THE RELATIONSHIP OF SCHOOL ACHIEVEMENT TO ANIMISTIC THINKING AND THE SIZE-WEIGHT ILLUSION IN GRADES ONES, TWO, AND THREE

By

DONALD REED AUSTIN

Bachelor of Science
Southwestern Oklahoma State University
Weatherford, Oklahoma
1973

Master of Science
Oklahoma State University
Stillwater, Oklahoma
1976

Submitted to the Faculty of the
Graduate College of the
Oklahoma State University
in partial fulfillment of
the requirements for
the Degree of
DOCTOR OF EDUCATION
December, 1979

THE RELATIONSHIP OF SCHOOL ACHIEVEMENT TO ANIMISTIC THINKING AND THE SIZE-WEIGHT ILLUSION IN GRADES ONE, TWO, AND THREE

Thesis Approved:

Bill F Elsom
Thesis Adviser

David W. Berrien

Joseph Pearl

William E. Segall

Norman N. Durham
Dean of the Graduate College

PREFACE

This study was suggested to me from a statement by Piaget in his research on children's conceptions of time. He stated that young children possess all the prerequisites for understanding relativity. Obviously, there is a discrepancy between what Piaget believes children can understand and what they are generally expected to understand. This raised the question, how could children readily understand something that is poorly grasped by intelligent adults, even after a great deal of study? In the most general terms, this study is an attempt to understand cognitive processes in childhood and the forces which affect the development of mental abilities.

Each committee member has made both indirect contributions to the research from material discussed in various courses, and direct suggestions for expanding and improving the study. The typist and editor, Susan McClure, has contributed to the preparation and completion of the paper. My brother Bruce has also helped me meet deadlines, by taking care of errands on campus which I could not do myself. All these people who have contributed to the study are hereby offered my sincere appreciation and recognition.

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER I

INTRODUCTION

Social institutions, such as public schools, encourage certain ways of thinking and behaving over others. Public education of children is especially concerned with the 3 R's, i.e., tasks requiring verbal-logical thinking. Many educators (such as Ornstein, 1972, and Pearce, 1977) have said that children can perform certain cognitive tasks more effectively at a younger than at an older age, and they attribute this loss of mental abilities to teaching children to rely on verbal-logical thought. At about the age of six, children begin to show rapid development of language and logic skills and no longer display dependence on developmentally more primitive mental processes. This study examined the relationship of the development of language and logic, especially as taught in public schools, to the loss of certain mental abilities in childhood.

Rationale

The loss of certain mental processes may be associated with the development of language skills. This phenomenon of loss may be understood within the framework of certain dualistic psychological theories. The main feature of

these theories is that there are two modes of thinking and relating to the world that are, to some extent, in conflict with each other; thus, what can be processed in one mode cannot readily be understood by the other.

Freud posited the dualistic theory that the mind could be divided into two principles, the conscious and the unconscious. The unconscious mind is characterized by primary process thinking, which is instinctive and not subject to the critical restrictions of logic. It is presumed that children begin with primary process thinking but later must develop a secondary process, the conscious mind, which is characterized by ego functions. The ego arises from interactions with the external world and is governed by the reality principle, whereas the primary process is ruled by the pleasure principle (Sahakian, 1974). The ego must try to maintain a maximum amount of satisfaction for the unconscious forces, while minimizing conflict with the forces of society. In minimizing this conflict, functions of the unconscious mind--primary processes--may be repressed by mechanisms of the ego--secondary processes.

Cognitive development may be viewed as a process in which the child manifests a primitive mode of experiencing the world, or representing it to consciousness, which subsequently is superceded by a more sophisticated representation through interaction with members of a civilized society. This interaction between child and society requires an adaptation on the part of the child;

specifically, the child must learn a language, or symbolic representation of the universe (Bruner, 1949). In learning this language, the child conceives of a model of the universe governed by implicit laws (all events fall within time and space, there is causality, linearity, a subject-object separation, an actor who acts). The child focuses on aspects of his universe which can be understood within his symbol system, and he screens all else from consciousness and the problem-solving process. Rather than acting on simple perceptions of the world, the child comes to interact with a model or representation of that world. Learning a symbolic system of language therefore facilitates communication and thus the meeting of needs, but it may also result in the loss of contact with the primary process.

Piaget (1929), also, has discussed child development as the replacement of one kind of thinking for another, which parallels Freud's model, and has provided certain descriptions of the child's mind which pertain specifically to thinking abilities, rather than to motivation.

Piaget has described the development of explanations of natural events offered by children as moving from a precausal stage, through a transitional stage in which aspects of both precausal and causal explanations are given, to a final stage in which the child's explanations are characterized by physical objective causality. The shift from precausal thinking to causal thinking reflects a

substitution of one way of thinking for another. Piaget views intellectual development as the shift in childhood from natural innate tendencies to interpret the world in a precausal manner (as in the example of animism, in which children may attribute the characteristics of life to inanimate objects) to the use of causal explanations, which children learn from interacting with others, especially adults. Initially, the child does not differentiate himself from his environment and attributes his personal characteristics to things around him. The child appears to operate from certain presuppositions; namely, he does not separate himself from his environment, he regards his own point of view as absolute, and he ignores the fact that his own point of view is subjective. Differentiation occurs as the child structures a concept of the world as existing externally and independently of himself, and in this process becomes conscious of himself as an individual entity.

Piaget views the shift in cognitive development as a result of interaction with others. Language acquisition, in itself, is not enough to advance development to a causal stage. But as language is learned, facts about the environment, cultural beliefs, and values are learned which may influence the quality of thinking that is to develop. Language is seen as just one aspect of many socializing forces. It is possible that formal education in reading, writing, and arithmetic--tasks of language and logic--also influence the child to substitute one way of thinking for another.

Objective of the Study

The objective of the study was to determine whether the development of skill in reading, writing, and arithmetic is related to a decrease in the tendency to use the primary process. If, as the model says, learning in the verbal-logical mode interferes with the primary process, then a significant negative relationship should exist between measures of the primary and the secondary processes. The study tests for a relationship; if the predicted relationship is obtained, then the model is supported. However any obtained relationship is not necessarily causal, and the nature of any obtained relationship is still open to alternative interpretations.

Hypotheses

H_1 Animistic thinking is negatively related to age.

H_2 Animistic thinking is negatively related to school achievement, even after controlling for age.

H_3 The size-weight illusion is positively related to age.

H_4 The size-weight illusion is positively related to school achievement, even after controlling for age.

H_5 Animistic thinking is negatively related to the size-weight illusion.

Definitions

Primary Process

The term was first used by Freud to refer to the interaction between assumed elements of the id; the primary process is concerned with immediate gratification of animal drives, cannot use symbolic representations of experience, and is not subject to the critical restrictions of logic (Sahakian, 1974). Pearce (1977) adds to this definition that the primary process is the function through which we experience unity and wholeness in our environment and general field of awareness.

Exactly what the primary process is, is hard to state, partly because of its nonconceptual nature. The primary process is regarded in the present study as a function of the right hemisphere mode of thought, as proposed in the split-brain model of Ornstein (1972). Both the primary process and the right hemisphere are theorized to be (a) more operative in childhood, (b) concerned with the perception of wholes, (c) nonlinear, and (d) nonverbal or conceptual. The right hemisphere function is described as intuitive and involved with rhythm and coordination of body movements, music, dreams, imagery, and visual-spatial perception; intuition also is associated with the experience of wholeness in the universe.

Piaget's notions of precausal thinking and animism are regarded in this study as products of the primary process

because of their presence in childhood, their contradiction of logic, and the perception of unity implied in precausal statements.

The freedom from susceptibility to the size-weight illusion is also taken here as an indication of the functioning of the primary process. Making judgements based on actual density may reflect awareness of gravitational forces which is not used when a person relies on verbal-logic, as is discussed further in Chapter II.

Secondary Process

The secondary process is characterized by verbal-logic. School achievement in reading, writing, and arithmetic is considered a function of the secondary process. Furthermore, tasks of language and logic are associated with the left cerebral hemisphere. For the purposes of this study, a test of school achievement is regarded as a measure of the verbal-logical, left-hemisphere, secondary process.

School Achievement

School achievement is defined as performance on the SRA Assessment Survey, Achievement Series. The SRA provides measures of mastery of reading, language arts, and mathematics. These three subject areas correspond to the 3 R's; the language arts part of the test deals with alphabetization, capitalization, punctuation, pronoun usage, verb and sentence usage, adjectives-adverbs, and spelling,

all of which are subskills of writing. School achievement is regarded as a function of the verbal-logical mode, the secondary process.

Size-Weight Illusion

The SWI refers to the tendency to confuse the density of an object with its weight, so that a person presented with two objects of the same weight, but of different sizes, will judge the larger object to be lighter. This illusion of the larger object seeming lighter has been interpreted to be the result of the subject's relying upon his "conceptual organization of available sensory data," of analyzing weight as density; there is a mental set or expectancy that denser is heavier, which leads to an incorrect judgement (Pearl, 1972). Susceptibility to the SWI (and thus, lack of weight-judging ability) as a result of learning a symbolic representation of reality, indicates that a loss of the primary process has occurred with development. With the SWI test (described in Chapter III), a quantitative measure of the primary process can be obtained.

Animism

Animism is the tendency to attribute life and consciousness to surrounding objects, thinking, for instance, that clouds are aware of their own motion. It is a specific form of the more general precausal thinking which is defined below.

Laurendeau and Pinard (1962) have developed a methodology which replicates the clinical investigations of Piaget and corrects methodological errors of other researchers; consequently, their scale of animism provided a useful tool for determining the stage of thought present in children under investigation. Laurendeau and Pinard classify responses to their animism questionnaire into four stages:

0. Incomprehension or Refusal
1. Animistic Thinking Based upon Usefulness, Anthropomorphism, or Movement
2. Autonomous Thinking with Some Residual Animistic Thinking
3. Total Disappearance of Animistic Thinking (pp. vi-vii).

The loss of animistic thinking is regarded in this study as indicative of loss of the primary process.

Precausal Thinking

The word precausal is used to describe the child's thinking because

> children's questions showed evidence neither of any search for the mechanical cause of phenomena nor of the search for any logical justification of their judgements, but pointed only to a search for motivation, which was conceived as the only possible explanation. In a world filled with and animated with intentions, such as the child conceives it to be, the true cause of a phenomenon is the moral reason for its happening. Every end calls forth the very force which is to realize it, and in looking for the 'why' of things, the child is also exploring the manner of their production. The 'how' is of no interest to him and raises no problems (Piaget, 1930, p. 12).

