise to the same difficulty in all groups in that many of the children at each age level persisted in interpreting relation between external objects as between the self and each object. For example, instead of saying that the blocks were placed around another block, they said, "Here's one, here's one's, etc.," often repeating as many as eight times. This type of response was much more frequent at the lower age levels.

In summary, expressions of relations in space offer little difficulty in terminology. Relational prepositions are a part of the vocabulary of children two years, six months in age with a mental age of four years. Relations are interpreted very largely with the self as a point of reference as is shown by the expressions "here" and "gone," "here" and "there," "my head," "my shoulder," and by expressing the relation between two external objects as between the self and each object. Using the self as a point of reference occurs less frequently as age increases.

The Relation of the Part to the Whole

Piaget¹ contends that in the beginning the child's conception of the world is syncretistic, that his perceptions are diffused wholes with little detail standing out to make relations possible. Because of these relatively undifferentiated perceptions, the child's interpretations manifest similar characteristics in that the details most clearly defined are lacking in any relationship to give them unity. This results in juxtaposition or the "side-by-side-ness" of experience which is found not only in his perceptions, but is carried over into his interpretation and verbal expression as well.

For the present study the part-whole relation offers a splendid opportunity for the study of the degree of analysis and relatedness present in the child's concept. To determine whether discreteness in perception was an element in the child's ability

to conceive of the relation of part to the whole, questions were presented which dealt with a homogeneous substance, an apple; a substance more easily divisible into parts, namely sand; and a group of objects or blocks each of which was a discrete entity in the perceptual field.

An attempt was made to word the questions so that the experimenter would not make distinctions between parts and whole for the child. For example, one question was stated; "A part of your apple tastes good. How does your apple taste?" rather than, "Only a part of your apple tastes good, how does your apple taste?" The presentation in this study was criticized, however, on the basis that the question, "A part of your apple tastes good. How does your apple taste?" leaves an undistributed middle which permits either "good" or "bad" to be the correct response. This criticism is justly taken. How many children experienced difficulty in this undistributed middle, however, cannot be said. Where the child gave an "incorrect response" saying the apple tasted good, the experimenter asked, "All of it?" or "How did the rest taste?" The responses to the main questions are classified in Table VI.

TABLE VI

PER CENT OF CHILDREN GIVING CORRECT AND INCORRECT RESPONSES TO QUESTIONS IMPLYING THE RELATION OF THE PART TO THE WHOLE, AND THE PER CENT ASKED SUPPLEMENTARY QUESTIONS WHEN THE RESPONSES WERE CORRECT AND WHEN THEY WERE INCORRECT

Group	Per Cent		Per Cent Given Supplementary Questions	
	Giving Correct Responses	Giving Incorrect Responses	Giving Correct Responses	Giving Incorrect Responses
Question 1				
I	73	27	27	20
II	80	20	32	20
III	100	0	27	
IV	100	0	20	
Question 2				
I	80	20	60	14
II	76	24	68	20
III	69	31	57	31
IV	91	9	56	9
Question 3				
I	14	86	14	86
II	56	44	52	32
III	79	21	73	21
IV	89	11	77	4

1. Jean Piaget, Judgment and Reasoning in the Child (New York: Harcourt, Brace, 1928).

As difficulty with the relation increased the supplementary questions, "All of them?" and "What of the rest of them?" were more frequently asked. Apparently these had little effect on the child's ability to express the relation for the number of supplementary relations were in inverse proportion to the number of correct responses.

With increase in age there is decrease in difficulty in expressing the partitive relation. Inasmuch as the blocks, sand, and apple were not present in the child's field of vision, the child's concept of part depended upon former perceptual experience. From the results obtained it was more difficult to conceive of a part of a homogeneous substance like an apple than it was a mixed substance like sand, and still more difficult than to conceive of a part of a group of blocks. This difference can be attributed to the discreteness in the percept of part which is carried over into concept and hence to verbal expression, as there is little possibility of its being a matter of terminology.

Understanding of the terms "part," "some," and "all" was determined beforehand by asking each child to give the experimenter part of the blocks, to place some of the blocks in the box, and then to put all in the box. All children gave perfect responses except one child who put all blocks in the box when asked to put some in. He did not do this because he did not understand but merely as an act of self-assertion.

Considering again this ability of children to think only in terms consistent with their own experience, as was found in the discordant relation, it may be possible that the experience of the younger children has been limited to include parts of blocks and sand, whereas their experience with apples has been limited to that of a piece prepared for them. In summary, the ability of the pre-school child to express the relation of part to the whole increases with age and with the discreteness in outline between the part and its whole which he has previously perceived. The degree to which the correct response is consistent with the child's previous experience may be a possible influence in his reply.

The Concept of Time

Attempts have been made to analyze the child's concept of time. These studies are in many ways similar, but differ in two fundamental respects. The first difference lies in the number of children observed, the second in the method employed. The present study attempts an analysis of the concept of time in pre-school children, placing emphasis upon developmental trends which appear through successive age levels.

