The Effects of Aerobic Exercise on Anxiety in Pregnant Women

Janet L. Fourman

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THE EFFECTS OF AEROBIC EXERCISE ON ANXIETY IN PREGNANT WOMEN

by

Janet L. Fourman

A Dissertation
Submitted to the
Faculty of The Graduate College
in partial fulfillment of the requirements for the Degree of Doctor of Education
Department of Educational Leadership

Western Michigan University
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April 1988
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ACKNOWLEDGEMENTS

I would like to dedicate this dissertation to Gary and BJ. Both sacrificed much so that I could complete my education.
I would also like to express deep appreciation to the staff at the Borgess Fitness Center.

Janet L. Fourman
# TABLE OF CONTENTS

ACKNOWLEDGEMENTS .............................................................. ii
LIST OF TABLES ........................................................................ vi

CHAPTER

I. INTRODUCTION ................................................................. 1
   Operational Definitions .................................................. 5
   Research Objectives ..................................................... 6
   Conceptual Framework .................................................. 6
   Limitations ...................................................................... 8
   Overview of the Dissertation ....................................... 8

II. REVIEW OF THE LITERATURE ............................................. 9
   Biophysical Domain ..................................................... 9
   Cognitive Domain ....................................................... 25
   Social Domain ........................................................... 50
   Affective Domain ........................................................ 77
   Research Hypothesis ..................................................... 92

III. STUDY DESIGN ................................................................. 93
   Subjects ............................................................................. 95
   Internal Validity ............................................................ 96
   External Validity ............................................................ 97
   Instrumentation ............................................................. 100
   Data Analysis ............................................................... 102
   Paired-Sample t Test ..................................................... 103
   Chi-Square ................................................................. 103

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Table of Contents—Continued

CHAPTER

Summary ................................................................. 104

IV. ANALYSIS OF DATA ............................................... 106
Data Collection .......................................................... 106
Frequency Distributions .............................................. 107
Subjects ....................................................................... 107
Trait Anxiety Scores .................................................... 107
Research Hypothesis .................................................... 118
Demographic Hypothesis ............................................. 120
Summary ....................................................................... 121

V. CONCLUSIONS AND RECOMMENDATIONS ..................... 123
Summary of the Results ................................................ 123
Research Hypothesis ..................................................... 123
Demographic Hypothesis .............................................. 124
Interpretation of the Results ........................................ 124
Research Hypothesis ..................................................... 124
Demographic Hypothesis .............................................. 125
Implications of the Study ............................................. 126
Recommendations for Future Research ............................ 127
Summary ....................................................................... 127

APPENDICES ................................................................. 129

A. Letter of Protocol Confirmation ................................. 130
Table of Contents—Continued

APPENDICES

B. Subject Consent Letter ............................................. 132
C. Permission to Reproduce State-Trait Anxiety Inventory 134
D. State-Trait Anxiety Inventory (Trait Portion) ........ 136
E. Demographic Survey .................................................. 138

BIBLIOGRAPHY ................................................................. 142
LIST OF TABLES

1. Subjects by Group ......................................................... 107
2. Pretest Anxiety Score Frequencies ................................. 108
3. Posttest Anxiety Score Frequencies ............................... 110
4. Age Frequencies .......................................................... 112
5. Occupational Frequencies ............................................. 112
6. Income Frequencies ...................................................... 113
7. General Physical Health Frequencies ............................. 114
8. General Mental Health Frequencies ............................... 115
9. Education Frequencies .................................................. 115
10. Lifestyle Frequencies ................................................... 116
11. Previous Exercise History Frequencies ......................... 117
12. Pre- and Posttest Trait Anxiety Scores for All Groups: ANOVA ......................................................... 119
13. Posttest Trait Anxiety Scores for All Groups: (ANOVA) .. 119
14. Pregnancy Fitness (X) and New Beginnings (C1) Pre- and Posttest Trait Anxiety Scores: Paired-Sample t-Test .......................................................... 120
15. Crosstabulation of Trait Anxiety Scores by Variables in Demographic Survey: Chi-Square Values ......................... 121
CHAPTER I

INTRODUCTION

According to Hippie (1974), the educational system has evolved slowly. But because education is such a cornerstone of the American ethos, educators must accept the "change-as-progress" sentiment of our society. The relationship is reciprocal: to change our society, we will have to change our schools (Hipple, 1974).

But in what direction will this change take place? According to Wagschal (1979), American education over the next 30 to 50 years will extend the range of its clientele. Children will go to public schools at earlier ages, and adults will come back to school to finish degrees, or pursue training in skills for new jobs. The idea of "birth-to-death education" will become more and more of a reality.

The idea of children going to school at earlier ages is of interest to the author of this paper. The 1980's is not the only period of time when radical changes in preschool education have taken place. During the years 1830-1865, academies and colleges experienced dramatic growth and entirely new forms of education appeared. Not only were there efforts to meet the needs of the school-age population; considerable attention was also devoted to preschoolers and adults (Binder, 1974).

The father of the kindergarten movement was a German named Friedrich Froebel (1782-1852). Froebel felt that it was the school's responsibility to develop man's spirit and to make him aware of it.
(Binder, 1974). Froebel strongly urged this process begin in early childhood. The child of three or four, Froebel insisted, acquires knowledge in a natural way through playing games and manipulating objects. According to Froebel, the ball, for example, was not only a plaything but a teacher of numerous concepts of physics. It was Froebel's wish that in the child's garden—the kindergarten—adults would provide the setting and objects of educational value, but the child would be allowed to freely express himself/herself with minimal interference (Binder, 1974).

While the kindergarten movement spread throughout Germany and the rest of Western Europe prior to mid-century, it was virtually unknown in the United States. Educational leaders in the United States were preoccupied with expanding and improving traditional forms of schooling. It was difficult to imagine pragmatic Americans supporting a school in which play and enjoyment were the only observable results (Binder, 1974). As a result, kindergarten would not be accepted as the first rung on the United States' educational ladder until the end of the nineteenth century.

The twentieth century has seen the rise of schooling for children even younger than kindergarten age. Child care centers and nursery schools are now an important part of our cultural ethos. Hippie (1974) claims there will be two types of preschools in the future. For children from low income homes, there will be publicly supported schools with teachers trained to foster cognitive development in children. These teachers will be especially sensitive to the social development of their students but will also be aware
that cognitive development is the principal objective.

For preschool children from middle and upper income homes, there will be a variety of nursery schools where the main emphasis is on the total personal-social development of the children. Cognitive development exercises will be secondary. Some of these schools will be child care centers, for children of working parents, and will be open over a long day. Others will be half day nursery schools for children whose caregivers are at home (Hipple, 1974).

Hipple (1974) also claims education of the young child is just now coming into its own terms of parental demand and government support for it. Child care centers and nursery schools will become an important part of the public school system. Custodial child care and educational programs will be available from infancy to age five for any constituents who wish to take advantage of them.

However, education does not start at infancy. According to Gaines (1981), pregnant women can enhance their child's development in the womb. Gaines (1981) goes on to say that the lifestyle of a pregnant woman can be positive or negative to the developing fetus. The importance of this becomes more apparent as researchers recognize the critical nature of the fetal period of growth and development. The unborn infant is at the mercy of the mother's lifestyle (Gaines, 1981).

Education, including the health-related effects of lifestyles on the unborn, is an essential component of education for responsible human sexuality. Much of this responsibility is in the domain of the health educator (Gaines, 1981).
It is essential that the health educator structure learning experiences related to individual health behaviors so that they are meaningful in terms of behavioral consequences, both positive and negative. These learning experiences need to relate to goals and outcomes that are valued by individuals and society. For example, society values healthy, "normal" infants and children (Gaines, 1981). Modern society abhors abuse and neglect of our offspring. Yet parents are unconsciously denying their fetus optimal development due to lack of knowledge, acceptance of health myths regarding pregnancy, and general lack of awareness of the tremendous impact of the individual's health behavior on the developing human organism (Gaines, 1981).

Gaines (1981) continues her argument for prenatal health education by stating that parent education might be more effective if individuals understand the relation between their behavior and the desired outcome of pregnancy.

Risks are greater for babies born to mothers who smoke, drink, use drugs, have poor nutrition, who lack adequate prenatal care, or who experience situational stresses. These factors have been documented as contributing to medical risks and defective development of the fetus (Gaines, 1981). It is Gaines¹ (1981) opinion that some of the risk factors can be reduced when expectant parents develop positive health behaviors and/or modify behaviors that may prove detrimental to their unborn infant.

In the past decade, the general public has become more conscious of its health behaviors. For example, exercises such as jazzercise
classes, swimming, cross-country skiing, and jogging have been popular forms of cardiovascular fitness. It logically followed that questions about aerobic exercise during pregnancy would arise, and this has indeed been true.

Yet in the past, research done on the effects of exercise during pregnancy has concentrated on physiological outcomes (Dibblee & Graham, 1983; Hauth, Gilstrap, & Widmer, 1982; Platt, Artal, Sernel, Sipos & Kammula, 1983). Psychological aspects of prenatal exercise has gone unnoticed (G.H. McGlynn, Franklin, Lauro, & I.K. McGlynn, 1983). This is ironic because a human's mind and body work together to contribute to total health. A harmonious mind-body combination will benefit the expectant mother as well as her developing child (Verny & Kelly, 1981).

Therefore, this research addressed the problem, what effect does aerobic exercise have on trait anxiety in pregnant women?

Operational Definitions

The concept of trait anxiety is that of a relatively enduring personality characteristic--stress proneness. A person who is defined as being high in trait anxiety is not a person who necessarily shows evidence of high stress at any given time, but is rather a person who is prone to respond to certain specified conditions with stress responses (Buros, 1978). Trait anxiety is measured on the State-Trait Anxiety Inventory (Spielberger, 1983).

In addition, pregnant women who exercise are those in their last trimester of pregnancy who aerobically exercise three days or more
Lastly, aerobic exercise is defined as exercise demanding continuous and steady output from the muscles. Aerobic exercise raises the heart rate to its training rate—80% of maximum. This can be measured by placing fingertips along the thumb side of the wrist or the side of the neck. The pulse is counted for exactly six seconds and was multiplied by 10 (Bailey, 1978).

Research Objectives

1. To determine if aerobic exercise affects trait anxiety in pregnant women.

2. To study the relationship of selected demographic variables and how they relate to trait anxiety. These variables are age, occupation, family income, general physical and mental health, education, lifestyle, and previous exercise history.

Conceptual Framework

According to Schuster and Ashburn (1980), there are four basic domains of human behavior: biophysical, cognitive, affective, and social. The biophysical domain includes every aspect of genetic, chemical, and physical self, from conception until death. The physical self is maintained with adequate nutrition, exercise and stimuli (Schuster & Ashburn, 1980). Schuster and Ashburn (1980) define the cognitive domain as encompassing all aspects involved in perceiving, interpreting, organizing, storing, retrieving, coordinating, and using stimuli received from the internal and
external environments. It also includes creative activities involved in forming new combinations of information in order to adapt to the unique needs of a novel situation. The social domain includes those aspects that identify a person's relationship with society or the culture—roles, affiliations, communication styles, adaptive behaviors, expressions of internal response, and interactional patterns. In other words, the social domain is concerned with the individual's external response to external events, other people, and himself/herself—one's interpersonal relationships (Schuster & Ashburn, 1980). The affective domain encompasses all the emotional aspects of one's self—feelings, values, longings, and stress levels to name a few. This research concentrated on the affective domain of human behavior. All of the emotional aspects of the affective domain are beyond the scope of this paper. Therefore, the author has selected stress levels as the focus. For the purposes of this paper, the term "stress level" will be synonymous with the term "trait anxiety level."

When a person is depressed or emotionally upset, his/her state of mind can affect the functioning of the biophysical domain (Schuster & Ashburn, 1980). For example, many people have changes in appetite after a major confrontation with a roommate or spouse. Similarly, more household and automobile accidents are likely to occur following confrontations. Prolonged stress is physically harmful to all humans (Schuster & Ashburn, 1980). This is especially true when a stressed woman is pregnant, because she is harming not only herself, but her unborn child as well (Verny & Kelly, 1981).
This study investigated the effects of one biophysical variable, level of aerobic exercise, on one affective variable, trait anxiety level, for women in their last trimester of pregnancy.

Limitations

This study was restricted to Kalamazoo, Michigan pregnant women. In addition to this limitation, selection and selection-maturation interaction were threats to internal validity (Campbell & Stanley, 1966). These concerns are addressed in more detail in the research design section of Chapter III. Reasons for the lack of external validity are also addressed in detail in the research design section.

Overview of the Dissertation

Chapter II is a literature review regarding the four basic domains of human behavior. It concludes with the research hypothesis. The research design for this quasi-experimental study was the Solomon Four-Group Design. Chapter III contains a discussion of this design along with the procedures for subject selection, instrument selection, and data analysis. Chapter IV is an analysis of the data and Chapter V presents an interpretation of the findings.
CHAPTER II

REVIEW OF THE LITERATURE

The following literature review addresses four domains: biophysical, cognitive, social and affective. The biophysical domain is discussed first.

Biophysical Domain

The average baby grows about one inch per month for the first six months and increases its length by 50% by the end of the first year (Lowrey, 1978; Marlow, 1977). Weight is another important measurement. The average infant gains close to two pounds per month for the first three months of life (Lowrey, 1978). Most babies have doubled their birth weight by five months. From about the age of six months, the infant's weight gain decreases to one pound per month. The baby should have tripled its birth weight by the end of the first year. During the second year, the normal monthly increment is approximately one-half pound (Lowrey, 1978).