Lack of differentiation in the child's mind gives rise to three adualisms. First is the confusion between the

sign and the significate: the name of an object is inseparable from the object. For instance, the child may believe that the name of the sun is part of the sun itself and has its origin in the sun, and to touch a symbol for the sun is to touch the sun itself. The second adualism is the confusion between internal and external: thought is believed to be situated in the child, as well as outside himself. For instance, children believe that dreams exist external to themselves and are actually in the room with them. The third variety of adualism is the confusion between thought and matter: thoughts are believed to have a material substance. These characteristics of undifferentiation between the child and his environment result in precausal thinking.

Piaget (1930) has identified five main forms of precausal thinking in children which, he believes, reflect the child's innate predisposition for understanding the world: (1) Phenomenism is the most primitive form of precausal thinking used by children in their representation of reality. It is the establishing of a causal link between phenomena which appear together in space or time, or are similar to each other. Since the child is unaware of the subjective nature of such connections, he tends to relate everything to anything. For instance, the child may explain the floating of an object in water by referring to its color. This tendency to believe in the interrelatedness of all things manifests itself in the magical beliefs of children. For instance, the child may believe that he can

direct the motion of celestial bodies by the action of his own will, which is in contact with all other things. The child may attempt to influence the actions of external objects by manipulating symbols for the objects (which are indistinguishable for the child). (2) Finalism is the belief that the world is organized along well laid plans, almost always centered around human activity. Every object has a purpose, and this purpose is the reason for its existence and characteristics. Dreams, for example, may exist to punish the dreamer, or trees exist to provide shade for men. (3) Artificialism builds on finalism and refers to the belief that the origin of things is in the actions of someone who makes them, either God or man. (4) Animism is the tendency to attribute life and consciousness to surrounding objects, such as clouds being aware of their motion. (5) Dynamism is related to animism but refers to attributing an independent will to objects, such as clouds being able to choose their own course and move without assistance. Piaget emphasizes that these ideas children have are not the product of careful reasoning; rather they reflect an innate attitude or predisposition of the child's mind to uncritically accept certain assumptions.

Of the five forms of precausal thinking, animism has received the most attention from other researchers. Thus, this study will choose animism to exemplify a form of thinking which children lose as they develop.

Primitive

The word primitive is used to describe two quite different conditions which both, nevertheless, indicate an early stage of development. Primitive may describe the child's thinking, compared to that of an adult, given the same modern western culture. Primitive may also describe pretechnological societies which have not adopted characteristics of modern civilization. The use of primitive to describe both children and pretechnological societies may lead to the erroneous conclusion that, with regard to cognitive development, a child of the United States is in all ways like an adult tribesman living in the jungles of Africa. Although there are some similarities (which are discussed in Chapter II), the word primitive simply connotes a lower or beginning stage of development. In this study, usage of the word should be clear from context. Of significance to this research is that the thinking of the child and the thinking of some African tribesmen are both characterized by animism.

Socialization

> Socialization is that aggregate of
>
> activities that are devoted to the inculcation and elicitation of basic motivational and cognitive patterns through ongoing and spontaneous interaction with parents, siblings, kinsmen, and other members of the community (Cohen, 1971, p. 22).

Education

Education is seen as part of socialization in general, but it is concerned with "the inculcation of standardized and stereotyped knowledge, skills, values, and attitudes by means of standardized and stereotyped procedures" (Cohen, 1971, p. 22).

Implications

Critics of education have contended that training in the verbal-logical mode interferes with the development of valuable characteristics already present in children; schools are out of balance, they maintain, since they provide experiences designed to encourage appreciable development of reading, writing, and arithmetic skills, but virtually ignore primary processing. Advocates of the open classroom believe that schools should delay formal instruction until the child is ready and shows a desire to learn. The purpose of delaying formal instruction is to allow the lower stage processes to become firmly established, thereby providing a foundation for higher levels of cognition. It might be easier to develop and maintain access to primary processes up through childhood than to try to retrieve such in adults.

Another educational trend is the attempt to "get back to basics"--the basics being the 3 R's--at as early an age as possible. Educators who emphasize the importance of

early education in the 3 R's, consider such educational goals important to the student's successful adaptation to his environment. It is thus believed that children who acquire reading, writing, and arithmetic skills (important tools of language, logic, and communication in general) will be better prepared to meet their needs and make a healthy adaptation to life that allows for the greatest expression of human potential (Biehler, 1974). Indeed, students who do master verbal-analytical skills are in a distinctly advantageous position for succeeding, both in and outside of school. Implied in this notion of mental development is that the sooner the child begins high-level learning, the better.

Man needs high-level cognitive processes to function in the modern world and deal with the problems confronting survival. Making good decisions requires utilizing all personal resources and available information. Logical decisions must be based on factual premises. But developing dependence upon a symbolic mode of thought may interfere with one's ability to utilize certain sensory information and primary processing. The emergence of secondary processing results in focusing on what fits the limits of the secondary process input requirements. If secondary processes inhibit operation of primary processes, then some provisions may be necessary when a person is engaged in an activity which requires primary processing.

Attempting to integrate both processes in the

educational program may require special activities, teaching techniques, and media designed to exercise the primary mode in addition to the opposing secondary mode. It is not practical for public schools to delay formal education indefinitely; hence, many programs have appeared to provide experiences with psychological processes, other than the 3 R's. Canfield and Klimek (1978) recommend discussion of dreams, meditation, visualization, guided fantasy, music and dance, and biofeedback as means of blending the elements of imagination, intuition, sensory awareness, and a sense of purpose into education for training right hemisphere skills. A common feature of these activities is that those engaged in them are often instructed not to think or conceptualize. Ornstein (1972) says that the purpose of these activities is to suppress the active verbal-logical mode, "to rid the practitioner of a strict reliance on verbal intellectuality" (p. 156). Ideally, students could learn to switch back and forth between modes, as needed. The model of Ornstein (1972), for which this study attempted to find support, has some implications for educating both hemispheres of the brain. The verbal-logic of the left hemisphere tends to dominate and repress the intuition of the right hemisphere. Hence, if one wishes to utilize the right hemisphere, he may first have to tune out the left, avoiding conceptualization in those tasks requiring right hemisphere processing, such as dancing. Avoiding conceptualization in the early stages of problem solving may

actually be an effective aid in determining the final most reasonable conclusion. According to some mathematicians, logic must proceed originally from intuitions. It seems reasonable that one would try to work from the broadest base possible, in order to establish the most accurate intuitions from which deductions can be made. At the beginning of formal education, a child presumably still relies to some extent on the right hemisphere primary process, but he is taught to use the left. If the child subsequently loses access to the right hemisphere in the educational process, then education has at once provided the child with a model for understanding the world yet taken away the direct experience of that world which the model should help clarify.

Just as the left hemisphere may interfere with the right, so also may the opposite be true. One may have to set aside lower-level thinking, in order to effectively use concepts and solve problems requiring language.

Since animism is basic to a child's thinking, he is likely to seek explanations to his most pressing concerns about how to deal with life in terms of animism (Bettelheim, 1976). For this reason fairy tales, which contain rivers that talk and animals that give advice, can provide the child with solace for his concerns and offer explanations that are more acceptable than logical explications. Ideas may be presented to adult and child, alike, through the metaphors of myths and fairy tales, since such stories speak to the primary process, which does not translate

directly into logical concepts. May (1969) says that people need myths to believe in, to give meaning to life; it should be noted that myths tend to reflect many of the pre-causal beliefs of childhood (examples of which appear in the following chapter). To ensure the development of mental health, as well as intellectual excellence, educators might do well to recognize this primary mode of thinking in children. There is evidence that adults, too, resort to animistic thinking under circumstances of stress or ambiguity (Laurendeau and Pinard, 1962).

If cultural institutions do primarily reinforce the verbal-logical mode, and, as some critics maintain, ignore all other modes of thought, then the development of primary process thought may be left to random influences or to counter-cultural forces. Jung (1961) has stated that there is an innate tendency toward balance of all psychological forces in a person; a person may seek experiences which provide needed stimulation or emotional outlet in order to gain balance. If there is no outlet then mental illness may result, due to repression of a part of the self.

CHAPTER II

REVIEW OF RELATED LITERATURE

Since the nineteenth century, considerable systematic observation and research has been conducted, accompanied by a great deal of theorizing and speculation. This study will now survey the literature pertinent to respective topics under consideration in the model. Interpretations of current social phenomena within the context of the model will also be discussed. An attempt will be made to show that the organization of psychological processes, in particular the relation of language to other processes, corresponds to the demands for survival and adaptation within society; the relative strength of language to other skills is affected by the developmental program usually provided by cultural institutions. Evidence that the development of language inhibits the primary process will be presented.

A central belief has endured throughout the history of civilization that there are forces of socialization which act to inhibit the full development of intelligence, and that in becoming a part of society a child sacrifices some valuable part of his mind. This belief that intelligence is stunted by socialization is part of the broader myth of the Fall of Man.

> We see this theme of lost certainty and splendor not only stated by all the religions of man throughout history, but also again and again in nonreligious intellectual history. It is there from the reminiscence theory of the Platonic Dialogues, that everything new is really a recalling of a lost better world, all the way to Rousseau's complaint of the corruption of natural man by the artificialities of civilization. And we see it also . . . in Marx's assumption of a lost 'social childhood of mankind where mankind unfolds in complete beauty,'. . . an innocence corrupted by money, a paradise to be regained. Or in the Freudian emphasis on the deep-seatedness of neurosis in civilization and of dreadful primordial acts and wishes in both our racial and individual pasts; and by inference a previous innocence, quite unspecified, to which we return through psychoanalysis. Or in behaviorism, if less distinctly, in the undocumented faith that it is the chaotic reinforcements of development and the social process that must be controlled and ordered to return man to a quite unspecified ideal before these reinforcements had twisted his true nature awry (Jaynes, 1976, p. 444).