A series of questions was asked the children which dealt only with the day's routine. There was no effort to distinguish between the child's concept of short or long intervals. The interest was primarily to find what means a child employed in attaining his concept of time in meeting the requirements of the day's routine.

To most of the children, the questions were difficult. Among the younger ones who had little conception of time, an attempt was made to explain in adult terminology the concepts they did not understand. Some of the children gave a very general explanation: M721 said, "In the morning, it's morning"; M153 said, "Somebody told me that after night came morning."

The responses of the youngest children showed that they did have some concept of time, for otherwise their responses would have been entirely irrelevant. Their concepts were, however, so vague they were of no practical value in meeting the demands of their routine. This is the first and most immature stage in the development of a concept of time. As in other relations of cause and space, the terminology was not the cause of the difficulty. It was the vague diffusion in the concept which the words expressed which made impossible relations in time.

A more definite incident, usually one which involved the child rather definitely, is cited by children having a clearer concept of time. For example, F758 said, "We were all at breakfast"; M644, "Haven't had dinner"; and F737, "Because I have to get up and get to school." The child is still the center of his world and each incident exists very definitely in relation to him. This may be termed the second stage.

The third stage is characterized by a very definite incident which is more impersonal in nature. Number F752 said, "Because all the children make a line"; F742, "When school's out"; M745, "Pretty near when school's over." The final stage is seen where there is ability to tell time by the clock.

Throughout the three stages in the development of the concept of time, explanations were in terms of incidents which were characterized almost entirely by their spatial attributes. When a child of three said, "My daddy looks at the clock," he was speaking of an incident which was entirely spatial in character. Even when older children were asked what time they get up they answer, "My mother comes in and tells me." Table VII shows the increase from 31 to 82 per cent in the number of children who employed incidents in conceiving of time. Children establish this relation not as before or after something else but as contiguous with it.

Group	Incidents Used in Designating Time	Per Cent of Children Using
Chronological Age Groups		
I	2	21.9
	3	7.3
II	2	56
	3	4
III	2	41.6
	3	10.4
IV	2	64
	3	12
	4	4
Mental Age Groups		
I	2	30.4
II	2	39.6
	4	6.6
III	2	65.6
	3	8.2
IV	2	72.8
	3	10.4
V	2	90
	3	10

The length of sequence in incidents, which enables the child to more definitely place an experience in time, is seen to increase

TABLE VII

THE MEAN PER CENT OF CHILDREN IN EACH GROUP GIVING DIFFERENT TYPES OF RESPONSE TO QUESTIONS PERTAINING TO TIME

Group	Re-sponses	Incident	Doesn't Know	Psychological Motivation	Final-istic	Indef-inite	Irrel-levant	No Re-sponse	Misunder-standing	Ability To Tell Time By Clock
Chronological Age Groups										
I	14	31.8	21.0	5.3	1.4	13.6	15.4	5.4	1.0	
II	25	55.3	13.5	.4	7.5	8.0	8.4	2.2		
III	19	74.9	5.8	1.8	1.7	6.3	3.5	2.2		6.0
IV	23	82.4	6.6	1.0	1.9	3.1	.9	2.0		12.0
Mental Age Groups										
I	13	34.9	29.6	6.8	6.0	15.0	9.2	5.9	1.7	
II	15	51.5	24.0	2.7	4.4	7.3	3.7	2.9		
III	24	71.7	13.0	1.3	.9	7.7	2.0	.9		3.7
IV	19	82.3	5.8			1.7		3.5		7.5
V	10	83.3	2.2	1.0	1.0	1.0				9.0

The roots of abstract temporal concepts are evident in the small number of children who had some conception of before and after, as evidenced by their citing more than one incident in determining time. The following tabulation shows the extent to which this prevails, by giving the number of incidents used in designating time and the per cent of children using them:

slightly with both mental and chronological ages.

In conclusion, the very young child acquires a vocabulary of temporal terms before his concepts have become clearly defined. He learns to recognize different "times" by contiguous phenomena, which become more definite criteria as he grows older. A few children, the number increasing as

one proceeds upward in the mental and chronological age scales, cite two or more incidents in their concept of time. Growth in appreciation of the relation of before and after is slow. Since it involves the relation between two incidents relatively exclusive of the self, the situation is not unlike that found in the relations of cause and space.

ESTIMATE OF VOCABULARY EXTENT

It was first thought that an estimate of vocabulary extent would reveal a partial explanation of the child's ability to express the relations dealt with in this study, but it has been found that his ability is dependent upon a complex of factors. Possession of terms with which to express a relation is not an adequate criterion of the maturity of his concept. At times differentiation of relationship in the child's concept is not sufficiently complete to warrant his use of a specific relational term, even though he be in possession of it. Among those interested in the language development of children, understanding is thought to precede verbal expression. This holds true for the meaning of most single words but in cases where words are grouped in order to serve as conveyance for a given relation, definite concepts lag far behind the knowledge of words necessary for their expression. Throughout this study, the illogical, irrational expressions have repeatedly been voiced in the same words essential for correct, logical response.