As the infant grows in length and weight, its nervous system is also developing. This development begins early in embryonic life and is not completed until after puberty (Timiras, 1972). Since an in-depth discussion of this process is beyond the scope of this paper, the author will focus here on the functional development of the nervous system.

The human nervous system consists of two major components: the
central nervous system and the peripheral nervous system. The central nervous system, composed of the brain and spinal cord, possesses control of all body functions. The peripheral nervous system consists of both the involuntary and voluntary nervous system, which both carry impulses to and from the central nervous system. Nerve impulses transmitted within the involuntary nervous system control the body's internal organs without conscious control. The voluntary nervous system consists of nerves which carry sensory and motor impulses from the central nervous system. In short, the voluntary nervous system is under conscious control (Schuster & Ashburn, 1980).

Nearly half of the postnatal growth of the brain has been completed by the end of the first year (Lowrey, 1978). Most of the growth occurs in the cerebral cortex which is associated with sensation, motor functioning, and cognitive processes. The brain stem, located at the base of the brain, is well developed at birth compared to the other structures of the central nervous system. The brain stem primarily controls functions such as respiration, digestion, and heartbeat. The cerebellum, located under the cerebrum at the back of the brain, shows a large increase in weight, not only during infancy but throughout the first decade (Lowrey, 1978). The cerebellum coordinates equilibrium and movement. An observer can watch the results of the development of these areas: first, the two-month-old infant lifts its head and chest a short distance above the surface he/she is lying on when placed on its abdomen. About a month later, the infant is able to raise its chest and support itself
on its forearms. At four months the baby takes great delight in lifting its head and shoulders to a 90 degree angle when it is on its abdomen and uses this position to look around and learn more about the world.

Myelinization of the nervous system, which has been occurring since the second half of intrauterine life (Valadian & Porter, 1977), is critical to functioning. A fatty substance called the myelin sheath grows around the nerves of both the central nervous system and the voluntary nervous system. This myelin sheath functions much like the insulation on an electric wire. The coordination of selected neurological and neuromuscular functioning are correlated with the deposition of the myelin sheath.

At birth, the pathways of sensation and equilibrium are myelinated in the brain, as are most of the sensory nerves. However, this does not mean that the neonate will react to a sensation in the same way a neurologically mature individual would. It must be remembered that the underdeveloped motor nerves must mature to develop coordinated voluntary movements. Reflexive behavior is thus normal during early infancy. The corticospinal nerve tract does not acquire myelin until after birth and this process does not approach completion until the toddler stage. This explains why the infant first acquires neurological control of his head and neck, and then his trunk, arms, hands, pelvic girdle, legs, bowel and bladder, and so forth. Some nerve tracts are not completely myelinated until the preschool age. Even after they are fully covered, the myelin sheath will continue to thicken until the elementary years (Lowrey, 1978).
The fibers of the higher centers of the brain are the last to be myelinized.

The central nervous system along with the senses help the infant learn about its world. Researchers now know that the five senses—touch, taste, smell, hearing and vision are operable in the newborn and that these senses develop during the prenatal period. Touch and taste will be discussed first.

It is difficult to verify if the fetus can sense warmth because of constant uterine temperature conditions. In studies of premature infants, it has been found that when these infants reach 28 weeks of gestation age, their reactions to temperature are approximate to the reactions of full-term babies. This suggests that a fetus can also sense temperature differences.

The skin is not the only sensitive area of the developing fetus. The mouth and throat areas are also very sensitive. Taste buds begin to develop in the fetus during the third month. By birth, the infant possesses buds on the hard palate, the tonsils, parts of the esophagus and on the tongue. The taste buds recede to the tongue only in adult life. It is agreed that the fetus can taste the salty amniotic fluid that it lives in. However, the amniotic fluid surrounding the fetus changes so little during pregnancy that the fetus cannot utilize its total taste capabilities while it is in utero.

The fetus is capable of swallowing by the fifth month of development, and will normally begin to swallow small amounts of amniotic fluid. It has been noted that one obstetrician used this
swallowing sensation of the fetus to treat expectant mothers suffering from polyhydraminos (an excess accumulation of fluid within the amniotic sac). The obstetrician injected saccharine directly through the abdominal wall into the amniotic sac. The fetus began immediately to swallow large quantities of the sweetened amniotic fluid, obviously preferring it over the unsweetened fluid. Eventually, much of the excess fluid was returned to the mother as waste product through the placenta. The mother in turn expelled the unwanted fluid through her urinary tract.

Similar to the taste buds, the olfactory region of the brain is reported to be one of the earliest regions to be completely developed in the fetus. It is most likely that the fetus does not use its smell sensors to their fullest due to the composition of the amniotic fluid. Infants who are born one month early are capable of using their smell receptors. When these infants are approached with an unpleasant odor, such as ammonia or acetic acid, they turn away with a facial grimace (Verny & Kelly, 1981).

Similar to the olfactory regions of the brain, the hearing mechanism fully develops in utero. It is not surprising that the mother's heartbeat is the first sound heard by the infant before birth. Research on the significance of the mother's heartbeat has been conducted by Salk (1962). One of his experiments compared the responses of an experimental group of infants exposed constantly to a recording of a heartbeat sound for the first few days of their lives, with the responses of a control group of infants in a quiet hospital nursery.
To measure the effects of exposure to this constant heartbeat sound, Salk (1962) focused upon the infant's weight change, food intake, and amount of crying. Regarding food intake, Salk found no significant difference between the experimental group and the control group. Yet after measuring weight change, Salk concluded that more infants gained weight who were exposed to the heartbeat sound, regardless of their weight at birth. This difference was significant beyond the .002 level. To measure the crying, a tape recorder was stationed in the nursery during the entire experiment. During the heartbeat sounds, in the experimental group, one or more babies were crying 38.4% of the time. In the control group, one or more babies were crying 59.8% of the time. Salk (1962) felt the heartbeat group gained more weight than the control group because they did less crying.

Those attending a conference on "Neonate and Infant Cognition" in New York City had the opportunity to hear what a fetus hears in the amniotic sac. As reported by Pines (1982), an obstetrician from France described an experiment in which he inserted a hydrophone into an expectant mother's uterus shortly before delivery and made a recording of what the hydrophone picked up. It was possible to hear conversation between the doctor and the mother. The words of the conversation were muffled, but the rhythm and tone of their voices were clearly audible. There was also a marked difference between the mother's heavy heartbeat and a variety of "whooshing" noises. One could hear the music the mother was listening to in her hospital room. This music sounded as if a neighbor was playing the recording.
on the other side of a thin apartment wall. From the tape, it was very clear that music and even rhythms of language can be heard by the fetus in utero.

The vision apparatus is less developed at birth since major structural changes, such as differentiation of the visual part of the brain develop after delivery. Yet, cells that comprise the visual mechanism start developing during the third month of gestation and again during the sixth month. In the last months of gestation, the eyes move together with increasing coordination. It is during these last months of pregnancy that the eyes develop to the extent that the light or iris reflex is possible. Within days after birth, a full term infant is capable of tracking a slow moving object. Myelinization is not complete until about four months after birth. The ability to fixate on an object improves steadily until the child is about six years old. "Perfect" 20/20 vision is not achieved until age seven (Schuster & Ashburn, 1980).

It is evident that the senses are functional in the fetus. These senses are capable of receiving and responding to external stimuli. However, without the skeletal system, the infant could not take itself to the sources of the stimuli.

The tissues that compose the muscular and skeletal systems provide structure and allow movement of the infant's growing body. The development of bone, beginning during fetal life, follows a sequence of steps. Cartilage is first deposited and then gradually replaced by mineral salts that aid in the formation of bony tissue. It is important to emphasize here that except for the bones of the
face and cranium (which were formed during fetal life), all other bony structures undergo this gradual growth after birth (Chinn, 1979). If this immature bone is subjected to much trauma, incomplete fractures may result. However, healing in this rapidly growing bone does occur quickly as compared to other phases of the life cycle. While bony tissue is forming, bones continue to grow in length and width and, consequently, change in shape (Schuster & Ashburn, 1980).

Contrary to bone growth, most muscle fiber growth is near completion at birth. In fact, voluntary muscles comprise the bulk of body weight at birth (Lowrey, 1978). Muscle growth is about twice as fast as that of bone during the period of time from five months through three years. During this time, growth hormone, thyroxine, and insulin all play a role in the growth of muscle tissue.

Serving as a covering for bone, muscles, and organs is just one major function of the skin. In addition to its cosmetic function, skin aids in protecting the body from extreme temperatures, excess humidity, bacterial invasion, and other harmful agents. The outer layer of the skin gives the most protection against such elements. During infancy the outer layer of skin (the epidermis) is loosely connected to the layer of skin beneath it (the dermis). As a result, the infant has an increased susceptibility to blistering and chafing (Chinn, 1979). Melanocytes in the skin produce pigmentation that protects a person from harmful sun rays. However, during infancy, the baby's ability to produce pigmentation is limited and thus its sensitivity to the sun is quite high (Valadian & Porter, 1977).

Along with melanocytes in the skin are sweat glands. Adults
have two types of sweat glands (eccrine and apocrine) that secrete perspiration in response to emotional stimuli. The eccrine glands, which produce sweat in response to both thermal and emotional stimuli, are present but not fully functional during early infancy. The apocrine sweat glands (responsible for what is commonly called "body odor") are fully developed at birth but do not begin to function until puberty (Valadian & Porter, 1977). It is important to note here that the body can also lose water by insidious water loss. This occurs when fluids seep from the body into the outermost layers of the epidermis. The fluid evaporates when it reaches this point. As the epidermis matures during the first year of life, the amount of insidious water loss decreases.

The sebaceous glands, which help in covering the newborn with vernix caseosa, are distributed over all of the infant's body except on the palms of its hands and the soles of its feet. The sebaceous glands actively secrete sebum during early infancy and thus lubricate the baby's skin. These glands decrease in activity during childhood and are reactivated during puberty.

Under the skin are blood and blood vessels. Combined with the heart, the three make up the cardiovascular system. This system carries nutrients to and waste products away from every cell in every system of the body.

The heart of the infant will double its weight by its first birthday (Lowrey, 1978). It lies in an almost horizontal position at birth; as the baby grows older, it will shift to a permanent, more vertical position.
When the infant is born, the left and right lower chambers of the heart (ventricles) are the same size. By two months of age, the walls of the left ventricle will become thicker than those of the right ventricle (Valadian & Porter, 1977). This difference in size is critical, since the left ventricle is responsible for pumping blood to the entire body; the right ventricle pumps blood to the lungs. As the total heart increases in size, the heartbeat will slow and the blood pressure will rise.

The small blood capillaries in the infant's body soon play a major role in regulating body temperature. Under the influence of the involuntary nervous system and hormones, these capillaries will contract to conserve body heat and expand to cause heat loss. These abilities are essentially absent at birth. Yet they gradually begin to develop after the first few weeks of extrauterine life (Chinn, 1979).

Another system associated with life-sustaining function is the respiratory system. Although the infant's initial respiratory efforts expand most of the alveoli, not all are expanded until a few days or even a few weeks after birth (Valadian & Porter, 1977). These alveoli increase in numbers and complexity at a rapid rate during infancy (Murray, 1976). The weight of the lungs doubles by six months and triples by one year (Lowrey, 1978).

The infant's more rapid respiratory rate (compared to older children or adults) is due in part to a large amount of "dead air space," or that portion of the airway where air passes but gases are not exchanged (Chinn, 1979). This situation combined with the high
metabolic rate requires that proportionately more air enter and exit
the lungs per minute. The baby is a "nose-breather" during the first
few months of life and then gradually learns to breathe through its
mouth by the third or fourth month (Comroe, 1974).

Certainly, an organism cannot survive without nourishment. At
birth, an infant's gastrointestinal system is ready to ingest and
digest breast milk or its equivalent. With further development, the
gastrointestinal system is capable of digesting a wide variety of
different-textured foods.

Since food normally enters the body through the mouth,
discussion of the gastrointestinal system will start there.
Salivation is adequate at birth to maintain sufficient moisture in
the infant's mouth. However, maturation of many of the salivary
glands does not occur until three months of age, and corresponds with
the infants's learning to swallow at other than a reflex level. The
result is an increase in the baby's drooling (Schuster & Ashburn,
1980).

Swallowing, sucking, and respiration are activities that require
coordination. These functions are adequately developed in the
full-term baby. Nevertheless, the infant must learn to interrupt
sucking and breathing when it is swallowing.

Initially, the baby manipulates all foods placed in its mouth
the same way that it manipulates the nipple. This forward-thrusting
movement of the tongue may be misinterpreted by many caregivers as an
indication of dislike for solid foods. At about four to five months
the infant learns to move solid foods back into its mouth with its
tongue. At about six to eight months of age, control of lateral jaw movement increases, allowing the baby to begin a chewing movement when eating food (Schuster & Ashburn, 1980).

The esophagus of the newborn differs from that of the adult in that the tone of the lower esophageal sphincter is poor, accounting for frequent "spitting up" of foods. The infant's stomach lies somewhat lengthwise in comparison to the permanent position it will assume when he/she is older. The first three months of life mark the most rapid growth period for the stomach. By the age of one month, the stomach capacity is generally three to five ounces, and at one year of age, seven to 12 ounces (Lowrey, 1978). The rate at which the stomach empties varies among individual infants. Factors relating to the speed with which the stomach empties include the following: state of the baby's health; degree of hunger when it is fed; how the baby is positioned; amount of handling during feeding; content of the feeding; tenseness of the caregiver; environmental conditions; and temperature of the feeding (Davidson, 1973).