In the civilizing process, man increasingly divides his rational consciousness from his primitive unconscious. Samuels (1975) interprets the evolution of civilization in terms of "the waxing and waning of two basic mental processes: verbal thought and visual thought" (p. 11). Primitive man's basic mental process was visual representation; dreams and fantasies were valued over cognitive thought, and he was in harmonious connection with his environment. All things participated in the same spirit as man. In precausal thinking, an interrelatedness is perceived and valued over discriminating functions of thought. The development of written language and the accumulation and organization of knowledge helped rational thought achieve dominance down through the ages.

Historically, it has been observed that certain mental abilities tend to be incompatible with others. Sir Francis Galton, a pioneer researcher in the field of intelligence, "remarked on the astonishing finding that scientists in general had poor imagery, and specifically commented on the antagonism between sharp mental imagery and abstract thought" (Rimland, 1978, p. 79). And "Nietzsche once remarked that 'many a man fails to become a thinker for the sole reason that his memory is too good!" (Rimland, p. 79).

Localization of Psychological Processes in the Brain

A current popular theory of dualism which postulates two mutually exclusive psychological processes is based on research which demonstrates that the two hemispheres of the cerebral cortex are specialized to perform different functions (Ornstein, 1972). The left hemisphere performs the verbal-analytical skills, such as reading, writing, and arithmetic, which are localized in the left side of the brain. The functioning of the right hemisphere is specialized in perceiving visual-spatial relations and has been described as intuitive, holistic, and creative. Ornstein (1972) observed that, like western culture in general, "western education is heavily dominated by the verbal-analytical mode" (p. 145), schools generally having ignored the right hemisphere processes. At school, students are trained to focus on certain perceptions processed in the

left hemisphere and disregard others, notably those emanating from the right hemisphere. While this perceptual selectivity in favor of the verbal-analytic mode may have survival value, the automatic selection of only left hemisphere perceptions necessitates the individual's paying less attention to all other perceptions, namely those processed in the right hemisphere. Thus it would appear that formal education, which primarily emphasizes the 3 R's, has lost sight of potentially valuable mental abilities and is not acting in the best interests of full human development.

Ornstein emphasizes the importance of developing the functions of both hemispheres and says that scientific activity requires both modes working complementarily; the right hemisphere is good for generating possible relationships between data, but since all patterns proposed may not correspond to reality, the proposed patterns should be subjected to the critical analysis of the left hemisphere. Galin (1976) has described the importance of both modes by saying that

> the verbal-analytic style is extremely efficient for dealing with the object world. Our modern technology, standard of living, and scientific achievements depend heavily on highly developed linear, analytic methods.
>
> The holistic mode of information processing is very good for bridging gaps; we can perceive a pattern even when some of the pieces are missing. In contrast, a logical, sequential mode cannot skip over gaps. In this imperfect world, since we are usually trying to operate from incomplete information, we very badly need to have a capacity to perceive general patterns and jump across gaps in present knowledge (p. 18).

Galin also says that although, ideally, the two modes should function in a complementary fashion, they

> also may be in conflict; some mutual antagonism is evident between the analytic and the holistic. The tendency of the left hemisphere to note the details in a form suitable for expression in words seems to interfere with the perception of overall patterns (p. 18).

If this is so, it may be that children lose the use of right hemisphere functions as they become proficient in the use of the left hemisphere. Pearce (1977) claims that children possess ESP, perfect musical pitch, and intuition, associated with the right hemisphere, but when they begin to specialize in left hemisphere functions these abilities are lost. Rennels (1977) says that in emphasizing the 3 R's, educators have neglected human capacities for imagination and visual-perceptual thinking.

> The schools systematically suppress opportunities for children to exercise their visual/sensory abilities; . . . children should be given the appropriate synthetic, sensory, visual, and perceptual experiences (p. 65).

Continued sensory stimulation is needed, if the "innate capacities of individuals are to remain functional rather than . . . atrophy" (Rennels, 1977, p. 65). Schools may simply ignore certain mental abilities, or they may actively suppress them, or both. Also, it appears likely that activation of one hemisphere may inhibit the activity of the other.

McDougall (1928) considers animism, i.e., a belief in the spiritual basis of the universe, to be the philosophical

polar opposite of materialism, i.e., the belief in matter as the fundamental aspect of everything; a comparison may be made to the split-brain model. The lateralization of brain functions has been used to account for all kinds of polar opposites: conscious and unconscious; rational and intuitive; science and art (Goleman, 1977). However, the localization of abilities is not the same for everyone; language and logic are localized in the left hemisphere in only about two-thirds of the population, estimates Goleman. Also, the separation of functions is not absolute; there is duplication of functions in each hemisphere, and the two share in creating many behaviors and experiences within consciousness. Some research indicates that women show the separation of function less clearly than men, suggesting that women's brains may be organized differently.

Pearce (1977) has posited that cognitive development reflects a shift from dependence on right hemisphere functions to specialization of thought appropriate for the left hemisphere, the lower stage reflecting the right hemisphere, and the higher stage manifesting the functioning of the left. This shift in hemispheres which is regarded as the neurological basis for the shift from precausal to causal thinking, occurs around the age of six, when most children are given instruction in the 3 R's at school.

The popular contention that over half of the brain is not used raises some interesting questions for Sagan (1977). This, supported by the fact that large portions of the brain

may be removed without apparent effect on behavior, does not take into account redundancy of function, and the fact that much human behavior and experience is subtle: lesions in the right hemisphere may lead to impairment of thought and action, but in the non-verbal realm, which is difficult for doctor and patient to describe. The separation of function by hemisphere is considered an adaptation to the need for two incompatible thought processes. The cerebral cortex evolved because it served survival and functions, in part, by inhibiting the more primitive parts of the brain. But the old brain still functions, and it is either still necessary or cannot be entirely bypassed by the rest of the brain. Another explanation offered for hemispheric specialization is that because the child acquires language before he has complete competence in perception of visual-spatial relations, the right hemisphere specializes in visual perception by default, and the left hemisphere is redirected toward language, exclusively.

Autism

Some case studies of autistic children provide support for the split-brain theory (Rimland, 1978). Autistic children display gross disturbances in their abilities to communicate, and many do not talk at all. However, about 10% of these children display extraordinary abilities in mathematical computation and exhibit mechanical, musical, and artistic talent. Remarkably, in those cases that

recover, the special abilities are lost in the process. Rimland notes that a common feature of these autistic savants is their ability for intense, focused concentration, but their inability to look at a broad spectrum. The autistic savant "is able to 'apprehend' visual or auditory stimuli, but not to 'comprehend' them" (Rimland, p. 78). The special abilities they demonstrate are those generally considered to be localized in the nondominant right hemisphere. He notes research showing a high rate of left temporal lobe abnormality in autistic patients. Rimland suspects that the autistic savant is able to perform mathematical computations at a remarkable speed because he grasps and processes all information simultaneously, rather than logically and sequentially.

Size-Weight Illusion

In coming to rely upon a model, symbolization, or conceptualization of reality, rather than attending to simple perceptions, people may become victims of various distorted ideas or perceptions, as is illustrated in the size-weight illusion (SWI). It has been observed that children below the age of four years do not experience the SWI, and the illusion becomes apparent only shortly thereafter (Ohwaki, 1953, cited in Werber and King, 1962). (Details concerning how this observation was made were not given.) This appearance of susceptibility to the SWI may be related to the development of language and reliance upon symbolic logic.

The increase in size-weight illusion with development may likewise be interpreted as a result of the child's reliance on left hemisphere, symbolic processing, rather than attending to the direct sensory perception. Marijuana, and possibly other drugs which inhibit conceptual thought, may cause an adult to regain access to the primary process and thus be more proficient at tasks, such as the SWI, than under nondrugged conditions (Pearl, 1972). This is congruent with the observation that left hemisphere activity decreases relative to the right hemisphere when the subject is under the influence of a psychedelic (Ornstein, 1972). Details regarding the SWI will be given in Chapter III.

Eidetic Imagery

The incidence of eidetic images, i.e., a strong visual memory, is higher in children than in adults; the explanation is that in literate societies, emphasis is placed on verbal memory over immediate recall of visual images (Haber and Haber, 1964). Giray and Barclay (1977) find eidetic imagery negatively correlated to age in brain-damaged children observed over a twenty-month period. The authors hypothesize that eidetic imagery decreases in importance in the course of intellectual development. It is difficult to find support for such a hypothesis because of problems inherent in methodology and finding subjects. Doob (1964) finds the incidence of eidetic imagery high in samples of children and adults of the Ibo tribe of eastern Nigeria. For this group

of Africans there was a higher incidence of eidetic imagery in rural than city dwellers; incidence was higher in children than adults in the urban sample, but not rural; incidence was higher in rural adults than city-dwelling adults, but there was no difference between samples of children. Suggested problems for further research are: (1) determine if eidetics are really negatively correlated to age and schooling or the western style of culture; and (2) determine the significance that kinds of images in one's memory have for modes of social communication. Primitive psychology and the impact of culture will be discussed in more detail later in this study.

Dreams

Psychoanalytically oriented psychologists have traditionally held the dreams of children in special regard. Before logical thought has developed, the primary process is more powerful and pervasive. The primitive forces of the unconscious express themselves in dreams; these primitive forces are strongest and most easily observed in the dreams of children, for whom the repressive action of the ego is not yet operative. In dreams, adults are thought to regress to a primitive state of consciousness and gain access to the primary process (Foulkes, 1978). Current research does not support the belief that children's dreams are more complex and traumatic than adults'. However, some evidence indicates children have the ability to recall their dreams more easily than adults, and the content of their

dreams does reflect presumptions of a precausal sort (Sagan, 1977). The prevalence of dreams in childhood may be understood as a function of the analytic part of the brain not working to full capacity. The dream state, as a product of the primitive processes of the unconscious, may reflect a shift of dominant hemispheres from left to right. The dream is a state

> where we recognize 'signs,' such as the feel of running water and the smell of honeysuckle, but have an extremely limited repertoire of symbols such as words; where we encounter vivid sensory and emotional images and active intuitive understanding, but very little rational analysis; where we are unable to perform tasks requiring extensive concentration; where we experience short attention spans and frequent distractions and, most of all, a very feeble sense of individuality or self (Sagan, 1977, pp. 150-151).