In the adult, expressive ability depends upon the number of words he possesses. After a certain number is reached, the richness of his expression is dependent quite as much upon the number of uses to which he puts his words. Vocabulary range is no doubt, a matter of greater significance in the child's ability to express himself than it is in the adult. Yet even in children from two to six expressive ability is dependent in part upon the varied use of words. Viewed in this light, vocabulary extent is not so important in the study of the child's concepts of relation.

Williams¹ modified the Smith² vocabulary form by using eighty-four of the original 203 words. This list of eighty-four words comprised the test given to the eighty-three children used throughout this study of concepts of relation. The results of the test are given in Table VIII. The increase in vocabulary parallels increase in both mental and chronological age.

TABLE VIII

ESTIMATED VOCABULARY EXTENT ON THE SMITH-WILLIAMS VOCABULARY TEST

Group	Mean Age		Children	Range of Estimated Number of Words	Mean Estimated Number of Words
	Years	Months			
Chronological Age Groups					
I	3	0	15	816-2064	1507
II	4	0	25	1392-2976	2148
III	5	1	19	1776-3120	2527
IV	6	1	24	2256-3600	3054
Mental Age Groups					
I	3	11	13	816-2016	1456
II	5	0	15	1392-2448	2023
III	6	1	24	1776-3264	2385
IV	7	0	19	2256-3418	2867
V	7	11	10	3024-3600	3254

SUMMARY AND CONCLUSIONS

The purpose of this study was to discover and analyze the trend of development in the verbalized concepts of pre-school children pertaining to relations of time, space, number, part-whole, discordance, and cause. The related factors of mental age and vocabulary extent were also studied.

Eighty-three children, two to six years of age, from the pre-school laboratories of the Iowa Child Welfare Research Station were used in the study. Six series of questions, each dealing with one of the relations mentioned, were asked each child individually. Most of the conversation was recorded on dictaphone records by an electric recording machine and later was transcribed. The balance was recorded by the experimenter on forms prepared for the purpose.

1. Harold M. Williams, *A Modified Form of the Smith Vocabulary Test*. Unpublished investigation, State University of Iowa, 1932.
2. Madorah Elizabeth Smith, *An Investigation of the Development of the Sentence and the Extent of Vocabulary in Young Children*. University of Iowa Studies, Studies in Child Welfare, III, No. 5, (1926), p. 92.

The results indicate that each series of questions, dealing with a particular relation, yields gradations of maturity affected more by mental age than by chronological age.

In the relation of time there was progression with age through the successive steps of "I don't know," being told, the recognition of a contiguous incident, a series of incidents, and the telling of time by the clock.

With increase in age, spatial relations revealed greater explicitness as well as the ability to consider objects in relation to themselves, without interposing the self as a point of reference.

In number relations, there was an increase in the ability to count, which was unaltered by the color, size, and shape of the objects counted.

Difficulty in expressing the part-whole relation increased as the image upon which the concept depends lacked definiteness of outline. It was easier to conceive of a part of a number of blocks than to conceive of a part of a substance like sand, and to conceive of a part of the sand than a part of an apple. Correct expression of the part-whole relation was influenced strongly by the degree to which the situation involved was consistent with the child's previous experience.

The difficulty in the correct expression of the discordant relation varied with the discordant terms used. This difficulty decreased with age. Incorrect expression tended to translate the discordant relation into terms consistent with experience.

In the many types of response voicing causal relation, four stages of development revealed themselves: (1) The response in which desire, existence, and contiguity in space and time were interpreted as cause. (2) The phenomena owed their existence to an external consciousness, as God or man, or the animistic endowment of the thing itself with consciousness. (3) The causal relation was imperfectly understood, yet the mechanical connection or sources may be accurately

conceived as cause. (4) Statements of cause and effect and logical interference.

Throughout the entire study, mental age played a noticeable part in the maturity of concepts. Juxtaposition, or the "side-by-sideness" of experience, in which elements seem to exist separately for the self in an additive way devoid of interrelations between themselves, was most pronounced throughout the age range, but decreased at the upper levels.

Inability to think from a supposed premise, as evidenced by the failure to correctly express relations inconsistent with experience, was more marked at earlier levels. There was a tendency in all relations to interpret in terms of a single specific experience.

Interjection of the ultimates, God, moral compulsion, and eternal existence, in the form of finalism, occurred with greater frequency among the older children, together with highest frequency of expressions of cause and effect and logical inference, showing contradictions, and inconsistencies of a transition period. From this, the conclusion is drawn that the interjection of a mystic or divine factor, to account for the relations not clearly understood, constitutes a step in the normal transition from the psychological purposiveness of all things to the possessor of that purpose, and from this to the more accurate interpretation of cause and effect, rather than the interjection of an illogical concept by education. However, education, rightly applied, may shorten this period beyond which the child must pass if higher levels of maturity are to be reached.

The child achieves greater stability in his use of relations as he less frequently interprets them in the light of his own specific experience, from which he makes generalizations.

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