Gastric (stomach) digestion occurs primarily as a result of the secretion of hydrochloric acid and pepsin, both of which aid in the breakdown of protein. However, this ability is relatively limited throughout infancy. As a result, many doctors are advising delay of the introduction of solids until the second half of the first year of life (Schuster & Ashburn, 1980).

Most of the digestion and absorption of food occurs in the small intestine, which increases its length by 50% during the first year. Pancreatic secretions composed of three enzymes (trypsin, lipase, and
pancreatic amylases) are released into this intestine. Infant levels of trypsin, which further breaks down the partially digested proteins that travel from the stomach, are equal in amount to adult levels. Pancreatic amylase, which digests starch, is secreted at three months of age. Lipase, which breaks down fats, also reaches adult levels at three months. However, this does not mean the infant is capable of digesting all fats by this age. Lipase needs mature bile secreted from the liver and stored in the gallbladder to aid in fat digestion. By one year of age, the lipase and bile are working together well enough to approximate adult fat digestion. Polyunsaturated fats are more easily absorbed than saturated fats during the first year of life (Fomon, 1974).

Although some water is absorbed in the small intestine, a much greater amount is absorbed into the bloodstream by the walls of the large intestine. Since intestinal contents move rapidly through the complete gastrointestinal tract, and since the large intestine is initially immature in water absorption, the baby's stools during the first year of life contain more water and are consequently looser. This biophysical fact combined with the introduction of more adult foods to the infant's diet contribute to the stools becoming more formed and solid in consistency around one year. While the neonate may have a bowel movement after each feeding, during later infancy the frequency may range from three to six stools per day (Gryboski, 1977). As the baby gets older, his/her ability to retain stools between feedings improves. In addition to absorption of water, and storage of fecal material, the large intestine plays an important
role in the synthesis and absorption of vitamin K, essential for optimal development.

Along with the large intestine, other excretory organs include the kidneys, ureters, bladder, and urethra. The kidneys, which are responsible for filtering wastes from the blood, function in an immature way during the first few weeks of extrauterine life. However, they adequately meet the infant's needs. Urine formation involves many factors: among these are the reabsorption and secretion powers of the kidney tubules and the filtering capacity of the kidney epithelium (McCrory, 1968). Although the tubules are short and narrow at birth, by six months they closely approximate adult size (Valadian, & Porter, 1977). Although, kidney epithelium is very thick and therefore less efficient in filtration when the infant is born, it gradually becomes thinner throughout infancy. Thus, the neonate's ability to concentrate urine is less well developed than the adult's. Consequently, since more urine must pass through the kidneys, the infant's fluid needs are relatively greater than the adult's.

Nevertheless, if an infant is given an overload of fluid, the kidneys are unable to respond adequately by increasing urinary output (Lowrey, 1978). Consequently, an infant can become overhydrated if it is given too much fluid. After one month of age a more efficient response is possible. At this time, the urine volume will begin to increase as the baby's total body grows in size. Urine volume is affected by the amount of fluid ingested; the amount of activity (more activity, less urine); and the environmental temperature.
The last biophysical system which will be discussed is the endocrine system. This system is composed of a number of glandular structures that are found throughout the body. These ductless glands secrete hormones directly into the bloodstream to affect the functioning of organs in various parts of the body. Even though mature hormonal control of physiological functions by the endocrine system is not achieved during infancy (Chinn, 1979) the glandular structures are functioning. The pituitary body, composed of an anterior and posterior lobe, produce several hormones. Most important during later infancy is the production of pituitary growth hormone. This hormone, produced by the anterior lobe, aids in the control of skeletal growth as well as the metabolism of protein, fats, and carbohydrates (Lowrey, 1978).

The pituitary body also produces two other hormones: adrenocorticotropin hormone, secreted by the anterior pituitary, and antidiuretic hormone, produced by the posterior pituitary. The functions of these hormones are somewhat limited during infancy. Adrenocorticotropin hormone stimulates the adrenal glands to produce hormones, affecting the metabolism of glucose, fat, and protein. Antidiuretic hormone inhibits the extra flow of water from the body through the kidney tubules, but since the kidneys do not respond well to this hormone during infancy, the urine contains more water and is therefore more dilute (Schuster & Ashburn, 1980).

The thyroid gland secretes and stores the thyroid hormones, which are responsible for tissue respiration rate and other metabolic...
processes. Thyroid function is mature at birth (Lowrey, 1978). If the thyroid gland produces too much hormone, the individual will experience the symptoms of a rapid metabolism. When the thyroid gland produces too little hormone, the effects on the baby's growth and development are significant. A deficit of thyroid hormones pre and postnatally affects skeletal maturation and central nervous system development. The mental deficiency that results from such a deficit is partially reversible if hormone therapy is initiated before six months of age (Valadian & Porter, 1977).

The parathyroid glands, located in the neck near the thyroid gland, produce hormones that act with Vitamin D to regulate calcium and phosphorus metabolism—both vital to bone growth and development (Schuster & Ashburn, 1980).

The size of the immature adrenal glands, located on top of the kidneys, decreases during infancy. They are quite limited in function at birth. This is partly because the cells that will eventually form the adult adrenal cortex begin to grow and develop at that time. The inner part of each adrenal gland secretes epinephrine (adrenaline) and norepinephrine (noradrenaline), both of which aid in the regulation of blood pressure, heart rate, and sugar metabolism (Schuster & Ashburn, 1980).

The islets of Langerhans of the pancreas manufacture insulin and glucagon, both of which aid glucose metabolism. Since these glands are immature at birth, blood sugar levels may be unstable throughout infancy.

The liver, another endocrine gland, converts blood sugar into
glycogen (animal starch) and stores it for future use. It also synthesizes and oxidizes fats, stores various vitamins and minerals, manufactures blood proteins, and removes toxic substances from the blood. Liver functioning remains immature throughout infancy. The liver of the newborn is relatively large (occupying two-fifths of the abdominal cavity) and is able to be felt by the experienced practitioner (Schuster & Ashburn, 1980). When the biophysical domain is adequately functioning, the infant is ready to learn about his/her world. The next section of this literature review, the cognitive domain, further elaborates on this point.

Cognitive Domain

As mentioned in Friedrich (1983), the traditional view of infancy was best expressed by Shakespeare who described the helpless newborn as "mewling and puking in the nurse's arms" (p. 53). Nearly a century later, John Locke proclaimed the infant's mind a tabula rosa, or blank tablet, waiting to be written upon (Friedrich, 1983). William James (1890) wrote at the turn of the century that the infant is so "assailed by eyes, ears, nose, skin and entrails at once" that it views the surrounding world as "one great blooming, buzzing confusion" (Friedrich, 1983, p. 53). In addition, according to Friedrich (1983), as recently as 1964, a medical textbook reported not only that the average newborn could not fix its eyes or respond to sound but that "consciousness as we think of it, probably does not exist in the infant" (Friedrich, 1983, p. 53). Such views have been increasingly re-examined and revised during the past two decades.
There is increasing evidence that infants are not only aware of the stimuli and activities around them but begin to learn from such experiences from the first days of life (Martin, 1972). An infant who is accidently pricked by a diaper pin may not initially know what caused the experience, but he/she is very much aware of it, will respond to the stimulus and may begin to associate it with other events. Pleasant experiences, such as the satisfaction of hunger, also become opportunities for knowledge acquisition (Schuster & Ashburn, 1980).

One of the major leaders in the study and explanation of the processes of cognitive (intellectual) development is Jean Piaget. His concept that cognitive development occurs through the interaction of an individual's genetic disposition with environmental experiences has promoted an interest in altering the experiences offered to infants to facilitate development of their potentials. Other researchers, using his framework, are reexamining the effects of early sensory deprivation on the infant's intellectual development (Martin, 1972).

Evidence exists that the fetus is capable of being conditioned in utero (Montagu, 1970), giving support to the idea of the existence of a cognitive domain for human beings from the beginning of extrauterine life. According to Schuster and Ashburn (1980), cognition is the process of obtaining and using knowledge about one's world through the use of perceptual symbols, abilities, and reasoning; it therefore includes using the human senses to receive input about the environment. Schuster and Ashburn (1980) continue by
saying this activity normally leads to perception, the process of extracting information in such a way that the person transforms sensory input into meaning. Cognition incorporates knowledge and the processes by which it is acquired and used; therefore, ideas and language are two of its tools. Learning, or the dynamic process in which perceptual processing of sensory input leads to concept formation and change in behavior, is a major part of cognition. It should be noted that learning does not necessarily follow immediately after the reception of sensory input, nor does the change in behavior have to be such that it can be observed by others (Schuster & Ashburn, 1980).

Two studies conducted in the 1940s verify this point. In one study conducted by Sontag & Newbery (1940), a loud noise was made near a pregnant woman's abdomen. Initially, the noise produced a change in fetal heart rate. The loud noise was then repeated successively. After many times, the fetus no longer responded. It was speculated that the fetus "learned" the noise, adjusted to it, and no longer responded.

In the second study, Spelt (1948) concluded that he was capable of conditioning the fetus to give a startle response. In the study, Spelt paired a loud sound, to which the fetus would unconditionally give a startle response, with an electric doorbell that vibrated only and made no sound. When initially applied to the mother's abdomen, no startle response from the fetus was noted. However, after 15 to 20 paired trials with both loud noise and doorbell, the vibratory doorbell alone produced three to four startle responses. According
to Spelt (1948), the vibratory apparatus thus became a conditioned response.

Verny and Kelly (1981) gave two subjective accounts of fetal learning that went beyond primitive reactions. The famous musician Boris Brott is convinced his musical interest started in utero. Many other musicians make this same claim. In Brott's case, while he was playing his cello, he was amazed to be able to recall complete passages of a score without ever having seen the music. The mystery was solved when Brott's mother admitted to playing the remembered music on her cello while she was pregnant.

The second account that Verny and Kelly (1981) cited involved the famous architect Frank Lloyd Wright and his mother Anna Wright. Even before birth, Anna Wright made up her mind that her son would be an architect. (She never doubted she would have a son and she called him Frank Lloyd from the beginning.) Anna hung framed pictures of great cathedrals all about the nursery. She filled baby Frank's intended room with all kinds of cardboard shapes and maple blocks. During her pregnancy, Anna would visit the nursery to imagine Frank building structures with these toys, and to her delight, after birth, he did build with his blocks (Verny & Kelly, 1981).

An individual who has a healthy nervous system (in the biophysical domain) possesses the basic tools for meaningful perceptual experiences leading to healthy cognitive development (Schuster & Ashburn, 1980). Most theorists consider perception to be an intermediate stage in the transmission of information from sensory organs to the central process of cognition (Munsinger, 1975).
However, some perceptual skills appear to be unlearned. For example, as cited in Friedrich (1983), Meltzoff and Moore demonstrated in 1977 that babies only 12 days old could imitate an adult sticking out his/her tongue. These researchers also demonstrated that if a pacifier in the baby's mouth prevented the infant from imitating the adult, it would remember what it wanted to do until the pacifier was removed: then the baby would promptly stick out its tongue. As quoted in Friedrich (1983), Meltzoff claimed, "We had one baby 42 minutes old, with blood still on its hair. We washed it and tested it. We found that even newborns could imitate adults" (Friedrich, 1983, p. 55).

As cited in Friedrich (1983), the experiments by Meltzoff and Moore demonstrated the infants' very early capacity for what psychologists call "intermodal perception"—that is to combine the brain's perceptions of two different activities, in this case, vision and muscular action, which is virtually the first form of thinking (Friedrich, 1983). Meltzoff continued his exploration of intermodal perception by a different test of vision and touch. He gave smooth pacifiers to a group of month-old babies and pacifiers with bumps on them to another group. He then had the infants look at models of the two kinds of nipples. Friedrich (1983) claimed Meltzoff reported, "they would look at the ones they had felt" (Meltzoff quoted in Friedrich, 1983, p. 55). Now, with Dr. Kuhl, Meltzoff has extended those test to language. The researchers showed neonates two films of faces saying "ahh" and "ee," then placed between the two pictures a loud speaker that could make either sound. The infants looked toward
the picture that fit the sound. This meant babies could detect the relationship between mouth movements and the sound they heard. Meltzoff concluded, "Essentially, babies are lip readers" (quoted in Friedrich, 1983, p. 55).

However, whether innate or learned, all perception soon entails storage and retrieval of information. In addition, the perceptual process goes through a series of development sequences, which can be identified as the "hierarchical organization of perceptual segregation" (Schuster & Ashburn, 1980). The sequence is as follows:

1. Detecting stimulus energy.
2. Differentiating gradients in stimulation.
3. Differentiating the world in terms of similarities and differences.
4. Distinguishing foreground of stimulation from background of activity.
5. Responding to patterns and wholes, rather than to details.
6. Identifying form.
7. Recognizing form and manipulating it in varying situations.
8. Learning body schemata and orientation.
9. Developing space perceptions. (Schuster & Ashburn, 1980, p. 164)

Perceptions of any type of stimulus follow this pattern throughout the life cycle. The tasks that comprise this process continue until death. An individual does not just master each task once and then forget it. Every time a healthy individual perceives a stimulus, at least part of the process is used. The more novel the stimulus, the farther back (and thus close to the first tasks) the
person must go to conceptualize what is being interpreted. Each person's maturation and experience combine to form uniqueness within the pattern (Schuster & Ashburn, 1980).