The evolutionarily more primitive parts of the brain, the midbrain and the limbic system, working in conjunction with the right hemisphere, are considered the source of dreams, myths, and fairy tales. The significance of dreams and the regression to a "primitive animal-like unreasonable state of mind" for wish-fulfillment and problem solving has been speculated upon for centuries. Sagan (1977) believes dream insights "always have an intuitive or pattern-recognition character" (p. 171).

Animism

Not all researchers find evidence of animism in childhood, as described by Piaget (Klingensmith, 1953; Mead, 1932; Huang and Lee, 1945), but differences in results can be

explained by differences in methodology (Laurendeau and Pinard, 1962). The studies not finding clear evidence of childhood animism considered the child's classification of objects as alive or not alive, but animism becomes evident when the child's explanation is taken into account (Smeets, 1973). A child may respond that a tree is not alive because it does not move; movement is a general characteristic of animals, and so the child may incorrectly generalize that movement equals life--an error observable only when considering the explanation given by the child for his classification of objects. Adults have been observed to exhibit animistic thinking, but it is questionable whether childhood animism has all the implications of adult animistic beliefs and spontaneous actions (Klingensmith, 1953). Piaget (1929) notes similarities between childhood thinking and the psychology of primitive societies, which are often characterized by animistic and magical ideas; however, whether they are of the same process is open to debate.

McNew (1973) provides three reliable and valid measures of animism to support the existence of this kind of thinking in childhood, and she notes that animism is negatively related to age. From a factor analytic study using first graders, animism emerged as relatively independent of 33 variables, including operational thought and reasoning about interpersonal relations (Berzonsky, 1973). Stern (1966) presented tests and demonstrations to which children gave explanations, and he observed that young children do give

precausal, nonmechanical explanations for the demonstrations. Stern (1966) notes that general characteristics of children's explanations involve

> lack of attention to details of how things happen, lack of understanding of temporal sequences of events, and the lack of understanding of the need for spatial contact for the transfer of energy and motion (p. 4116).

A standardized animism questionnaire was administered to 98 Hopi Indian children, ages 12-18 years, by Dennis (1943). The Hopi children were more animistic than white children of the same age. The concepts of the Hopi and the white children were of the same types; the difference in the rate of the shift from precausal to causal thought may be due to cultural factors which are not isolated in this study. Tomlinson and Keasy (1972) found that second-grade children are less animistic than children were in 1929. The explanation offered is that the emphasis on science is now greater. Torrance (1972) sampled fourth and sixth graders in metropolitan areas of the United States and Mexico. Results showed that U.S. children are more causal than Mexican children; sixth graders are more causal than fourth graders; and advantaged youngsters are more causal than their disadvantaged counterparts. Torrance suspects the shift in mode of thought to be related to the slump in creativity which he observed in the fourth grade. Looft and Charles (1969) presented an instructional film on the biological nature of life to 35 children, ages 7-9 years. Comparison of pre-test/post-test results showed that some

children were able to make a significant change in thought from precausal to causal. Three general types of responses to the film were prominent: one group was unaffected; one group was confused--they retained the information but did not "accomodate it"; the third group definitely showed alteration of thinking. The authors suggest that the transition in mode of thought is not necessarily a slowly unfolding process, as Piaget described; rather, it is possible to alter the thinking of some children. Mikulak (1970) found animistic tendencies in 59.8% of a sample of 127 college students. No significant difference was found between students who had taken one or more courses in biology, versus those who had taken none.

Another finding of interest to this study is one showing that children are aware of the distinction of animate versus inanimate in certain verbal contexts, but perceptual features of movement and sound are often more salient; the verbal perspective serves to control animistic thinking (Margand, 1975). Generally, no sex differences are found in any of these studies.

Cross-Cultural Studies

Some evidence to support the hypotheses underlying this study may be found through cross-cultural comparisons. The impact of culture upon development of mental abilities can be estimated to some extent by comparing societies which are different and observing those differences in their respective

psychologies. Animism, for instance, is characteristic of some primitive peoples' psychologies (Tyler, 1969). As the thinking of the child seems to come in conflict with adult thought, so does the thinking of primitives compare to that which is dominant in western technological nations.

Many researchers interpret observations made on primitives to indicate that such people are of low intelligence (Radin, 1927). However, one salient trait of the primitive is that "he allows full and appreciative expression to his sensations" (p. 19). Decision making aided by sensations, emotions, and intuition is typical of primitive thought. Radin believes this nonintellectual thought may be as effective as rational analysis. Radin discounts another basic assumption of contemporary anthropologists, namely, that the primitive personality lacks differentiation and integration. Instead, he maintains, the primitive bases no ethical judgement on emotion, so he thereby achieves a balance of repression and expression in his personality. Western Europeans differ from primitives, Radin (1927) says, only in their use of the "written word and the technique of thinking elaborated on its basis" (p. 387).

And yet, many observers have been struck and puzzled by the differences between Europeans and African tribes. Bredsford (1935) notes that when social and political institutions of western nations are overthrown, new institutions arise to replace them. However, a survey of colonial history reveals to him that "savage tribes tend to die out

when tribal authority is removed or destroyed" (p. 3). The primitive seems to have no individuality outside of his institutions; his authorities and institutions are bound up with customs and traditions characterized by phobias, taboos, and magical beliefs, resulting in a stagnation of cultural development. Like the child, the primitive has an outlook which is susceptible to corruption by the lack of discriminating intellect. Bredsford describes the education of the white race as concerned with the development of the individual as an entity, but says the savage is taught to take his place in the social order.

Primitive philosophy is characterized by participation, as well as animism. The primitive believes in a universal cause for all things, in a symbiosis of the essence of all things, and in the possibility of participating personally in this universal life essence. The word "participation" has been used to refer specifically to the relation that a primitive man might believe to exist between similar phenomena, although there is no spatial contact or causal connection apparent. Piaget observed that participation is characteristic also of the child. Participation is illustrated in the behavior of hitting a picture or symbol of something or someone in anger, an action which children and primitives have claimed actually affects the object or person represented. There is confusion between the object and its representation, between self and world. Compared to adults, the child--like the primitive--is close to immediate

experience and, paradoxically, further from a reality of logical coherence.

Segall (1963) compared the performance of Europeans to African and Philippino adults and children on tests of visual perception of geometric illusions, in which the task was to judge the longer of two lines. Results indicated that non-Westerners were not only less susceptible to the Müller-Lyer illusion ("in which direct and reversed arrow-heads make lines of identical length appear to be unequal" [Harriman, 1969, p. 112]), but also more susceptible to the horizontal-vertical illusion than were the Europeans; this is consistent with cross-cultural comparisons made by Rivers (1924). Segall takes an empiricist, rather than a nativist, interpretation and postulates that visual response habits are a function of cultural and ecological factors in the visual environment. For example, the prevalence of rectangularity, i.e., straight lines and square corners in the environment, is a factor "related to the tendency to interpret acute and obtuse angles on a two-dimensional surface as representative of rectangular objects in three-dimensional space" (Segall, 1963, p. 99). Such an inference is valid for people who live in houses of modern cities, but not for those living in open terrain or the jungle.

Mundy-Castle (1966) claims to show that pictorial depth perception in children from Ghana is culturally affected by familiarity with pictorial material. Not only did the African children show less ability to understand

pictures, but more important was their great tendency to explain their reasoning with "projected imaginative elaborations." The author interprets this in Piagetian terms, noting an identification of the child with the event or object being described. There was not much sign of an attempt to integrate sets of answers into a logical whole. Instead, the child focused on the "needs, motivations, and feelings of the characters in the pictures: they are not regarded as static, symbolic representations, but as direct and animated aspects of reality" (p. 291). The child's logic proceeds from this viewpoint of one aspect of the picture at a time; the thinking is egocentric, dominated by

> immediate experience, [which] is more syncretic than deductive, and [which] operates according to special laws of symbolism and immediate satisfactions. Transitions from premise to deduction occur abruptly without intervening deductive steps, and little heed is given to proving or checking propositions, or fitting them together into a logically coherent whole (Mundy-Castle, 1966, p. 292).

The Australian aborigines' concept of time provides a good example of animism and its place in primitive culture (Priestley, 1964). Aboriginals believe everyone possesses an eternal soul; at death the spirit goes not only to a different geographic location, but also exists in a time qualitatively different from the unidirectional, unidimensional flow. The aborigines go to this "Great Time" where everything occurs at once in dreams also. Their society has many rituals and totems, based on gaining access to "eternal dream time." This seems to reflect the need for

gaining access to the right hemisphere processing. Likewise many esoteric meditation practices, such as repeating a word over and over or concentrating upon a single point, are oriented toward achieving an experience of timelessness, indescribable in words and lending an intuitive glimpse of ultimate truth. These exercises are popularly interpreted in many terms of the split-brain model; activities, such as chanting a mantra, tend to inhibit the left hemisphere and permit access to the right.

Language and Primitive Psychology

The way in which words and language are used reflects the psychology of the user. Jung, among others, has attempted to provide a general understanding of language and the conscious mind from observations of primitive societies.

Observing that mythical themes are produced in the psychoses and the dreams of individuals who could not have been acquainted with systems of mythology, Jung (1958) concludes that the expression of mythical ideas is the product of myth-forming structures in the unconscious (archetypes). These archetypal preconceptions can be observed operating in primitive tribes. "Primitive mentality differs from the civilized chiefly in that the conscious mind is far less developed" (p. 116); the primitive does not think willfully and logically, rather he believes thoughts appear to him. "The primitive cannot assert that he thinks; it is rather that 'something thinks in him'" (p. 116). Similarly, the

precausal child regards his thoughts as material objects associated with the workings of the mouth, and only later does he recognize thought as nonmaterial and occurring inside the head.

Prior to the development of a civilization based on verbal logic and symbolization, man's mind may have been organized differently; the left hemisphere probably did not dominate and suppress functions of the right hemisphere. The early records of man reflect the phenomenon of thought being material.

> The words in the Iliad that in a later age come to mean mental things have different meanings, all of them more concrete. The word psyche, which later means soul or conscious mind, is in most instances life-substances, such as blood or breath; a dying warrior bleeds out his psyche onto the ground or breathes it out in his last gasp (Jaynes, 1976, p. 69).

The primitive mentality, in which myths supposedly are produced and originally were formed, is a

> state of reduced intensity of consciousness (in dreams, delirium, reveries, visions, etc.). In all these states the check upon unconscious contents by the concentration of the conscious mind ceases, so that hitherto unconscious material streams, as though from opened side sluices, into the field of consciousness (Jung, 1958, p. 118).