Infants use this process and often proceed through most of the steps more than once as they come upon new stimuli and learn new things about old stimuli. Sensory factors are important in the determination of the lower-order tasks, whereas experiential factors are dominant as higher levels of the perceptual tasks are reached (Forgus, 1966). Each perceptual step will now be discussed in greater detail.

The first step in the perceptual sequence involves detecting stimulus energy. According to Schuster and Ashburn (1980), it is difficult to pinpoint the first time an individual becomes aware of a sensory stimulus. A four-day-old infant sucking on a nipple may momentarily stop sucking if an object begins to move in its visual field (Haith, 1966). This is an illustration of the infant's ability to detect the movement of a stimulus.

At birth, healthy neonates react to a change in their visual field as well as a change in their environmental temperature. Because the four-day-old infant will look for different amounts of time at stimuli that vary in intensity of brightness, it is inferred that the infant has detected a difference in the stimulus energy. This is the second step in the perceptual process called "differentiating gradients in stimulation" (Schuster & Ashburn, 1980).

Fantz (1958) suggested that one-week-old infants are capable of
pattern (shape) perception, which requires that infants differentiate one stimulus from another. The infants in Fantz' research were presented with four black and white patterns, (horizontal stripes, a bull's eye, a checkerboard, and a grey patch) in random order. A standard grey field was presented simultaneously for pattern comparison. By determining how long a reflected image of each stimulus appeared in the infant's pupil, Fantz measured the differences in response to the four patterns. Some researchers have interpreted Fantz' results to indicate that the infant has early sensitivity and preference to contour or complexity, or both (Schuster & Ashburn, 1980).

Researchers are not in agreement as to when infants first perceive color (detecting stimulus energy) and then discriminate one color from another (differentiating the world in terms of similarities and differences). The biophysical explanation maintains that the infant begins to respond to specific colors at one to two months of age when the retina of the eye develops sufficiently (Valadian & Porter, 1977). In one experiment, four-month-old babies were tested to determine if they could remember the colors they saw. The infants were shown the same color until they lost interest in it; then that color was reintroduced later along with an entirely new one. The reasoning was that if the babies had "forgotten" the first color, then they would have been equally fascinated by both. As it turned out, the new color captured the infant's attention, indicating that they had both discrimination ability and memory at this early age. The infants also indicated certain color preferences: red was
the favorite, followed by blue, yellow, and green ("Out of the Minds of Babes," 1976). At the completion of this perceptual task, an infant can begin to distinguish objects in terms of distinctive qualities and uniqueness.

The next step in the perceptual process is "distinguishing foreground of stimulation from background of activity" (Schuster & Ashburn, 1980, p. 165). This involves an understanding that some things are out in space, or, distinguishing a given stimulus from its background. The baby must learn to select the pattern that it will treat as a figure and hold it against a tendency for some other pattern to become the figure.

Bower (1971) placed two-week-old neonates upright and moved various objects toward their faces. The infants appeared to perceive that the objects were approaching, because they cried, pulled their heads back, and shielded their faces with their hands. If the object was moved farther away, the infants did not demonstrate this behavior. Two-week-old infants were also studied at Harvard's Center for Cognitive Studies. Here, the infants were confronted with a cube that began moving slowly toward them. When it seemed about to hit, the infants showed what psychologists call "a strong avoidance-reaction pattern." The infants turned aside and squirmed and tried to avoid being struck, though they had no previous experience that would make them think that the approaching object would hit them. When the cube approached the babies on an angled path that would miss them, however, the babies followed its motion with their eyes but showed no sign of anxiety. Apparently, the
infants have a consummate skill of predicting the path of a moving object, and an evident wish to avoid objects on a collision course (Friedrich, 1983).

Gibson and Walk (1960) designed a test of depth perception for infants called a "visual cliff." A clear glass-top table had checkered linoleum secured immediately under the glass table top. Gibson and Walk (1960) discovered that the infant would move only to the table surface that had the linoleum secured immediately under the glass. This experiment demonstrated that an infant will, if he/she has begun crawling before the time of experimentation, use depth cues after the age of seven months. Animal research indicates that some mobile species (e.g., chickens and goats) will not cross to the deep side when tested immediately after birth, suggesting innate depth perception (Schuster & Ashburn, 1980).

Responding to patterns and wholes is the next step on the perceptual ladder. This involves the individual taking in as many aspects of the stimulus as possible so that increased information is gained. For example, a mother and father may say exactly the same thing to a baby, but the baby may give each parent a totally different response. One thing influencing the baby's response might be the intonation used by the speaker; another thing might be the speaker's facial expression. Of course, familiarity with the speakers is also of significance. If the baby collects more information from one speaker then he/she does from the other, and if the baby likes the information, he/she is more likely to giggle or coo in response to the former (Schuster & Ashburn, 1980).
When the process of responding to patterns and wholes is accomplished, the infant is ready to identify forms—the sixth step in the perceptual process. This task involves the individual recognizing similarities in contour and differentiating those essential to form. This requires the baby to note distinctive features in order to indentify similar stimuli. Fantz (1958) concluded that if an infant is shown two stimuli with differing amounts of contour and looks longer at one of them, then the infant has detected their difference. It has also been reported that a time period exists when infants look longest at stimuli that possess a moderate amount of contour--too much contour seems to be overwhelming and too little appears not to be perceived (Schuster & Ashburn, 1980). The baby is gradually able to distinguish more specific features of a stimulus with increased development and experience. An example of identifying form is available if one listens over a period of time to the babbling of a young baby. Gradually, the baby simulates the form and intonation of some of the words its caretaker uses—and tends to be delighted with its accomplishment.

The next perceptual step, recognizing form in varying situations, is an important task to master if the baby is to identify order in the world. Eventually, the perception of a stimulus becomes separated from the context in which it is presented. This accomplishment helps the baby to recognize its bottle, even though it may be handed to him/her upside down. It will later help an individual to recognize a professional person who is usually wearing a uniform, or that the food on the plate is a variety of
potato—whether baked, mashed, or french fried.

Bower (1966) studied shape constancy in infants between 50 and 60 days of age. He concluded that his subjects already possessed a "perceptual corrective mechanism" so that they could recognize an object presented to them in a new orientation.

Several studies suggest that infants perceive an extremely overpopulated world of objects. It could be that infants perceive one object as a different object when it is moved to a new location. If this is true, it is possible that a baby would not know he/she had just one caretaker but would think that each time the caretaker left and returned, he/she was a new person! Bower (1971) performed research that supports this theory. He used mirrors to create the illusion that there were three of the infant's own mother in the room with the infant. He found that three-month-old babies reacted with pleasure to three mothers, whereas four-month-olds tended to cry. From this experiment he concluded that babies under five months may think they have many identical mothers. According to Schuster and Ashburn (1980) object constancy is the ability to recognize that an object or person in the kitchen is the same as that in the bedroom, or that father-from-a-side-view is the same as father-from-a-front view. This concept is to be distinguished from Piaget's concept of object permanence, which is when a child remembers an object or person even when the child is no longer in direct contact with the object or person.

The eighth level in the perceptual process is learning body schemata and orientation. During the accomplishment of the
perceptual task, the baby forms mental pictures of its own body. The
body then becomes a reference point from which the baby will view and
relate all the experiences and observed phenomena of life. Little
research is available concerning the infant's body schemata (Schuster
& Ashburn, 1980). Piaget's sensori-motor stage (discussed later in
this chapter) gives one view. Toddlers, with all their words and
actions, give researchers more information for study. According to
Schuster and Ashburn (1980), body schemata are constantly changing,
especially during childhood. A child's perceptions of self and the
world change dramatically when he/she advances from a supine
position, to sitting, standing, walking, running, jumping, and so
forth.

Developing space perception is the final step in the perceptual
sequence. Discovering the relationships of objects in the spatial
world is fundamental to the development of space perception (Schuster
& Ashburn, 1980). Mastery of this task is essential for orientation
to one's environment and mobility within it. Logically, blind people
experience much difficulty mastering this task (Schuster & Ashburn,
1980). Spatial perception enables an individual to make assumptions
about the world. For example, a person can judge distance by picking
up cues from texture, brightness, clarity, shadows, and so forth.

The idea of space emerges gradually. First, the space between
oneself and various objects is defined. Later, the space between
objects emerges. The first concept of space is called the
"action-space concept" because the infant is aware only of the area
he/she is experiencing at a certain moment. Several "spaces" exist
for the infant under four months (e.g., a visual space, an auditory space): after that the infant begins to "cognitively map" (mentally organize) various spaces into a whole environment (Schuster & Ashburn, 1980).

The completion of the perceptual sequence is essential for concept formation. Individuals structure reality and deal with the world by forming concepts. Several theorists suggest that concept formation, which includes symbolizing, categorizing, and generalizing, is characterized by the formation of a common response to stimuli (Flavell, 1970). This association could be made on the basis of some arbitrary characteristic of the stimulus (e.g., if an animal barks it must be a dog) or on the common characteristic possessed by several stimuli (e.g., a car, bus, wagon, and train all have wheels, therefore they can all move from one place to another).

Hebb (1958), an experimental psychologist, postulated the concept of "cell assemblies" and "phase sequences." Cell assemblies are the neurological building blocks of the brain and are dependent on adequate exposure to sensory experiences. The reception of sensory stimuli from adequate exposure leads to the development of neural networks. Hebb (1958) postulated that the neurological building blocks remain unconnected, and therefore undeveloped, if inadequate sensory experience is available. His reports of animals raised in the dark who were later exposed to visual experiences confirm how the lack of early sensory experience may be related to perceptual disabilities.

But what about the abilities of infants to conceptualize their
experiences? Piaget theorized that in roughly the first 18 months of life, the baby's learning consists of developing and coordinating actions into organized "schemata of action" or "sensori-motor schemata" (Schuster & Ashburn, 1980). Even in late infancy, babies only manipulate their immediate environment with short-term goals in mind (e.g., how to retrieve the dropped bottle of apple juice). Nevertheless, it is during the latter part of this sensori-motor stage that the baby is able to see connections between actions (e.g., smoke from the fireplace and steam from coffee mean "hot"). This stage is just a step away from Piaget's "representational thought": the baby is on the correct pathway to true concept formation. Representational thought consists of the child's ability to represent one thing by another and originates from the sensori-motor schemata (Wadsworth, 1971). The child enters a time period after the sensori-motor stage which Piaget still terms preconceptual. Piaget says that most children are operating at this level until about four years of age. During this preconceptual period, the young child cannot yet understand how to categorize things in the environment at the level achieved by older children or adults (Schuster & Ashburn, 1980).

It is during Piaget's sensori-motor stage, which begins at birth and lasts (arbitrarily) until 24 months, that the baby changes from operating primarily at a reflex level to consciously organizing its sensori-motor activities in order to exert control on the environment. Piaget observed that the infant's activities progress from organized reflex actions to trial-and-error learning and then to
the solving of simple problems. It is during this time that the infant becomes goal-oriented and attempts to devise ways to get what he/she wants. This activity requires that the baby become aware of where the boundaries of its own body end and where those of the world begin (Schuster & Ashburn, 1980).

According to Schuster and Ashburn (1980), Piaget broke the sensori-motor stage into six sequential levels. Since the author is an educator who has specialized in fetal and infant education, she will restrict this section of the literature review to Piaget's sensori-motor levels concerned with birth to age one. Piaget called the level of development from zero to one month "Reflex Activity" (Schuster & Ashburn, 1980, p. 168). The infant comes into the world equipped with all its senses and a few survival reflexes. The sucking reflex is triggered automatically by anything placed in the mouth. In a search for objects to suck the infant exercises this reflex. The infant also learns to recognize objects by sucking on them and begins to discriminate between objects to suck. Since sucking a thumb is performed differently from sucking a mother's breast, the infant learns to accommodate its activity to differences in size, shape, and position (Labinowicz, 1980).

As cited in Schuster and Ashburn (1980) on page 168, Piaget's sensori-motor stage "Primary Circular Reactions" are evident between one and four months. Labinowicz (1980) has also termed this "Formation of First Action Patterns" (p. 62). Many of the infant's random movements produce interesting results; for example, the thumb may fall into the infant's mouth, trigger sucking and drop out. The
infant immediately attempts to rediscover the behavior so that the pleasurable sucking can be repeated. After much trial and error, the infant is able to coordinate its erratic movements and produce a repeatable action pattern. The infant does not invent new behaviors but merely reproduces familiar ones through a cycle of self-stimulation. Initially, these action patterns are restricted to the infant's body (Labinowicz, 1980).

Four to eight months is the level called "Secondary Circular Reactions" (Schuster & Ashburn, 1980, p. 168) or as Labinowicz (1980) calls it "Formation of Action Patterns with the External World" (p. 63). In this level, the infant exercises its grasping reflex to manipulate objects in the immediate vicinity. This is a development of eye-hand coordination. The infant's ability to crawl expands his/her horizons to include more of the external world. Acts which were initiated by chance can now be repeated purposefully. For example, an infant lying in a crib may make chance contact with a mobile while kicking its feet. The infant will then reproduce this action pattern to recreate the interesting movement of the mobile. Such purposeful activity is initiated only after chance discovery of the connection between kicking and the mobile's movement. Also between four and eight months, when presented with a pair of objects, the infant will reach for the moderately novel one as opposed to a familiar object (Labinowicz, 1980).