In speaking of archetypes, Jung says it is impossible to define them exactly, interpretable metaphorically at best. It is the nature of the unconscious that it cannot be reduced to concepts upon which the rational mind can perform operations. The conscious mind is characterized by language, and language itself is a metaphor or a model of the universe through which experience is interpreted. Jaynes (1976)

describes consciousness as a metaphor for external reality: understanding something comes through finding a metaphor for it. The difficulty of defining consciousness is finding something in our immediate experience that is like our immediate experience. The problem also can be seen in terms of the part trying to analyze the whole. In defining something one must limit it, thereby eliminating certain aspects of the experience; in so doing, the whole is lost. Concepts of life and reality likewise pose problems of definition for science.

The archetype must be interpreted to be healthy to ensure good connection between conscious and unconscious. Since men continue to speak of myths of child-gods, regressing primary mental processes, and reminiscences of a golden age, the analogy may hold from individuals to societies at large. Jung (1958) observes that

> humanity, too, probably always comes into conflict with its childhood state, that is with its original, unconscious, and instinctive state, and that the danger of the kind of conflict which induces the vision of the 'child' actually exists (p. 125).

The formal myths and religions telling of the child serve the purpose of bringing the image of the child in the unconscious into an unbroken line with the consciousness.

The conscious mind can focus sharply on only a few objects at a time, necessarily excluding other potential objects of attention. This exclusion brings about a one-sidedness, a differentiated mind, which is an effective

instrument of the will, but which separates man further from his childhood psychological roots, leaving him in "danger of being uprooted; hence it [consciousness] needs compensation through the still existing state of childhood" (Jung, 1958, p. 126).

> As the evolution of the embryonic body repeats its prehistory, so the mind also develops through a series of prehistoric stages. The main task of dreams is to bring back a sort of 'recollection' of the prehistoric as well as the infantile world, right down to the level of the most primitive instincts (Jung, 1964, p. 89).

Application of the Model to Current Trends

A broad example of different psychological organizations corresponding to cultural differentiation is apparent between countries of the East and the West. At the risk of oversimplifying the situation for convenience, Westerners are generally considered to be dominant in left hemisphere thinking, while Easterners are more adept at using the right hemisphere. What caused this cultural dichotomy (which corresponds to physiological and psychological dichotomies) is still an unresolved issue for anthropologists. As environmental conditions change, so may psychological organizations, in order to adapt. Currently, there is an influx of Eastern philosophy into Western culture, just as the East is rapidly adopting the ways of the West. The split-brain model contains the assumption that either mode, in itself, is insufficient. The major problem is defining what the optimal relation

between the two hemispheres is and how to educate for their proper integration, allowing for the best of both.

Many scientists have speculated on the nature of intelligence and the use of nonlinear thought to understand aspects of the universe not easily conceptualized. Some imply that children have an intuitive understanding of certain aspects of reality, not readily grasped by modern adults dependent on verbal logic. Einstein is said to have believed that his difficulty learning language was actually an advantage for him when thinking about physics, since he was not limited by the inherent constraints of linguistic thought (Priestley, 1964). Another physicist and the developer of the atomic bomb, Robert Oppenheimer,

> believed that there were children playing in the street who could solve some of the most difficult problems in physics because they possessed modes of sensory perception that he felt had been lost in his development (Rennels, 1977, pp. 69-70).

Capra (1975) concludes from relativity and quantum mechanics that there is a unity of all things, the universe is interrelated, human consciousness should be included in the description of the universe, and the notion of observer as separate from the observation is replaced by the notion of the participator. This world view is incongruent with that of Newtonian logic and the thinking of modern society, but it is reminiscent of the description of the child's mind provided by Piaget.

Becoming limited by a single perspective has given rise to arguments in some academic fields concerning what is the best perspective. In the field of literary criticism, some

critics believe that a piece of literature is best understood by scrutinizing and analyzing each part, whereas others take a phenomenological perspective, emphasizing the work as a whole and attending to the impression the literature creates as it is read. The respective acts of analyzing and of appreciating the immediate aspects of the reading are both important to the complete understanding of a piece of literature. While these two approaches to criticism may be used to complement each other, it seems that some critics have a marked preference for one over the other.

Within society today are events which require a reorganization of the relationships among mental processes. With the advent of equal rights for women, the value of basic behavioral stereotypes are being challenged, and other lifestyles are being experimented with. Women are taking active and aggressive roles, and must must relinquish previously unquestioned positions of dominance. Men also now may have fewer inhibitions about expressing feelings.

Advances in technology make space travel possible, and plans for colonizing outer space are being discussed. Dealing with the problems of high-speed space travel requires a working understanding of relativity theory. As was mentioned in the introduction, some physicists consider language and the linear model a handicap to some extent in understanding modern principles of physics, suggesting that ability to use the right hemisphere may be an advantage in

understanding problems of space travel. Not being susceptible to the SWI may be important in judging density of objects outside a planet's gravity field.

The solution to such global problems as overpopulation, food shortage, and pollution, proposed by economists who see more as better and specialization of vocations as an aid toward productivity, are often in conflict with the views of ecologists, who are concerned with the relations of the parts of a biological system to the whole. Ecologists perceive highly specialized technology a threat to the stability of the whole ecosystem, inasmuch as technologists emphasize maximizing one variable at the expense of the other. The current economic approaches to global problems often are exploitative and destructive to the balance of nature and lead to side effects which become problems over the long run. Lester Brown (in Silverstone, 1978) believes development and survival will require that fields such as economics have as their goal the balance of nature, rather than the technological conquest of natural forces. The new paradigm remains to be seen, and resistance to abandoning old theories is strong; nevertheless, a better working model may require suspending dependence on old methods of analysis to allow for the input of broader considerations.

In these changing times, characterized by high mobility and revolutions in nearly all cultural institutions and fields of knowledge, Americans form and dissolve social relationships faster than their forefathers, who lived in a

society of fairly enduring contact with the same people and the same world view. Not only are social systems changing at an accelerating pace, but language and man's relationship to it, as well. Discoveries in all fields of knowledge require that one learn new vocabularies and theoretical frameworks and set aside outdated ways of thinking about things. Toffler (1970) states that there are neurological limits to how much change persons can adapt to, before experiencing the effects of great stress, or Future Shock. Technological progression is likely to continue, and problems, such as energy shortages, will require highly skilled and specialized technologists to view problems and possible solutions within broad parameters that embrace other tangentially related systems.

Disciplines need to relate their knowledge of society in general, and education is no exception. A new consciousness, an "experientially based 'synergistic,' subjective, and integrated view of the world" (Wagshal, 1974, p. 129), has begun to emerge in recent decades, partly as a result of "the combination of mass media, psychedelic drugs, and jet flight, which has allowed students to make a quantum leap in consciousness over their parents" (p. 131). Educational reformers should attempt to understand and allow for the emerging new consciousness "mainly concerned with imagination, spontaneity, communality, and the integration of subject matter into the self" (Wagshal, p. 130), in this era of rapid change and no firm values, when a curriculum is

"overhauled just in time to be out of date" (p. 130). Many of the writers of the new consciousness are critical of the scientific method and the inappropriateness of natural science methods for social science.

Daniel Brown (1975), for one, is critical of the use of the linear model, as exemplified by analysis of variance and multiple regression, for educational research. The dependent variable - independent variable paradigm is not appropriate where there is not some justification for believing such a relationship exists. The meaning of statistical significance is a problem, because the magnitude of a significant relationship may be actually quite low and not generalizable. Correlations that are relatively low (.3 to .5), but statistically significant, may suggest that the researcher's theory is not very accurate. In looking at cause-effect relationships, a dynamic view is needed in lieu of a static application of the linear model, which does not allow for time delays. Brown recommends that other educational researchers be less concerned with quantitative analysis and suggests a return to historical, legal, and logical analysis, including such variations as multivariate analysis and the optimization model often used by economists.

Conclusions of the Review

The preceding review has attempted to illustrate some important principles of problem solving in general. There is more than one way to perceive the world. Furthermore,

different perspectives tend to be mutually exclusive: to view a problem from a given perspective or frame of reference is to limit the viewer from any other vantage. Effective use of primary and secondary processes may help a person select the best viewpoint from which to operate.

Also implied in this review is the notion of nonconceptual thought, with the inference that there are some aspects of reality which cannot be understood and expressed in logical language. Nevertheless, there is the characteristic of the mind which seeks to understand and does so by forming symbols and building models of the reality it seeks to comprehend. Science, as the search for knowledge, is not necessarily tied to the linear model; other methods may be available to be explored later. As the preceding discussion has tried to demonstrate, the linear model is inappropriate for psychology, to the extent that not all aspects of the mind are linear. And yet science shares with other philosophies (and precausalism in childhood) the quest for a teleological cause or an all-encompassing explanation--a principle from which all else is derived.

CHAPTER III

METHODOLOGY

The literature is essentially speculative concerning the relationship of learning that occurs within a public school curriculum to the primary process. The following methodology was used to determine if a significant relationship exists between school achievement and the primary process. According to the model of Ornstein (1972), school achievement is, in part, causally related to a shift from the primary to the secondary process; however, as a correlational study, any obtained significant relationship may only lend support to the model. A causal relationship cannot be inferred necessarily from the results.

Hypotheses

H_1 Animistic thinking is negatively related to age.

H_2 Animistic thinking is negatively related to school achievement, even after controlling for age.

H_3 The size-weight illusion is positively related to age.

H_4 The size-weight illusion is positively related to school achievement, even after controlling for age.

H_5 Animistic thinking is negatively related to the size-weight illusion.

Subjects

The subjects used were 105 elementary students (47 males, 58 females) ranging in age from 6 years, 8 months to 10 years, 2 months; 35 students were selected from grade-levels one, two, and three, respectively, of an elementary school in northcentral Oklahoma. The surrounding area is rural, and many of the students' families are farmers. The elementary school places emphasis on the 3 R's and utilizes the Spalding method of reading instruction, in which children are taught to analyze a word by breaking it into phonetic parts. The author had worked in the elementary school for two years, was acquainted with many of the subjects, and often had come in contact with the various subjects in classes.