As cited in Schuster and Ashburn (1980), Piaget called the level between eight and 12 months "Coordination of Secondary Schemata and Their Application to New Situations" (p. 169). It is common for a
child between these ages to strike down a barrier such as an adult hand which is placed between it and an interesting object. The child is capable of coordinating two familiar action patterns—striking and grasping. One of the child's actions serves as the means to the goal while the other serves as the goal itself. At this level, the child is able to coordinate familiar actions into larger patterns. However, the child is still unable to invent new action patterns. As cited in Libowicz (1980), since the child had a goal in mind prior to the action, Piaget views the child's behavior as an indicator of intelligence (Labinowicz, 1980).

Lastly, the period between 12 and 18 months is called "The Discovery of New Means Through Active Experimentation" (Schuster & Ashburn, 1980, p. 169). Labinowicz (1980) says this is when the child "Experiments to Discover Properties of Objects and Events" (p. 64). This last level will be discussed since some children enter this stage of development earlier than 12 months. At this time, a kind of experimentation is now initiated by the child. Instead of repeating the same action pattern to produce the same result, the child varies the behavior to produce different results. Now, the experiments are not always random—they may build on the results of preceding ones. The child may explore the dropping of objects by varying the height of release and the kind of objects in order to produce differences in landing position, noise produced, height of bounce, etc. The child appears to be actively checking the objects' properties. In addition, the child's ability to walk further expands his/her world of objects.
Clearly, much of what infants do is a product of learning (Schuster & Ashburn, 1980). Observers begin to make inferences that infants are learning from the minute they are born by observing their increasing repertoire of behaviors. Attention to external stimuli appears to be heightened when affective needs are met; high levels of stress preclude attention to significant events or stimuli in the environment. Therefore, the quality of the early caregiver-infant relationship is viewed as being essential to maximal development of the cognitive domain. Early interaction between infants and their caregivers is facilitated through the use of certain tools--smiling, crying, looking, fixation, hearing, and selected reflexes (Schuster & Ashburn, 1980). The reciprocal use of these tools by both the caregiver and the infant leads to and reinforces an intense, mutually satisfying relationship with freedom to develop the cognitive domain (Schuster & Ashburn, 1980).

Smiling in our culture is indicative of relaxation, happiness and acceptance; thus it becomes an essential tool in positive interactions. Research identifies two distinct kinds of neonatal smiles. The "gas bubble" smile is accompanied by tensing of the body and grimacing, possibly indicating that the infant has intestinal discomfort. Another type of neonatal smiling is "eyes-closed" smiling (Friedman & Vietze, 1972). At first, the neonate tends to turn up the corners of its mouth fleetingly, with the muscles of the eyes not being used until after the first week of life. Wolff (1973) has categorized neonatal smiling as either "spontaneous" or "elicited." Spontaneous smiling occurs without known external
causes, whereas, elicited smiling appears to be caused by external stimulation. The state of consciousness also appears to affect variations of smiling responses.

The smile of the infant has caught the attention of other researchers. Bowlby (1969), a child psychologist, has offered the following observations:

1. A smile's motor pattern is instinctive.
2. Some stimuli are more effective than others in eliciting a smile.
3. The primary caregiver initiates the most effective stimuli.
4. Often, effective stimuli becomes restricted to the human voice and face.
5. Smiles are elicited more promptly and more intensely by a familiar voice.

Infants soon learn that smiles are the rudimentary base of interpersonal relations. When infants later add vocalization with their smiles, they have already learned much about social control of the environment (Schuster & Ashburn, 1980). In fact, according to Capute and Biehl (1973), a sustained smile is a developmental milestone.

Crying is the infant's most valuable communication tool. When an infant cries all heads turn and each person in his/her own way (internally or externally) reaches out to shut off the cry. When a baby cries, the caregiver is stimulated to perform activities such as holding and rocking. If the crying ceases as a result of these actions, the caregiver is reinforced. The baby's tension decreases
and it is also reinforced. Eventually the baby will learn to control
the environment through crying or vocalization (Schuster & Ashburn,
1980).

An infant can put forth various types of cries. A "hunger" cry
has an unique pattern. This pattern has been observed within a half
hour after birth and, with some variation, lasts until approximately
six months of age. Wolff (1963) describes the hunger cry as having a
mean duration of less than one second. This short outburst is
followed by a brief silence. Then a second cry is heard but of a
higher frequency than the first. The second cry is followed by
another rest period. Then a third cry is heard and so forth.

The "pain" cry has been observed as early as one to two days
after birth. Wolff (1963) observed that infants vary in breathing
patterns during pain cries.

Similarly, infants have their own "anger" cries. But why do
infants become angry? Schuster & Ashburn (1980) give several answers
to this question. For one, fatigue may cause an anger cry. Other
infants get lonely and may cry in order to get company while other
babies tend to be more irritable in nature than their peers. Some
infants become very distressed at a soiled diaper and therefore voice
their opinion. If the crying ceases after the diaper change, the
caregiver can make inferences about the baby's communication efforts.

Schuster and Ashburn (1980) continue by saying that many infants
become upset when other external factors are making them
uncomfortable such as clothing that may be too tight. Many
caregivers overdress a young baby, and this may be the problem,
especially on a warm day. Or, clothing may have to be added if the baby is too cold.

However, there is another type of infant crying: the unexplained episode of crying. This occurs in most healthy infants—not necessarily in infants of an "irritable nature"—and continues even after the caregivers have exhausted their nurturing efforts. This crying is normal, and in most cases, it should be considered a healthy outlet. It is common for an infant to have a prolonged "fussy" time during the early months (Schuster & Ashburn, 1980).

Primary caregivers worry that a cry may mean illness. Often a subtle behavior change will accompany the cry during illness (e.g., alterations in sleep or feeding patterns, differences in bowel or bladder elimination); or the baby may just look "different." Health professionals should be consulted when the caregivers are in doubt (Schuster & Ashburn, 1980).

Wolff (1963) found that after an infant is five weeks old, even a "fussy" baby may stop crying upon seeing a human face or hearing a human voice. This finding has implications for quieting a crying infant, since speaking to a mildly crying baby at this age can arrest the crying as long as the infant can see the face belonging to the voice.

This also brings the tool "looking" into importance. Caregivers frequently express the feeling that they have not "seen" their infant until it opens its eyes and looks back at them (Schuster & Ashburn, 1980). The altertness that is present during the first hour after birth is an optimal time for caregiver-infant introduction. A sleepy
baby who meets his caregiver six to 12 hours after birth does not appear interested—which can be a detriment to the relationship.

Fixation, or the ability to visually zero in on an object, is a form of looking that seems very special by many caregivers. Since the baby shows a marked preference for the human face, his/her fixating on the caregiver's face can be a great thrill. When fixating, the infant will also stop sucking, will elevate its eyebrows, and may stop other body movements. This adds to the moment because all these behaviors give the baby an alert "bright-eyed" appearance—which makes the caregiver feel he/she is the object of the infant's affection (Schuster & Ashburn, 1980).

The infant's ability to hear is another effective tool for learning and establishing interpersonal relationships. The baby's tendency to turn its head toward the source of sound as the caregiver enters the room or speaks can be endearing. The synchronous response of the infant's body movement to the articulation, pitch, and speed of the caregiver's voice lead the caregiver to conclude that the infant understands what is being said (Condon & Sander, 1974).

The "palmar grasp" and "hand-to-mouth" reflexes also endear the infant to its caregiver. Interpreting these behaviors of primary trust and intelligence, caregivers may begin to stimulate the infant further and thus facilitate the infant's learning.

Another reflex, sucking, is the method by which the infant receives nourishment for growth. The psychoanalytical school says the infant equates food with the caregiver and that the caregiver in turn equates the infant's acceptance of food as an acceptance of him
or herself. Parents express anxiety when the neonate nurses poorly and elation when it eats vigorously. These verbal expressions indicate a dual concern: that the baby may not get enough to eat, and that the baby does not like them. The infant who nurses well helps the caregiver relax and enjoy the feeding time with the baby (Schuster & Ashburn, 1980).

General physical appearance is another important tool for enhancing interaction and learning. A "cute" infant elicits more interactional behaviors from the caregivers and from others. Characteristics such as plump cheeks, pleasing coloration, fuzzy hair, and petite proportions appear to elicit a desire for adult interaction. This interaction takes the forms of holding, caressing, touching and talking to the child—all excellent ways to begin learning about the world (Schuster & Ashburn, 1980).

However, as the infants begins to learn about the world, attention and memory are critical issues in the learning process. Wolff (1963) identified the infant's "attentive" or arousal state as an important factor influencing how the baby responds to selected stimuli in a constantly changing environment. Nevertheless, attention span in infants is variable: one baby will look at an object for several minutes, whereas another baby will be easily distracted. Much emphasis has been placed on studying the infant's visual abilities--its visual scanning, visual fixation (choice of target, length, frequency), and the accompaniments of attending (as demonstrated by respiratory and cardiac deceleration, pupil dilation, and motor quieting). The reverse of these attention indicators is
also significant. The baby's ability to "habituate" (to become familiar with a specific stimulus and thus decrease response to it or shut it out) demonstrates three things. First, the baby can detect changes in its environment. Second, the infant can discriminate among stimuli, and third, the baby appears to briefly remember a stimulus. However, there is still disagreement among researchers as to whether habituation is a form of actual learning or just a decreased response due to fatigue of the sensory receptors (Stevenson, 1972). Habituation is one reason why an infant can fall asleep in the midst of very loud noise.

Human memory also plays a major role in learning. Learning cannot occur without the recall of past experiences. Memory is necessary for conceptualizing these past experiences. In fact, Elkind (1967) states that "memory of previous experiences affects current behavior" (p. 361). Perhaps at this time it is helpful to distinguish two different forms of memory. Elkind (1967) states that the most elementary type of memory is called "sensori-motor memory." This involves (as one may expect after reading Piaget's theory) the retention of sensori-motor coordinations that are learned as the infant adapts to the environment. It is this type of learning that includes the recall of motor coordinations practiced in infancy and early childhood (e.g., dancing, swimming). Memory of such sensori-motor activities facilitates relearning of the same unpracticed coordinations years later. When an individual gives directions, the eyes are frequently closed to picture the route, the body position is redirected, the arms are used to indicate turns, and
The second type of memory is called "representative memory." This type of memory makes its appearance in mid-infancy. An example of "representative memory" is when the infant seeks an object that is hidden from view. An adult may hear a song that brings back memories of an earlier event; a symbol is used to represent a part of an earlier experience. Both types of memories, sensori-motor and representative, develop more fully through experience and maturation of cognitive structures (Elkind, 1967).

But, as previously mentioned, cognitive development is facilitated by social interaction. Therefore, the social domain will be discussed next.

Social Domain

Roberts (1974) tells a story of King Frederick II, a thirteenth-century monarch of Sicily, who wanted to know which language children would speak if they were never spoken to during infancy. The king ordered a group of foster mothers and nurses to bathe and feed their charges, but ordered no verbal communication or play with the infants. All the babies died. Consequently, the king's question was never answered. Something necessary to sustain life was missing: that important but absent factor was meaningful, positive human interaction.

Most theories of development contend that the early mother-child relationship is critical to successful social relationships in later
life. Many theories have received their original impetus for that assumption through observing adult pathologies that seemed to have the common element of a poor mother-child relationship in earlier years. There is much overlapping of theories, but there are also some sharp points of disagreement (Schuster & Ashburn, 1980).

According to learning theory, any type of human interaction, positive or negative, will influence the social development of an individual. The infant is an active participant in the social process, sometimes being the recipient of and at other times, the initiator of interactions. Even minutes after birth, the infant is a unique individual in its response to the environment. In fact, studies demonstrate that individual differences in infant activity level and temperament can be observed at birth. This is before most external environmental factors have had time to produce any effect (Brazelton, 1969). These differences can elicit qualitatively and quantitatively different responses from the caregivers. These genetic and prenatally influenced behaviors continue to shape and be shaped by the environment. This shaping widens the differences in individuals as age increases. Gesell (1937) describes 15 traits to aid in the appraisal of differences in children during the first year of life:

1. Amount and intensity of activity.
2. Posture, muscular control, coordination, and poise.
4. Positive reactions to other people.
5. Degree of identification with the family group.
6. Reference to others by gesture or vocalization.
7. Capacity to adjust to new situations.
8. Utilization of environment in order to gain new experiences.
9. Reactiveness to surprise and novelty.
11. Liveliness and subtlety of expressions in emotional situations.
15. Frequency of frowning and tears.

Korner and Thoman (1972) found that infants differ significantly in how easily they can be soothed and how long they will remain comforted. The infant's ability to use comforting to control its state will often influence the mood and quality of care given by the infant's primary caregiver. The consistency of the caregiver's reactions to the infant's crying will help to mold their relationship and, in part, will affect the way the infant will interact in social environments (Bell & Ainsworth, 1972).

Nearly all theorists concerned with the social development of the baby talk about the significance of the way the baby's needs are met. Schuster and Ashburn (1980) define a need as "a situation in which some necessity or want exists" (p. 185). Although each theorist proposes his/her own concept of need and satisfactory goal attainment, the fact remains that an infant's needs go beyond purely biophysical satisfaction. Babies who lack sufficient cognitive and
social stimulation exhibit signs of physical and affective disequilibrium. In contrast, children who receive adequate cognitive and social stimulation will progress through sequentially more complex social and affective behaviors (Schuster & Ashburn, 1980). Several theorists have identified these behaviors and have constructed developmental frameworks to clarify the sequences. These theories may use different jargon, but they essentially all discuss the same principal concept—the emergence of a "self-concept." According to Rogers (1961), as the self-concept develops, it strives for consistency among the individual's pictures of what he/she is, should be, and might like to be. This process begins in infancy and continues throughout life as the individual attempts to integrate past and anticipated future experiences with the present situation.