Procedures

The SRA test was administered in the classroom during the school days March 13 and 14, 1978, by the regular classroom teachers, according to procedures outlined by the SRA test administration instructions. The tests of animistic thinking and size-weight illusion were administered one subject at a time, by the author, in a small office separate from the classroom, on the school days April 25 to May 16, 1978. Each child was escorted from his classroom to the test room and back by the author. After being seated, the child was asked if he would answer some questions, and he

was told that the author would like to see how well the child could do some things. The animism questionnaire was administered first. Next, the child was asked to stand and move over to a counter in the same room, where the twenty-nine small weighted bottles were arranged in order. The size-weight illusion test was administered, after which the child was returned to his classroom. There were two or three sections of each class/grade at the elementary school. In order to get 35 subjects at each grade, all the students from one class were selected, and the remainder needed to complete the 35 for each grade level were taken from another section of the grade. Selection of those remaining students was made with the permission of the teachers. Scheduling of activities in the school and location of the students when time was available for testing necessarily influenced the selection of some students.

Measuring Devices

SRA Assessment Survey, Achievement Series, Primary Edition

The SRA is an achievement test to measure student growth in reading, mathematics, and language arts. The test was designed from the results of 118,000 pupils tested, and there may be some question as to how representative of the general population these norms are, depending upon a particular school's curriculum. The Kuder-Richardson reliability coefficients are in the .88 or above range generally;

no equivalent forms reliability data are reported. Content validity is claimed, inasmuch as the test was constructed to measure commonly expected outcomes in public schools (which may not be appropriate for a given school); no concurrent validity is reported (Buros, 1970). The total raw score from the SRA is used as a measure of school achievement. Two levels of the test were used--grade one had 159 items; grades two and three had 175 items. Procedures for adjusting for the two levels of the SRA are explained in the Statistics section.

Animism Scale

As explained in Chapter I, animism is considered a function of the primary process, and a test of animism shall be an operational definition of the primary process. The animism scale of Laurendeau and Pinard (1962) was used to validate the existence of precausal thinking in children. Laurendeau and Pinard attempted to gather a completely representative stratified sample (N = 500), selected on the basis of age, sex, occupational level of parents, familial environment, physical condition, siblings, and academic level of students of Montreal, Canada, during the 1955-1956 school year. The authors report no reliability coefficients on their own test, considering it a refinement of an earlier research device which reported split-half coefficients in the 70's. These researchers consider the existence of childhood animism unquestionable because of the

large number of subjects who attributed life to one or more inanimate objects; only 31.5% of the children sampled correctly classified all the objects in the questionnaire. Life, as used in the lowest stage of thinking in children, is defined by activity, movement, or usefulness in general. Another type of response used by children to classify inanimate objects as living is reference to anthropomorphic attributes, such as the ability to breathe, eat, and see, or the possession of a body and soul. Thus, a child may misclassify fire as being alive because it "breathes" and "eats" things as it burns them up. In this case, animism is evident without reference to autonomous movement. Children who classify objects on the basis of such traits are likely to make errors, thereby giving evidence of their precausal-animistic tendencies. Although the Stage 1 child may refer to more than one criterion of classification, his thinking is generally consistent; he never uses the same reason both to attribute and deny life to an object. For instance, objects planted in the ground are considered inanimate because they can't move; likewise, a fish or snake is not alive because neither has feet (anthropomorphism). Stage 2 children all make at least some reference to autonomous movement, the proper criterion of classification, but these children still attribute life to certain inanimate objects. Thus, State 2 is essentially a transition between Stages 1 and 3. In Stage 3, explanations of classification primarily refer to autonomous movement, and so plants may

still be misclassified, even though no inanimate objects are labeled "alive." Laurendeau and Pinard note that correct classification of plants depends more on school learning than on "natural, personal development of thought" (p.152). The results of Laurendeau and Pinard's study show a decrease in the percentages of inanimate objects classified as animate as subjects increase in age; also, the children attribute life most frequently, and for a longer time, to those objects most removed from their direct experience. The higher the stage numerically, the less animistic thinking there is present; this fact is important in interpreting the results (see Statistics section).

Size-Weight Illusion Test

In the size-weight illusion test, the subject

> is presented with a series of 29 small volume cylindrical weights, arranged in a semi-circle before him. The cylinders are ordered according to weight. He is then given three larger cylinders, one at a time, and instructed to place each one in the series of small cylinders, in accordance with its weight, so that the small cylinder to its left seems lighter than it and the small cylinder to its right seems heavier than it. He is scored according to how far away from its true position he places each large weight, without regard to direction. For example, if a particular large weight ought to go between numbers 22 and 23, and a S places it between numbers 17 and 18, then he receives a score of 5. The score recorded for each S is a total of three such deviation scores, one for each large weight placed (Pearl, 1972, p. 30).

The weights in the small bottles in the ordered series ranged from 74 g to 186 g, in intervals of 4 g. The weights of the three large bottles were 140 g, 160 g, and

180 g, respectively. The size of the small bottles was 2-3/8 inches tall and 1 inch in diameter; the size of the large bottles was 3-3/8 inches tall and 1-5/8 inches in diameter.

A historical review, primarily of European research, indicates that the SWI is acquired sometime in childhood and has a very high frequency of appearance in the general population; moreover, it may depend on the development of intelligence (Nyssen and Bourdon, 1956). Because most of this literature is written in a foreign language, it cannot be evaluated in relation to the present study.

Koseloff (1958) describes a difficulty with measuring the SWI--the SWI phenomenon is not "robust." In testing for the SWI, a subject may show a large error in his judgement of heaviness on an initial comparison, but on a later comparison of weights show less of an error in judgement, or a judgement in the opposite direction: initially the large object is judged heavier, subsequently it is judged lighter than the small object. This might indicate that the SWI was present in one phase of measurement but not in later phases. However, after a brief rest, the subject would again display the SWI phenomenon. That a subject may not always demonstrate a SWI indicates that measurement of the SWI in this study may not be reliable.

As to whether or not the SWI is related to age and intelligence, Koseloff (1957) and Nyssen and Bourdon (1955) find the SWI clinically worthless for discriminating normal

subjects from the mentally defective, senile, paretic dementia, oliogophrenic, or brain-damaged subjects.

Statistics

Simple and partial correlation coefficients were computed to analyze the data. Since the SRA test used consisted of two levels with different numbers of items, the influence of grade on SRA scores was controlled by subtracting the SRA variance accounted for by grade, from the total variance accounted for in correlation of SRA with any other variable.

Since grade and stage (of animistic thinking) are both variables indicating a subject's membership in a category (nominal variables), they were encoded as dummy variables in a regression equation, with SRA as the dependent variable. The procedure allowed for the computation of correlation coefficients on data which were not appropriate for Pearson's correlation technique. The Statistical Package for Social Sciences (SPSS) computer program (Nie et al., 1975) was used to compute the results.

A regression equation was set up with SRA the dependent variable; grade, age, and stage of animistic thinking (or SWI for H_4) were then added, in that order. This procedure allowed for control first, of the effect of grade level on SRA, then of the effect of age over what was accounted for by grade. The variance of SRA accounted for by stage (or SWI), over and above or after controlling for grade and age,

was obtained by subtracting the variance of SRA, accounted for by grade and age, from the total variance of SRA accounted for by age, grade, and stage (or SWI).

Two things must be pointed out with regard to the animism scale. First, only three stages of response were used; no subjects in the sample gave a Stage 0 (incomprehension or refusal) response. Therefore, Stage 0 was left out in the analysis of results. Secondly, on the animism scale, a low score indicates more animistic thinking than a high score, so a statistically positive correlation between measures of animistic thinking and school achievement would actually indicate a negative relationship between the variables. With regard to Hypotheses 1, 2, and 5, therefore, the relationship should be negative, but positive statistical correlations should be obtained, due to numbering the stages of animistic thinking in reverse order.

CHAPTER IV

RESULTS

This section presents statistical analyses of the data obtained from the subjects. Table I shows the means and standard deviations for each variable and indicates the range and variability of the scores. Table II presents the correlations and illustrates the relationships among the variables in the study, which may be of interest to the reader in interpreting the results of the research. The simple or adjusted correlations will be presented separately for each variable.

TABLE I

MEANS AND STANDARD DEVIATIONS FOR VARIABLES IN THE STUDY

Variable	Mean	Std Dev.
Stage	1.9333	0.8235
SWI	51.1524	11.5947
SRA	118.2857	27.0568
Grade	2.0000	0.8204
Age	97.8476	11.0173

TABLE II

MATRIX OF ZERO-ORDER CORRELATIONS

	Stage	SWI	SRA	Grade	Age
Stage	1.0000	0.1491	0.2809	0.2277	0.1430
SWI	0.1491	1.0000	0.2173	0.1021	0.0904
SRA	0.2809	0.2173	1.0000	0.1287	0.0164
Grade	0.2277	0.1021	0.1287	1.0000	0.9149
Age	0.1430	0.0904	0.0164	0.9149	1.0000

H_1: Animistic thinking is negatively related to age.

The statistical correlation between stage of animistic thinking and age is .1529. The correlation between age and stage is the Multiple R of a regression equation with age as the dependent variable and stage the independent variable, coded as dummy variables. The F ratio of 1.2213 (df 2,102) does not reach the tabled value for significance at the .05 level of probability. Hypothesis number one is not supported by the results.

The above statistical method indicates no significant relationship between age and stage. However, Table III shows a frequency count of more children in grade one displaying Stage 1 of animistic thinking than any other group. As the grade (and thus age, since age and grade are correlated r = .9149) goes up, there are fewer students showing

Stage 1 thinking and more showing Stage 3 thinking. Caution must be exercised when discussing observed frequency data which are statistically non-significant.

TABLE III

NUMBER OF SUBJECTS IN EACH STAGE FOR EACH GRADE

	Grade		
Stage	1	2	3
1	17	12	10
2	12	12	10
3	6	11	15

H_2: Animistic thinking is negatively related to school achievement, even after controlling for age.