Truly, the process of attachment is the beginning of self-concept development. During the past century, social scientists have attempted to explain the essence of the caregiver-infant relationship through theory and research. Bowlby coined the term "attachment" and defined it as a focused relationship: the infant's interactions are directed toward a specific person (or small group of people, if the infant is exposed to multiple caregivers). Intense emotions are involved. It appears that before an individual can effectively relate to others in a socially acceptable way, this primary social bond must be established. Attachment endures over time, with the individual maintaining positive feelings toward the attachment object or objects (Schuster & Ashburn, 1980).

Imprinting, one concept of attachment, has originated from
animal research. This phenomenon occurs only during the critical period following birth. The baby animal attaches to and follows a selected moving object—usually its mother. However, there is still speculation as to whether or not there may be a "sensitive period" in human babies when they should receive certain types of stimulation to develop normally (Klaus & Kennell, 1976).

Harlow and Harlow (1970) have also done animal research on the attachment process. In 1958 these researchers proved that there was more to attachment behavior than just being fed adequately. They raised baby monkeys in cages with two very different surrogate mothers. One of the mothers was covered with soft terry cloth; the other was composed of hard wire mesh with a feeding apparatus. The infant monkeys did not spend much time with the wire mesh mother, which fed them, but instead spent most of their time clinging to the terry cloth mother, which did not feed them at all. One thing became apparent when this experiment was assessed—provision of food is not the basis for attachment: comforting potential is much stronger. When the Harlow monkeys grew up, they demonstrated marked social difficulties and sexual adjustment. This latter observation showed the necessity of reciprocity in the caregiver-infant dyad (Harlow & Harlow, 1970).

Attachment of human infants to a significant other person happens over a period of months, requires consistency, intimate interaction between the baby and this primary caregiver, and is affected by many factors (Schuster & Ashburn, 1980). Several theorists have written about the development of infant attachment.
For example, Freud based his attachment theory on instinctual drives; he viewed the infant as being a narcissistic organism who attaches to those people who can reduce its tensions and thus meet its needs.

Mary Ainsworth, another developmental theorist, views attachment as being influenced by the continuous feedback between infant and caregiver. She emphasizes that the intensity of attachment behavior (e.g., clinging, crying when caregiver leaves) decreases as the baby becomes more verbal (Ainsworth, 1967).

Reinforcement is the cause of attachment says Jacob Gewirtz, a behavioral learning theorist. He suggests that attachment is a response that evolves as a result of the infant and caregiver learning to exert control over each other's behavior (Gewirtz, 1956).

According to Maier (1969), development learning theorist, Robert Sears, equates attachment with dependence. He calls attachment a drive arising from other drives or a "secondary drive." He sees primary drives (e.g., hunger, thirst, discomfort) as first being satisfied by the caregiver, with the caregiver thus acquiring a positive value to the extent that the primary drives are met. The caregiver becomes a secondary reinforcer; therefore, the desire for the caregiver's nearness results in attachment (Maier, 1969).

However, a discussion of the infant's social growth could not be considered complete without mention of Bowlby's theory of attachment. Bowlby postulates that certain types of stimulation elicit certain types of behavior in the infant, and that infant behaviors elicit particular behaviors in the caregiver. For example, a caregiver may speak more frequently and lovingly to an infant who smiles and
babbles in response. Both the caregiver and infant feel good about this, and both will probably repeat this act. As they do, the two begin to form a meaningful relationship. Bowlby feels that the baby uses clinging, crying, sucking, and smiling to elicit maternal caregiving and attachment behaviors. In contrast to other theorists, Bowlby suggests that feeding plays only a minor role in the development of attachment (Bowlby, 1969).

Some theorists consider the terms dependence and attachment as synonymous. However, Bowlby strongly differentiates between the two. According to Bowlby (1952), dependence refers to the extent to which one individual relies on another for existence. Dependent behaviors may be demonstrated toward anyone. Two types of dependent behaviors are identified: instrumental—seeking help or assistance—and emotional—seeking attention or approval. Instrumental and emotional dependence are maximal at birth and gradually diminish over time. If dependent behaviors persist, they are considered a sign of immaturity. Attachment, in contrast, is altogether absent at birth, but appears during the first six months of extrauterine life.

In the development of attachment Bowlby (1952) discusses four phases which have overlapping boundaries. Phase one is labeled "orientation and signals without discrimination of figure." Bowlby believes that the baby's ability to discriminate one individual from another either is absent or very limited from birth to the age of two or three months. The reader should note that more recent research by Brazelton (1976) indicates that this skill is present at two or three weeks. However, Bowlby (1952) does acknowledge that the infant is
capable of eliciting significant responses in others during this time and eventually learns to exhibit specific behaviors to prolong interactions with others.

Somewhere between two and eight weeks the baby enters a phase of nonselective social smiling. This response is elicited by both stationary and moving visual stimuli, which are chiefly social in origin. Other stimuli (e.g., tactile, auditory) may also be used with the visual stimuli to elicit the smile. Bowlby (1952) claims smiling occurs whether the stimulating face is familiar or unfamiliar.

It is between three and six months of age that the baby behaves toward the caregiver "in more marked fashion" than it does toward others. Bowlby (1952) claims that this behavior is part of phase two, or "orientation and signals directed towards one or more discriminated figures." One research study indicates that infants, beginning at about three to four months of age, will smile more frequently in the presence of a familiar face than with an unfamiliar one (Dreutzer & Charlesworth, 1973). On the other hand Brazelton (1976) has observed that infants begin discriminating the caregiver versus the stranger by only three weeks of age. Nonselective social smiling peaks sometime between three and six months, depending on the infant's environment. Gewirtz observed this also to be true in institutionalized infants reared in either a small family or a Kibbutz in Israel (Stone, 1973). During this time the various components of full facial smiling become apparent. More total body activity also begins to emerge around this age.
Selective social smiling, or smiling that occurs when discrimination of certain stimuli (often the caregiver's face) is observed, usually occurs before 20 weeks. Selective social smiling overlaps with its nonselective predecessor. Between three and five months, the securely attached infant has been observed to visually explore a nonfamiliar face, and then to visually "check" the caregiver's face, as if comparing the two. This visual checking behavior is usually continued until 24 months of age. Selective social smiling coincides with the infant's increasing caution with strangers and anxiety when separated from the primary caregivers. At about five months of age, many infants will cry at what a stranger thinks is a very friendly smile.

Bowlby's (1952) third phase of attachment formation is called "maintenance of proximity to a discriminated figure by means of locomotion as well as signals." Here the infant demonstrates extreme discrimination between the caregiver figure and others. The baby tends to become less friendly to others, and often demands close contact with the caregiver figure. This commonly begins between six and seven months of age and continues into the third year. Infants who have had little contact with a stable caregiver figure may not begin this phase until after 12 months or so.

Situations that alter the human face (e.g., wearing a Halloween mask or sunglasses) will not usually evoke crying in an infant until the end of the sixth month. However, if a familiar face becomes altered in a certain way, crying may occur in an even younger baby. Wolff (1973) describes a situation where a four-month-old baby girl
began to cry in terror when she first saw her mother wearing a turban towel wrapped around her just-washed hair. However, Wolff (1973) cautions that not all distortions of the familiar face will provoke crying. For example, the removal of glasses from the caregiver's face when the infant is accustomed to seeing him/her with glasses will provoke crying, but the addition of glasses to a caregiver's face that is usually seen without glasses will not evoke crying.

It is around the first birthday that the child begins to understand that the caregiver figure is an independent person who tends to behave in predictable ways. The baby's world becomes more realistic, more sophisticated, and more flexible with this realization. This is the start of Bowlby's (1952) fourth phase called "formation of a goal-directed partnership." Under normal circumstances, this new-found security lays a foundation for the infant and caregiver to develop a more complex and interdependent relationship which Bowlby (1952) calls a partnership. This concludes Bowlby's theory of attachment.

The psychological birth of the infant is a slowly unfolding intrapsychic process (Mahler, Pine, & Bergman, 1975). During the first two to three years of life, the young child gradually becomes more aware that he/she is separate from significant others. This awareness leads to the development of self, as well as a primitive understanding of object relationships and the reality of the external environment (Schuster & Ashburn, 1980).

Margaret Mahler is known for her studies of the infant-caregiver dyad. Mahler theorizes that each person undergoes a psychological
birth known as the "separation-individuation process." The child gradually establishes a sense of separateness from the world of reality, and yet is aware of his/her relationship to it. This process involves recognition of the separateness of one's own body from the primary caregiver, or the infant's principal representative of the world (Mahler et al. 1975). Mahler et al. (1975) claim this process is never truly completed, and that new crises in the life cycle can reactivate the earliest processes. She continues by postulating that the major achievements of this process are accomplished in the time span from about the fourth or fifth month to the thirtieth or thirty-sixth month of life, a period called the separation-individuation phase. Mahler et al. (1975) define "separation" as the child's emergence from a symbiotic fusion with the caregiver. She claims "individuation" consists of achievements marking the child's assumption of his/her own individual characteristics. In short, it deals with the recognition of affective and social disjunction. Mahler et al. (1975) caution that although these two processes are closely related and intertwined, they are not identical.

Before the infant can differentiate between self and nonself, psychophysiological equilibrium must be attained. This equilibrium is dependent on the synchrony of communication between caregiver and child. This mutual cueing begins with focusing on the infant's needs and responses, with a gradual evolution to a more balanced blending of communication tools by the caregiver and the child.

Mahler et al. (1975) state that the early weeks of life are
characterized by absolute narcissism. This phase is labeled "normal autism" and lasts from birth to one month. The neonate is unaware of the role of the caregiving agent in satisfying its needs. Eventually, the infant develops a dim awareness that it cannot satisfy its needs without assistance. Innate reflexes and skills begin to be used as tools to obtain wished-for pleasures and to achieve homeostatic equilibrium.

This takes the infant into the next phase called "normal symbiosis." According to Mahler et al. (1975), from two to five months of age, the infant develops a vague awareness of the need-satisfying object. The baby no longer responds only to its own physiological needs and perceptions but begins to exhibit direct attempts to control stimuli in the environment. During this period, the infant perceives itself and the caregiver figure as one. Self and nonself are not yet differentiated. The baby seems to experiment with obtaining and maintaining the appearance of the caregiver's face, touch, and voice in much the same way as it experiments with the movements of its own body to create a desired effect. This is consistent with Piaget's description of the infant in substage II.

Symbiosis is enhanced when the caregiver is emotionally expressive with the infant: the infant becomes more responsive to auditory and visual stimuli. Even though internal versus external experiences are only remotely differentiated, this ability to begin to invest oneself emotionally in another person lays the foundation for all subsequent social relationships (Mahler et al. 1975).

Mahler's et al. (1975) separation-individuation period is
divided into four subphases. The first two—differentiation, and practicing—will be discussed here since they occur during the first year of life. Differentiation begins at the peak of normal symbiosis. It is during this period that the baby's more alert state enables him/her to learn more about the external world through increased use of the senses. The infant can be observed to visually focus on and then to touch faces, eyeglasses, watches, rings, and so forth with great fascination. These exploratory behaviors help the infant gain information about objects and lay the foundation for the intellectual ability to compare objects never before seen with a more familiar object. The baby of seven to eight months also begins to touch the caregiver's face and body in order to make comparisons with the corresponding parts of his/her own body and the bodies of other people. Prolonged sitting in the caregiver's lap is common during this phase. This "lap baby" stage may be critical to the ability to engage comfortably in intimate physical relationships later in the life cycle.

The differentiating subphase is overlapped by the practicing subphase. The beginning of this period incorporates the baby's earliest ability to move away physically from the caregiver. It is during this time that the exploration of inanimate objects becomes paramount. During the practicing subphase the baby accomplishes two important skills: he/she increases familiarity with and knowledge about the world, and he/she begins to perceive, recognize, and enjoy the caregiver from a greater distance (Mahler et al. 1975). It takes great courage and energy for the newly separating infant to venture
forth to explore the environment; consequently, the infant makes frequent visual and physical contact with the caregiver before continuing the explorations. This contact appears to give the baby the security and emotional power to go forth again (Schuster & Ashburn, 1980).

Erik Erikson's (1963) theory of social development is complementary to Mahler's model. Erikson claims that the degree to which the infant comes to trust itself, other people, and the world in general is dependent on the quality of care it receives during the early months. He feels the most significant developmental task of early childhood is to resolve a crisis between a "sense of basic trust" and a "sense of basic mistrust." The consistency and quality of caregiver-infant interactions have a direct impact on the development of the infant's self-concept. Erikson views this time as a foundation for all later social development.

The infant has come from a warm, protective intrauterine environment in which all needs were met. Birth presents a new environment with which to cope. Demands are now made. The infant needs food, warmth, comfort, stimulation, and many other things, to feel the sense of love and security. The consistency with which these needs are met enables the baby to begin to predict responses to its needs and therefore, to develop trust in its caregivers. Erikson (1963) is quick to point out that the quality of positive early experiences is more important than the quantity. If infant care is inconsistent, inadequate, or rejecting over a time span, a sense of mistrust develops. According to Erikson (1963), this mistrust
generates an attitude of suspicion and fear toward oneself, other people, and the world in general. A sense of mistrust will hamper other stages of social development.

Erikson (1968) coins the first six months of life as the "early incorporative stage." This is a time when the infant is capable of, enjoys, and learns from "taking in" the external world. Exploration is done both orally and visually. Again, Erikson (1968) emphasizes that the primary caregiver must coordinate and offer stimulation in appropriate degrees of intensity and at the right time so that the infant will not become defensive or lethargic. Imagine the effect on a baby if the caregiver turns on the stereo, the television, and a colorful musical crib mobile at the same time! Too much stimulation overwhelms the child. The baby will begin to "tune out" stimuli as a defense against the environment. The infant begins to coordinate its oral, visual, auditory, olfactory, and motor skills with neuromuscular maturation and experience (Mahler, 1969). The consistency of positive sensory stimulation helps the baby to develop trust in the environment as well as in its own abilities to predict outcomes of behavior. The older infant eventually coordinates touching and grasping with visual, tactile, and auditory stimuli to learn more about the environment.

Erikson's (Maier, 1969) "advance incorporative stage" becomes apparent at the time the first teeth erupt. By this stage, the baby has learned that it can control its environment to some extent. The infant discovers that he/she can learn more about an object by placing it in his/her mouth, and that biting can relieve some of the
pain accompanying teething.

During infancy, the child needs to feel that the world is a safe, happy place that will meet basic needs and will provide sufficient novelty to stimulate interests. The baby needs enough protection to feel safe in attempting new skills, exploring new objects, or making a new acquaintance. Nevertheless, situations eliciting mistrust do occur. Erikson (1963) feels these mistrusting situations should occur because the infant needs to learn to trust even its own mistrust. For example, fear of heights and of strangers can be healthy. However, Erikson (1963) emphasizes that the problem of basic trust versus mistrust is not resolved once and for all during infancy but occurs at each successive stage of development.

Results of current research dealing with the social competence of the infant are supportive of Harry Stack Sullivan's emphasis on the importance of interactions between individuals. Like Mahler and Erikson, Sullivan believes that the nature of early social relationships between the infant and caregiver was most influential in the infant's personality development (Mullahy, 1970).

Sullivan's personality theory states that individuals are constantly trying to reduce tensions that are the result of biological needs and social insecurity. He defines "tension" as the action that transforms energy into the activities of life (Mullahy, 1970). When a biological need is met, Sullivan claims that satisfaction is achieved. It is therefore obvious why the relationship with the caregiver is so important to the infant. As long as the baby's basic needs are met, it is in a state of
well-being; if they are not met, stress or a "fearlike" state occurs. Sullivan believes that a baby may display increased stress by having difficulty with feeding or sleeping, or by crying excessively (Mullahy, 1970).

According to Sullivan, stress may be felt on a continuum of levels. Mild stress is useful in promoting incentive for action—what Sullivan calls a "power motive." As the baby discovers its state of helplessness, it soon discovers tools to gains some satisfaction, and eventually, security. Sullivan describes infants as being very sensitive to the attitudes of others toward them. He further claims that a caregiver can easily set an emotional tone, whether positive or negative, while meeting the infant's physical needs (Mullahy, 1970).

Sullivan describes the early months of infancy as being very primitive or "prototaxic." He postulates that the young infant is unable to differentiate or categorize various experiences. Each experience is responded to as an isolated event. Sullivan contends that at this point the baby responds nondiscriminatingly and globally to all stimuli (Mullahy, 1970).

As soon as the infant begins to discriminate experiences, Sullivan states that it is capable of experiencing the "parataxic" mode. This is simply the ability to predict the next event. Visual and auditory cues help the baby understand causal relationships (e.g., "Father is smiling, so he's going to pick me up and hug me"). Complete transmission to the parataxic mode is achieved with the acquisition of language (Mullahy, 1970).
Sullivan claims that the baby's early "personifications" or mental images of the caregiver are not realistic but are often perceptions of the interactions experienced between the two (he suggests that the baby thinks of its caregiver as a "nipple" in the beginning because of the nurturing role he/she plays). Sullivan contends that in later infancy the child perceives the caregiver as a person who is sometimes tender and approving, and sometimes disapproving and stress-provoking. The baby at this point is gradually making some discrimination between itself and the world, although it still cannot connect experiences logically as adults do (Mullahy, 1970).

In Sullivan's third and highest type of experience, the "syntaxic" mode, the baby learns the meanings and use of gestures and words. This new ability enables the child to share experiences with others. A syntaxic experience usually begins when the child is a toddler.

Sullivan believes that some time during mid-infancy, two personifications develop in the child, the "good-me" and the "bad-me" which eventually fuse and form the essential self. Good-me feelings occur when the baby senses satisfaction; bad-me feelings occur when the baby experiences stress in an interaction with the caregiver. According to Sullivan, the fusion of good-me and bad-me occurs at about 18 months of age (Mullahy, 1970). The balance of which "me" is dominant can change with every situation. Frequent experiences with stress can lead to a perception of self as "bad," to depression, and to feeling of inferiority.
A third personification, "not-me," may be a result of intense stress. The "not-me" personification represents the individual's attempt to escape the negative feelings evolving from intense or continuous "bad-me" perceptions. The tendency is to project the stress onto another person or object and to deny or ignore one's true feelings. Much of Sullivan's "not-me" concept pertains to later schizophrenic tendencies which are beyond the scope of this literature review. Sullivan also contends that an infant who suffers intense stress over a time span may drop into an apathetic sleep-like state called "somnolent detachment." If somnolent detachment is used frequently, Sullivan predicts that permanent physical or psychological impairment, or both, could occur (Mullahy, 1970).

All of the previously discussed theories acknowledge that some form of insecurity or stress occurs in the infant. Theorists, however, differ in opinion concerning the cause of these stresses, when the infant is capable of perceiving such feelings, and how the infant demonstrates that it is experiencing some form of stress.

During the second month of life, some infants already appear to experience a feeling of "being left" and therefore cry when a meaningful object (caregiver, favorite toy) is removed from sight. By the time the infant is three months old, he/she will not cry when the caregiver leaves as long as another person is present. However, if that person leaves, the infant will frequently cry as hard as if it were left alone by the caregiver. This suggests that the infant is beginning to recognize its dependence on an adult but shows nonspecific attachment to the caregiver figure (Schuster & Ashburn,
The terms "stranger anxiety" and "separation anxiety" are often used interchangeably. But, according to Schuster and Ashburn (1980), they are not synonymous. Stranger anxiety is the stress experienced by a young child when he/she is introduced to an unfamiliar person. Separation anxiety is the insecurity felt by a young child when he/she is removed from a familiar person, object, or environment. Since the baby may display the same behaviors (e.g., screaming, refusing to cooperate, attempting to withdraw) when experiencing either of these forms of stress, it is important to differentiate between the two events.

Separation anxiety appears to peak when the baby is beginning to feel secure in its ability to predict events (about eight to 10 months), and again when the baby is beginning to realize its ability to control some events (18 to 24 months). When the baby is separated from known persons, toys, routines, or environment, it can no longer predict events. The baby must then expend more energy to process stimulus input. Behavioral responses are positive indicators of the baby's desire to be an active participant in environmental events.

It appears that the baby becomes most securely attached to the person whose behaviors can be predicted. Most researchers indicate that wariness of strangers begins at about five to six months, peaks in late infancy and early toddlerhood (12 to 18 months), and gradually decreases thereafter. This stress is demonstrated in different ways by individual babies, including sober examination of a new face, cessation of smiling, or physical withdrawal and crying.
Learning theorists observe that each caregiver-infant dyad establishes a unique communication system. It would appear that both the caregiver and the infant make important contributions to the relationship by mutually eliciting and reinforcing the behaviors by the other. Since social interaction is dependent on the baby's ability to identify cues, form schemata, and respond discriminately, when a stranger enters the scene the baby may no longer be able to predict the other person's responses. Therefore, the stimulus of stranger becomes a source of stress: the baby is not yet able to generalize discriminatory cues or response behaviors with the new communication partner. When separation occurs, the communication partner has left the baby's possession. Separation anxiety may also occur when "overlearning" has taken place. The baby is unable to generalize the communication system with a second person until he/she has more experiences with persons other than the primary caregiver to facilitate generalization (Schwartz & Schwartz, 1977).

The number of adults with whom an infant is familiar influences its degree of stress with strangers. Schaffer and Emerson (1973) report that infants reared around few adults demonstrate more stress toward strangers than those reared by a greater number. Yarrow (1972), a cognitivist, believes that attachment is based on the baby's ability to structure its perception of the environment and to respond discriminately. Attachment occurs because the baby develops a schema for "caregiver," and prefers stimuli that are only mildly discrepant from known stimuli or schemata. Other persons provide different stimuli and, therefore, may not fit into the baby's "people
behavior schema," thereby eliciting stranger anxiety.

This interaction between caregiver and infant is heavily influenced by individual temperament, memory traces of earlier life events, the immediate stimulus of the environment, hierarchical family relationships, level of emotional development, cognitive functioning level, and culture (Schuster & Ashburn, 1980). Consequently, each relationship is unique. Since most studies have assumed that it is usually the primary caregiver who sets the milieu for the first social interactions, an analysis of the caregiver-infant dyad is presented here.

A general but very important question concerning the caregiver-infant relationship appears to be "Will the caregiving person and the infant be able to adapt positively to each others idiosyncrasies?" Stern (1969) did a study that attempted to focus on the correlation between maternal personality and behavior characteristics and infant personality and behavior characteristics. The families used as subjects in this study varied greatly in quality and type of "mothering," marital status, socio-economic level, race, mother's age, and the gender and ordinal position of the baby. Nevertheless, Stern (1969) found nine different profiles of caregiver-infant behaviors that appeared to describe the relationship of these respective caregiver-infant dyads. It was found that caregivers who were subjectively rated as skillful, attentive, loving, and involved by the evaluator tended to have infants who reciprocated with accelerated mental and motor maturity. These caregivers, in turn, were described as being emotionally involved
with their babies. In contrast, caregivers who tended to be abrupt in their movements involving the infant, who responded indifferently to the child's distress, and who were assessed as having a low level of emotional involvement tended to have infants who displayed "hostile demandingness." Unfortunately, this only reinforced a negative picture of low caregiver self-esteem (Stern, 1969).

Bell and Ainsworth (1972) found that a caregiver's prompt response to the crying infant with close, comforting physical contact is associated with fewer and shorter bouts of crying in the child's first year. Spock (1976) says that caregivers should not worry about spoiling the child during the first two months by giving rapid attention to the infant's various needs. Using Mahler's et al. (1975) theory, mutual focusing on the baby's needs is an important foundation to later individuation. Therefore, spoiling is impossible in the first few months of life (Schuster & Ashburn, 1980). However, continuation of the relationship found during normal autism into the symbiotic and separation-individuation phases delays the baby's ability to distinguish between self and others and interferes with progression toward a realistic perception of the external world. Thus minor delays in the meeting of needs and frustrations as the baby grows older aid the child in learning how to differentiate between self-nonself. It also helps the child meet his/her own needs, and to recognize the needs of others (Schuster & Ashburn, 1980).

Feeding time is an example of two individuals interacting in a situation that requires some sort of teamwork. Brody (1956) has done
much research in this area. She postulated that the success of the feeding process was more a product of the caregiver's attitude than of the infant's neuromuscular skill. On the other hand, infant's demonstrate many unique feeding patterns and behaviors that will affect the caregiver's attitude about the feeding regime. With time, experimentation, and patience, the caregiver and infant will adjust to each other. The infant's degree of adjustment during feeding is considered by Bettelheim (1962) as having a greater impact on the developing personality than any other human experience.

While feeding is indeed life sustaining, so is touch. A much-told story speaks to this fact. As late as the second decade of the twentieth century, the infant mortality rate in various orphanages was nearly 100% (Montagu, 1978). For some reason the infants did not thrive, even in sanitary environments with nutritious food. Dr. Fritz Talbot happened to observe a "fat old woman" called "Old Anna" while he was visiting the Children's Clinic in Dusseldorf, Germany. Old Anna apparently made the babies happy by carrying them around on her hip as she did her duties. Whenever the clinic personnel felt everything had been done for an infant medically, yet the baby still failed to thrive, the child was turn over to her. Old Anna was reported to have always "pulled the child through" (Montagu, 1978).

Grossman (1972) tells a story of how he concluded that babies must be very sensitive to the vibratory movements of people holding them. He noted that infants undergoing baptism in his church were usually crying at full capacity by the time the stressed parents
delivered them to the minister at the baptismal font. However, shortly after the minister held the babies, the crying stopped. Grossman (1972) concluded that the tight body muscles of the trembling parents communicated stress to the infants, who could express this feeling only by crying. On the other hand, the relaxed minister, making use of the same physical mechanisms, was able to communicate a calm and secure feeling to the babies.

Mahler et al. (1975) observed the "holding behaviors" of several caregivers to gain insight into how the baby and caregiver would achieve the separation-individuation process. Mahler et al. (1975) postulated that babies separated easily or with difficulty from the caregiver depending on how the baby perceived the caregiver's "holding on" to them, both physically and emotionally. Some children tend to "cuddle" more than others. Emerson and Schaffer (Stone, 1973) concluded from one of their studies that there is no apparent reason why some children appear to resist physical contact, and postulated that the reason may be an innate predisposition. Nevertheless, most crying infants can be soothed by placing the child on a shoulder while pacing the floor or rocking in a chair. Rocking is said to be soothing because of its quiet stimulation of the baby's skin and muscles. It is also felt rocking excites vestibular-proprioceptive stimulation, which appears to facilitate the coordination and voluntary control of movements (Korner & Thoman, 1972). When rocking is combined with raising the child to the shoulder, his/her visual scanning behavior is increased; thus, the child is able to learn more about the environment by being rocked in
a state of alert inactivity.