The obtained correlation for H_2 is .268. This correlation coefficient is the result of applying the formula

$$\sqrt{R^2_{y \cdot 1,2,\ldots k_1} - R^2_{y \cdot 1,2,\ldots k_2}}$$

to the R^2's of regression equations

$$R_{SRA \cdot GRADE,\ AGE,\ STAGE} \quad (R^2 = .15236)$$

and

$$R_{SRA \cdot GRADE,\ AGE} \quad (R^2 = .08049)$$

The F ratio of 4.197 (df 2,99), not computed for this partial by the SPSS program, was computed with the formula

$$F = \frac{(R^2_{y \cdot 1,2,\ldots k_1} - R^2_{y \cdot 1,2,\ldots k_2}) / (k_1 - k_2)}{(1-R^2_{y \cdot 1,2,\ldots k_1}) / (N - k_1 - 1)}$$

(Kerlinger, 1973, p. 71).

The result is higher than the tabled value of 3.94 for the .05 level of significance; thus Hypothesis two is supported.

As explained in the Statistics section of Chapter III, a statistically positive correlation between measures of animistic thinking and SRA scores (and age also) would actually indicate a negative relationship between variables, as the stages of animism are numbered so that a score of one indicates the most animism; a score of three, the least. Also, with the omission of Stage 0, the degrees of freedom are figured for one less group than the animism scale allowed for.

H_3: The size-weight illusion is positively related to age.

The correlation coefficient obtained is .0904. The P of .18 is greater than .05, the value required for significance, and so Hypothesis three is not supported.

Unlike Table III, which shows an increase in frequency of Stage 3 thinking (and a decrease in Stage 1 thinking)

with increasing grade level, a breakdown of mean SWI by grade does not show a linear increase in SWI with increase in grade (and thus age), as Table IV shows.

TABLE IV

MEAN SWI SCORES FOR EACH GRADE

Grade	Mean SWI
1	61.9 g
2	49.42 g
3	54 g

H_4: The size-weight illusion is positively related to school achievement, even after controlling for age.

The correlation of the size-weight illusion and the SRA, after controlling for age, is .2077. This correlation coefficient was obtained using the same formulas as were used in Hypothesis two, to the R^2's of the regression equations

$$R_{SRA \cdot SWI,\ GRADE,\ AGE} \quad (R^2 = .12362)$$

and

$$R_{SRA \cdot GRADE,\ AGE} \quad (R^2 = .08049)$$

The F ratio of 4.92138 (df 1,100) is larger than the tabled value for .05 level of significance; thus Hypothesis four is supported.

H_5: Animistic thinking is negatively related to the size-weight illusion.

The obtained correlation for this hypothesis is .2381. This correlation coefficient is the multiple R of a regression equation with SWI as the dependent variable and stage coded as dummy variables. The tabled value for a significant F at .05 is 3.09, which is slightly higher than the obtained F ratio of 3.06429 (df 2,102). Thus Hypothesis five is not supported.

CHAPTER V

DISCUSSION

Some educators have claimed that children lose certain mental abilities with cognitive development, and that learning in the verbal-logical mode is one cause of the loss. This phenomenon may be understood within a dualistic model, in which there is a primary process--not subject to the restrictions of logic and defined here as animistic and not susceptible to the size-weight illusion--as well as a secondary process, which is characterized by language and logic. Skills of the secondary process are learned by the child through social interaction, as well as through formal instruction in reading, writing, and arithmetic. The secondary process dominates and suppresses the primary process.

It was hypothesized that age is negatively related to animistic thinking (as measured by the test of Laurendeau and Pinard) and positively related to the size-weight illusion (as measured by the size-weight illusion test of Pearl), indicating that children may have some mental abilities which are lost as they get older. It was also hypothesized that school achievement in the verbal-logical skills of reading, writing, and arithmetic (as measured by

the SRA Assessment Survey) is negatively related to both measures of the primary process (animistic thinking and the size-weight illusion), after controlling for age; this would suggest that learning in the secondary process interferes with the primary process. Finally, it was hypothesized that animistic thinking and the size-weight illusion are negatively related, which would indicate that there is a unified group of mental abilities which can be regarded as part of the same primary process. To test these hypotheses, test results on the SRA, the size-weight illusion test, and the animistic thinking scale were obtained from 105 first, second, and third graders (35 subjects from each grade); results were analyzed with correlation and multiple regression techniques.

That age is not significantly related to stage of animism may initially suggest that there is no transition from a lower to a higher stage as children get older. This result contradicts that of Torrance (1972), who found a significant difference between fourth graders and sixth graders. However, Torrance used older subjects and a different statistical tool and focused on the impact of culture and socioeconomic status on causal thinking. Smeets (1974) found that the attribution of life and life traits was dependent on an interaction of mental age and chronological age, neither variable alone accounting for the subjects' responses. The statistical procedure was one of testing the difference in performance for selected groups

of normal and retarded children. And, as mentioned earlier, Piaget has said that age itself is unimportant in determining stage of cognitive development, while experience is crucial. Since no significant relationship between age and stage was found in this study, there must be other factors involved in the development of thinking and the shift in mode of thought.

School achievement is negatively related to animistic thinking, and so these results are consistent with the theory that verbal-logical learning is involved in the loss of the primary process. Nevertheless, there is still some room to doubt the theory. Lack of longitudinal studies, incidence of animistic thinking in adults, and lack of age as a significant variable permit the interpretation that animistic thinking is a matter of individual cognitive style. A person may consistently display a preference for one mode or the other throughout his life. This does not seem likely, however, considering the evidence for malleability in the development of the mind presented in Chapter II.

The results for Hypotheses three, four, and five may all be suspect. First, there is Koseloff's research, showing measurement of the size-weight illusion to be unreliable. More important is this author's suspicion that the weight-judging tasks presented to the subjects, together with the basic instructions (i.e., to place the large bottle in the line of small bottles so that the one

to the left weighed less, and the one to the right weighed more) were not understood by many of the students. Sometimes a child would place the large bottle in the line, without making a comparison of weight with any of the small bottles; some children only made a few comparisons and placed the bottles in the line near bottles they had not lifted. Extra explanations and directions were provided in the manner of asking the child to pick up and to feel several of the weights and then to judge which felt heavier.

The mean SWI scores for each grade (Table IV) do not show an increase as grade goes up, whereas there is an increase in Stage 3 thinking and a decrease in Stage 1 thinking as grade goes up. Thus, using animism as the operational definition of the primary process fits the model better than SWI. Because of the problems mentioned above, the results for Hypothesis four may not be reliable evidence to support the model, even though SWI has about the same relationship to school achievement as animism. Since Hypothesis five is not significant, one might theorize that the primary process is more accurately a composite of independent factors, but one cannot assume the results of the SWI test to be meaningful.

Animism, allowing for anything to be alive, is in contradiction to the conclusions of scientific biology; exactly what it means to be alive is still open to debate, at any rate. Likewise, animistic thinking and school achievement are negatively related; the low correlation may

be interpreted to mean that the two modes are slightly, but not totally, in conflict. Also, there are other still unidentified variables which may account for variance in each mode. As with many human behaviors, animistic thinking may be interpreted to be the product of both modes of functioning. First, the child uses the right hemisphere, specialized in simultaneous processing and closure upon wholeness of perceptions. When the child--who has not yet fully mastered language and logic--expresses his perceptions and ideas, he resorts to precausalism, which is contrary to logic, but reflects percepts of unity and wholeness in references to all things being oriented to a single purpose by a single source. Likewise, the concept of a unified universe could be one way by which a right hemisphere perception is imperfectly, but usefully, expressed through the left hemisphere's verbal language.

Since results show that a primary-grade child in a public school that is high in school achievement is likely to be low in animistic thinking, the implications from the model of avoiding conceptualization when using the primary process and providing activities to help develop the primary process are in order. Since age is not significantly related, there is no basis for delaying formal education. An experimental study may show whether or not teaching of the 3 R's does, in fact, result in less ability to use the right hemisphere functions; the effects of simply not exercising the primary process should be controlled for, to

eliminate lack of experience as the cause of the loss of an ability. It would also be useful to determine if activities designed to promote primary processing skills do lead to improved mental health, heightened problem-solving ability, and deeper understanding of such subjects as relativity, which are not easily conceptualized.

The appropriateness of the simple dualistic model for classifying and explaining the relationships between abilities may be further explored. Some of the results of this research are consistent with the model of Ornstein; however, other than school achievement, there are still variables--yet unidentified--which may account for more of the variance. More recent research indicates that the lateralization of hemispheric function is less prevalent in women than men, suggesting that the two modes may be negatively related only in male subjects. Also, each mode may be composed of several independent subabilities: within the SRA, reading, writing, and arithmetic may not all relate to stage of animism to the same extent or in the same direction. Some evidence indicates that arithmetic is a right hemisphere function, at least in part. It may be useful to consider the relative contribution of each mode to a given behavioral outcome.

LITERATURE CITED

Berzonsky, Michael D. "A Factor-Analytic Investigation of Child Animism." Journal of Genetic Psychology, 122 (1973), 287-295.

Bettelheim, Bruno. The Uses of Enchantment. New York: Alfred A. Knopf, 1976.

Biehler, Robert F. Psychology Applied to Teaching. Boston: Houghton Mifflin, 1974.

Bredsford, Vernon. Primitive Philosophy. London: John Bale, Sons, Danielsson, 1935.

Brown, Daniel J. "Down with the Linear Model." American Educational Research Journal, 12 (Fall, 1975), 491-505.

Bruner, Jerome, and Leo Postman. "On the Perception of Incongruity: A Paradigm." Journal of Personality, 18 (1949), 206-223.

Buros, Oscar Krisen. The Eighth Mental Measurements Yearbook. New Jersey: Gryphon, 1970.

Canfield, Jack, and Paula Klimek. "Education in a New Age." New Age, 3 (February, 1978), 27-39.

Capra, Fritjof. The Tao of Physics. Berkeley: Shambhala, 1975.

Cohen, Yehudi. Personal quote, 1971. Appeared in "Anthropological Approaches to Comparative Education," Vandra Masemann. Comparative Education Review, 20 (October, 1976), 368-380.

Dennis, W. "Animism and Related Tendencies in Hopi Children." Journal of Abnormal Social Psychology, 38 (1943), 21-36.

Doob, Leonard W. "Eidetic Images of the Ibo." Ethnology, 3 (1964), 357-363.

Foulkes, David. "Dreams of Innocence." Psychology Today, 12 (December, 1978), 78-88.

Galin, David. "Educating Both Halves of the Brain." Childhood Education, 53 (October, 1976), 17-20.

Giray, Erol, Jr., and Allan G. Barclay. "Eidetic Imagery: Longitudinal Results in Brain-Damaged Children." American Journal of Mental Deficiency, 82 (1977), 311-314.

Goleman, Daniel. "Split-Brain Psychology: Fad of the Year." Psychology Today, 11 (October, 1977), 89-90.

Haber, Ralph N., and Ruth B. Haber. "Eidetic Imagery I: Frequency." Perceptual and Motor Skills, 19 (1964), 131-138.

Harriman, Philip L. Handbook of Psychological Terms. New Jersey: Littlefield, Adams, 1969.

Huang, I., and H. W. Lee. "Experimental Analysis of Child Animism." Journal of Genetic Psychology, 66 (1945), 69-74.

Jaynes, Julian. The Origin of Consciousness in the Breakdown of the Bicameral Mind. Boston: Houghton Mifflin, 1976.

Jung, C. G. Psyche and Symbol. New York: Bollingen Foundation, 1958.

_____. Memories, Dreams, and Reflections. New York: Vintage, 1961.

_____. Man and His Symbols. London: Aldus Books, 1964.

Kerlinger, Fred N., and Elazer J. Pedhazur. Multiple Regression in Behavioral Research. New York: Holt, Rinehart, and Winston, 1973.

Klingensmith, S. W. "Child Animism: What the Child Means by 'Alive.'" Child Development, 24 (March, 1953), 200-201.

Koseloff, Paul. "Studies in the Perception of Heaviness." Nordic Psykologie 9 (1957), 184-194.

_____. "Studies in the Perception of Heaviness, II." Acta Psychologica 14 (1958), 109-130.

Laurendeau, M., and A. Pinard. Causal Thinking in the Child. New York: International Universities Press, 1962.

Looft, William R., and Don C. Charles. "Modification of the Life Concept in Children." Developmental Psychology, 1 (1969), 445.

Margand, Nancy Adele. "The Influence of Perceptual and Semantic Features on Children's Use of the Animate Concept." Dissertation Abstracts International, 1975 (University of Virginia).

May, Rollo. Love and Will. New York: Delta, 1969.

McDougall, A. M. Body and Mind. London: Methuen, 1928.

McNew, Barbara Reynard. "The Measurement of Animism Across Three Experimental Tasks." Dissertation Abstracts International, 1973 (Louisiana State University).

Mead, Margaret. "An Investigation of the Thoughts of Primitive Children With Special Reference to Animism." Journal of the Royal Anthropological Institute of Great Britain and Ireland, 62 (1932), 173-190.

Mikulak, Ann T. "A Note on Piaget's Animism." Journal of Experimental Education, 38 (Spring, 1970), 59-60.

Mundy-Castle, A. C. "Pictorial Depth Perception in Ghanaian Children." International Journal of Psychology, 1 (1966), 290-300.

Nie, Norman H., et al. Statistical Package for the Social Sciences. New York: McGraw-Hill, 1975.

Nyssen, R., and J. Bourdon. "Contribution to the Study of the Size-Weight Illusion by the Method of P. Koseloff." Acta Psychologica, 11 (1955), 467-474.

_____, and J. Bourdon. "A New Contribution to the Experimental Study of the Size-Weight Illusion." Acta Psychologica, 12 (1956), 157-173.

Ornstein, Robert E. The Psychology of Consciousness. San Francisco: W. H. Freeman, 1972.

Pearl, Joseph. "The Effects of Marijuana on Human Cognition." Dissertation Abstracts International, 1972, (University of Michigan).

Pearce, Joseph Chilton. Magical Child. New York: E. P. Dutton, 1977.

Piaget, Jean. The Child's Conception of the World. London: Routledge and Kegan Paul, 1929.

Piaget, Jean. The Child's Conception of Physical Causality. London: Routledge and Kegan Paul, 1930.

Priestley, J. B. Man and Time. New York: Dell, 1964.

Radin, Paul. Primitive Man as Philosopher. New York: Dover Publications, 1927.

Rennels, Max R. "Help--My Eyes are Melting!" Viewpoints, 58 (May, 1977), 688-692.

Rimland, Bernard. "Inside the Mind of the Artistic Savant." Psychology Today, 12 (August, 1978), 68-80.

Rivers, W. H. Medicine, Magic, and Religion. New York: Harcourt, Brace, 1924.

Sagan, Carl. The Dragons of Eden. New York: Random House, 1977.

Sahakian, William S., ed. Psychology of Personality: Readings in Theory. Chicago: Rand McNally, 1974.

Samuels, Mike. Seeing With the Mind's Eye. New York: Random House, 1975.

Segall, M. H. "Cultural Differences in the Perception of Geometric Illusions." Science, 139 (1963), 769-771.

Silverstone, Jonathan. "In Print." Agenda, 1 (June, 1978), 19-20.

Smeets, Paul M. "The Animism Controversy Revisited: A Probability Analysis." Journal of Genetic Psychology, 123 (1973), 219-225.

_____. "The Influence of MA and CA on the Attribution of Life and Life Traits to Animate and Inanimate Objects." Journal of Genetic Psychology, 124 (1974), 17-27.

Stern, Harris Weil. "Animistic Thinking in Children." Dissertation Abstracts, 1966 (Duke University).

Toffler, Alvin. Future Shock. New York: Random House, 1970.

Tomlinson-Keasy, C., and Charles Blake Keasy. "Long-Term Cultural Change in Cognitive Development." Perceptual and Motor Skills, 35 (1972), 135-139.

Torrance, E. P. "The Development of Causal Thinking of Children in Mexico and the United States." Journal of Cross-Cultural Psychology, 3 (September, 1972), 315-320.

Tyler, Stephen A. Cognitive Anthropology. New York: Holt, Rinehart, and Winston, 1969.

Wagshal, Harry. "Education and the New Consciousness Literature." Comparative Education Review, 18 (1974), 129-133.

Werber, Morton, and David J. King. "An Investigation of the Response Mechanism of the Size-Weight Illusion." Journal of General Psychology, 66 (1962), 85-100.

APPENDIX

RAW SCORES

GRADE 1

Subject	Age in Months	Stage	SRA	SWI in Grams
1	83	1	112	50
2	89	1	80	16
3	85	2	84	62
4	82	1	128	56
5	83	1	82	60
6	83	2	132	48
7	81	3	79	59
8	90	2	119	41
9	90	1	144	46
10	90	1	72	55
11	84	1	122	42
12	96	1	117	59
13	94	2	109	61
14	89	2	122	46
15	80	3	148	48
16	81	1	65	43
17	88	1	152	57
18	88	2	120	60
19	85	2	105	60
20	84	2	112	46
21	80	1	126	13
22	80	2	116	62
23	79	1	111	42
24	78	1	123	59
25	83	1	141	55
26	88	1	121	56
27	91	3	103	43
28	83	3	111	49

Subject	Age in Months	Stage	SRA	SWI in Grams
29	83	2	103	56
30	89	3	118	58
31	85	2	83	43
32	91	3	110	54
33	85	1	132	57
34	82	1	140	57
35	91	3	140	50

GRADE 2

Subject	Age in Months	Stage	SRA	SWI in Grams
1	97	2	129	56
2	94	2	70	22
3	94	3	129	3
4	106	1	51	29
5	104	1	85	38
6	95	2	134	60
7	96	2	136	52
8	96	1	155	62
9	98	3	156	62
10	95	3	126	55
11	100	3	148	22
12	94	2	153	67
13	104	1	53	52
14	91	1	101	44
15	101	2	157	61
16	95	3	139	57
17	93	3	134	48
18	109	1	82	59
19	93	1	138	34
20	98	1	115	53
21	92	1	89	42
22	96	3	156	61
23	103	2	75	50
24	103	3	98	40
25	101	3	151	60
26	97	3	118	54
27	99	1	78	60
28	96	2	134	58

Subject	Age in Months	Stage	SRA	SWI in Grams
29	98	3	115	61
30	102	2	149	60
31	100	2	139	51
32	90	1	117	59
33	96	2	122	58
34	102	2	157	60
35	100	1	98	22

GRADE 3

Subject	Age in Months	Stage	SRA	SWI in Grams
1	114	1	126	34
2	110	2	155	52
3	109	1	119	53
4	112	1	68	57
5	108	2	123	45
6	118	1	66	40
7	112	2	146	60
8	102	3	79	61
9	112	2	119	60
10	122	1	56	58
11	111	2	152	55
12	106	2	117	47
13	107	3	127	45
14	104	3	136	57
15	105	3	140	55
16	106	3	129	54
17	119	1	88	37
18	104	2	126	53
19	113	3	136	61
20	108	2	125	54
21	106	2	137	59
22	113	3	95	60
23	105	3	140	61
24	108	3	155	51
25	111	3	146	57
26	108	3	84	61
27	118	3	120	60
28	109	2	134	57

Subject	Age in Months	Stage	SRA	SWI in Grams
29	111	2	156	61
30	113	1	97	57
31	108	3	117	42
32	113	1	134	60
33	110	2	127	53
34	112	1	144	40
35	106	1	151	53

VITA[2]

Donald Reed Austin

Candidate for the Degree of

Doctor of Education

Thesis: THE RELATIONSHIP OF SCHOOL ACHIEVEMENT TO ANIMISTIC THINKING AND THE SIZE-WEIGHT ILLUSION IN GRADES ONE, TWO, AND THREE

Major Field: Educational Psychology

Biographical:

Personal Data: Born in Honolulu, Hawaii, January 15, 1951, the son of Dr. and Mrs. Frank H. Austin.

Education: Graduated from Eisenhower High School, Lawton, Oklahoma, in June, 1969; received Bachelor of Science degree in Psychology from Southwestern Oklahoma State University, Weatherford, Oklahoma, in May, 1973; received Master of Science degree in Educational Psychology at Oklahoma State University, Stillwater, Oklahoma, in May, 1976; completed requirements for Doctor of Education degree at Oklahoma State University in December, 1979.

Professional Experience: Graduate Teaching Assistant, Applied Behavioral Studies in Education, Oklahoma State University, 1975-76; School Psychologist Intern, Bi-State Mental Health Foundation, Ponca City, Oklahoma, 1976-78; Psychological Examiner, Ozark Guidance Center, Springdale, Arkansas, 1978-80.

Professional Organizations: Oklahoma School Psychological Association (OSPA); National Association of School Psychologists; Arkansas Advocates for Children and Families.