Families, as well as the people who compose them, differ in their attitudes toward children and child-rearing. Parental behavior affects the child's social initiative as well as his/her ability to cope with stress. An experiment by Yarrow (1963) emphasized that the quantity of parental physical contact was not as important as its quality. Yarrow (1963) found that how appropriately and consistently parents responded to their infant's communications (crying or cooing) was more important than how much physical contact they gave.

Attitudes toward caregiver-infant relationships, child-rearing goals, discipline, and life in general also varies among different socioeconomic classes and different cultures. These differences affect the personal development of every person. One example is the holding of a baby. In some American families, the parents may hold the child frequently, whereas others limit their caregiving primarily to meeting "basic" needs. In many non-western cultures, infants are maintained in almost continual contact with their caregivers, often including sleeping with them during the night. Infants may be strapped to cradle-boards which are kept vertical or horizontal most of the time. Even the process of bathing differs greatly--it may involve tub submersion, never being placed in water, or bathing with one or more persons in the same vessel. With varying methods of stimulation, it is presumed that different norms of behavior and development will be the outcome (Schuster & Ashburn, 1980).

To confirm this point, Brazelton (1969) observes that "normal babies are not all alike." From the very moment of birth, and even
before that (e.g., some children kick more than others in utero),
differences in infant behaviors become apparent. Brazelton (1969)
has identified three varying interactional styles in infants. He
claims that a baby tends to adopt several of the characteristics of
one of these types—the active, the average, and the quiet baby. His
descriptions are composites of the many babies whom he has cared for
during his years as a pediatrician. For example, the average baby
may cry lustily in a cyclic fashion until its hand somehow finds
his/her mouth. Then the baby will become peacefully quiet. The
active baby may enter the world "crying and fighting." In contrast,
the quiet child may appear "sluggish." Brazelton (1969) claims the
temperament of these three different babies can strongly affect the
tenor of caregiver response and the foundation on which further
relationships will be built.

Whether active or passive, all healthy infants cry. Crying can
signify a need but it can also be a stress release. Each infant has
its own individual way of releasing stress, as well as receiving a
sense of security from various comforting behaviors (e.g., hair
twisting and crib rocking). Such behaviors begin to develop around
six months of age when the baby begins to recapture the security of
early infancy by an increasing reliance on "comforters" (Spock,
1976). A comforter is any object or behavior that recreates a
stimulus that was socially nurturing during early infancy. This
increase for the need of comforters is in conjunction with the
developing separation-individuation process. It is interesting to
note that Wolff (1973) claimed thumb-sucking, an obvious oral
comforter, was a specific response by babies as young as two months to stress caused by psychological factors, especially by "being left." Objects such as security blankets may also be thought of as comforters.

Ilg and Ames (1955) claim that thumb-sucking is most likely to begin around three or four months of age. They postulate that because thumb-sucking often occurs immediately after a feeding, the infant is seeking continued oral pleasure through sucking. Gradually the urge spreads to other times of the day and night with wide patterns of individuality displayed. After six months, thumb-sucking becomes a reminder of early infantile comfort, which the baby needs only when he/she is sleepy or upset (Spock, 1976). The infant who does not suck its thumb apparently has all sucking needs met through nursing. Thumb-sucking often peaks around seven months of age and again during toddlerhood. However, it is important to note that infants who suck their thumbs and those who do not may be equally normal, healthy and loved (Schuster & Ashburn, 1980).

This section of the literature review has focused on emotions existing in the infant after he/she is born. The next part will deal with the affective domain, or emotional domain, that exists in utero.

Affective Domain

Although it seems unlikely that even a near-term fetus is aware of its mother's emotional states, those maternal states can have a strong effect on the developing child by means of physiological pathways (Birren, Kinney, Schaie, & Woodruff, 1981). Distressing
events can produce powerful physiological changes in the body, including the release of various hormones such as epinephrine (Adrenalin) and changes in the distribution of blood flow and activity in various organs such as the nervous system. Such changes in body chemistry and functions are usually adaptive, in that they prepare the organism to cope with danger—for example, to flee from or face an adversary. This common stress response, however, is also a strain on the body's resources. In 1978, Selye reported that stress interfered with the growth and body maintenance functions, and, if maintained for too long, could actually kill an animal. Another experiment with animals demonstrated that stressing a pregnant animal could strongly affect the behavior of its offspring and that injecting the pregnant animal with hormones released by stress produced similar effects (Joffe, 1969). Such was the case in Lieberman's (1963) research. According to Lieberman (1963), injections of stress syndrome hormones into pregnant mice and into chicken eggs produced changes similar to those produced by subjecting mice to behavioral stresses. Lieberman (1963) concluded that possibly severe stress during pregnancy left its mark on the unborn through sympathetic activation of the stress syndrome and migration of hormones across placental barrier.

In the case of human beings, Sontag (1941, 1944, 1966) studied pregnant women undergoing stress. During times when mothers were stressed, fetal body movements increased several hundred percent. The increased activity normally persisted several hours, even when the maternal disturbance was of short duration. When the stress
continued for several weeks, fetal activity was greatly increased for the entire period. An example of a prenatal reaction to stress has been reported by Montague (1964) in this way:

Possibly the earliest account of a connection between a mother's emotional state and a child's movements were recorded in 1867 by Dr. James Whitehead. He described a woman in her ninth month of pregnancy who nursed her twenty-month-old child, an only child, through a severe three-week attack of a serious disease. As soon as it was clear that the child would live the mother collapsed, exhausted. The kicking grew more and more severe for several hours. Dr. Whitehead gave the mother chloroform and "repenthe" and the kicking began to subside. Twenty-one days after this, the baby was born, healthy and vigorous, and for as long as Dr. Whitehead observed him—a matter of thirty-five days—he showed no tendency toward unusual behavior.

Dr. Whitehead was well ahead of his time in his understanding of this episode. He pointed out in his report that although a child before birth may be quite unperturbed and unharmed by a physical shock such as [the mother] falling from a height, "It seems to be otherwise when the mental system of the mother becomes unbalanced by violent and severe shocks of anguish, or by prolonged and severe anxiety." (Montague, 1964, p. 148)

In addition, Sontag's (1941, 1944, 1966) studies with pregnant rats and other mammals indicated that severe and prolonged maternal stress could produce small offspring whose viability, activity, anxiety levels, and learning ability were affected. As early as the second World War, Sontag was writing about his fears that the emotional stresses of war time bombings and anxiety about loved ones would affect the prenatal development of unborn children in Europe. Sontag (1944) was concerned that these undesirable conditions would result in children born with functional disorders, particularly of the digestive system, or children who would exhibit unstable behavior patterns. This point was illustrated by Sontag (1944) when he wrote
Another change which is apparent at birth in infants of mothers undergoing severe emotional stresses is in behavior, in total activity level. Such an infant is from the beginning a hyperactive, irritable, squirming, crying child who cries for his feeding every two to three hours instead of sleeping through his four-hour feeding. Because his irritability affects control of his gastrointestinal tract, he empties his bowels at unusually frequent intervals, spits up half his feedings, and generally makes a nuisance of himself. He is to all intents and purposes a neurotic infant when born--the result of an unsatisfactory fetal environment. In this instance, he has not had to wait until childhood for a bad home situation or other cause to make him neurotic. It has been done for him before he has even seen the light of day. In certain instances of severely disturbed maternal emotions we have observed—for example, one in which the father became violently insane during his wife's pregnancy—the infants bodily functions were so disturbed that a severe feeding problem resulted. The child was unable to retain food and became markedly emaciated and dehydrated. Experience with other similar cases suggests that many of the feeding problems pediatricians experience with young infants arise from an abnormal fetal environment. (Sontag, 1944, p. 4)

It is possible that nearly all women experience some stress during pregnancy, including some possible ambivalence toward the pregnancy itself. Whether pregnant or not, women continue to experience the joys, sorrows, and occasional upsets of everyday life. Yet, most babies are born healthy and normal because their mothers are able to deal with these stressful situations without harm either to themselves or to their developing child (Annis, 1978). According to Ausubel and Sullivan (1970) the sources of stress during pregnancy are many:

1. The social stigma attached to sterility may be strong enough to coerce a woman into a pregnancy for which she is not quite ready.

2. An unwholesome situation exists when pregnancy is perceived
as necessary to retain the husband's affection or to rescue a faltering marriage.

3. In instances where a woman is deciding whether or not to divorce her husband, pregnancy often means she will stay married, thus restricting her freedom of decision.

4. For every woman, there is the possibility of protracted illness, disability, and death in connection with childbirth; of abortion or fetal death; of giving birth to a deformed infant or a child with a dreaded hereditary disease.

5. All pregnant women have to face the ordeal of labor and delivery—both the genuine pain and the emotional pain encouraged by fearful folklore.

6. Prudish women feel shame and humiliation from exposing themselves before doctors and nurses.

7. Motherhood curtails personal freedom, and limits opportunities for rest and relaxation. It may also create financial difficulties and interrupt or even end a woman's career.

The most serious type of stressful reactions to pregnancy—vomiting, amnesia of conception, delusions of infant death, and talk of suicide—occur in women who are strongly predisposed to regard prospective motherhood with apprehension, stress, ambivalence, or outright rejection (Ausubel & Sullivan, 1970). Consequently, previous human research has made it quite clear that prolonged strong and unpleasant stress during pregnancy can result in behavioral changes in the child before and after birth (Annis, 1978).
Thus, an expectant mother's stressful state during pregnancy may affect the disposition of the baby she produces. Brazelton, Parker, and Zuckerman (1976) claimed that infants who suffered intrauterine growth retardation seemed to have more difficulty organizing neuromuscular responses and were frequently labeled as "colicky" by mothers. Similar to the previous study, Dodge (1972) concluded prolonged maternal stress could produce a congenital defect known as "infantile pyloric stenosis," in which the infant may suffer from an excessive development of a valvelike muscle in the stomach, which could cause projectile vomiting a few weeks after birth.

A more in-depth study of the relation between pregnancy stress and child development was conducted by Stott (1973). This researcher interviewed a cross-section of 153 women within a month after they had given birth, after which public health nurses followed the development of these children over the next four years. The children were measured at regular intervals for the presence of various physical and mental problems that might have been related to prenatal stress, including failure to gain weight, convulsions, obesity, congenital malformations, retardation in speech and motor skills, and hyperactivity. Children who suffered from such problems were much more likely to have had a mother who experienced prolonged stress during her pregnancy (caused by factors such as repeated quarreling with a husband, mother-in-law, or neighbor). Stott (1973) concluded that such stress for the mothers was an important cause of the illnesses seen in the children after birth.

A decade earlier, Davids, Holden, and Gray (1963) reported...
relations between measures of stress in the mother during pregnancy and measures of psychological factors revealed when the mother and child were studied at a time eight months following childbirth. They predicted that mothers who were highly stressed during pregnancy would reveal less favorable childbearing attitudes and would be less well-adjusted psychologically at the time of the eight month assessment. These researchers also predicted that the children of highly stressed mothers would be assessed as less adequate, emotionally and intellectually, at the time of the eight month assessment.

The subjects in this study were 50 pregnancy women who participated in a research project conducted at the Providence Lying-In Hospital. The women were given a psychological test battery which was administered during the last trimester of pregnancy. The women and their children were also seen for a thorough psychological assessment when the child was eight months old. This group of subjects represented a random sample of women being studied on a local research project which focused on physical and medical events that affected the course of the pregnancy.

The pregnant women were examined individually by experienced psychologists who administered a comprehensive test battery which consisted of intelligence tests, self-ratings, questionnaires designed to reveal psychodynamics, and several projective techniques designed to reveal unconscious motivation. Also included in the assessment battery was the Taylor Manifest Anxiety Scale.

Eight months following birth, a psychological evaluation of the
mother and child was scheduled. The emphasis of this evaluation was on the child's behavior and performance but, in addition, there were several ratings and evaluations of the mother. During the assessment, the child's behavior was observed and rated in terms of "general emotional tone." This rating was made on an eight-point scale running from unhappy to happy. The lowest rating was assigned to a child who seemed unhappy throughout the examination. The highest rating was assigned to a child who appeared radiantly happy throughout the assessment.

At the time of this examination, the mother completed the parental attitudes research instrument. This study utilized a short form of the parental attitudes research instrument which consisted of 30 items indicative of maternal attitudes regarding family relations and childbearing practices. The mothers responded to each item on a four-point scale ranging from "strongly agree" to "strongly disagree." The mother's responses provided indices of the following factors: rejection of homemaking, irritability, domination, intrusiveness, deification, and marital conflict.

Since the child sat on the mother's lap during a large portion of the evaluation, it was possible for the psychologist to observe the mother-child interaction in the course of interviewing the mother. She was asked to report events of the baby's day, when and how much the child ate, what the baby played with, what annoyed the child, and what the baby enjoyed. Questions were also asked concerning the role of the child's father and others in caring for the child. Through this procedure, the psychologist obtained
indications of the mother's attitude toward her child, husband, and family, as well as signs of maternal personality attributes such as stress.

On the basis of this information, the psychologist made a personality evaluation called "Maternal Personality Ratings." This evaluation consisted of nine seven-point rating scales including the following variables: communication, stress, depression, cooperation, warmth, negativism, emotional inhibition, activity, and responsibility. Each of these dimensions ran from an undesirable extreme to a socially desirable rating. The higher the sum of the ratings, the more positive was the examiner's clinical assessment of the mother's personality dynamics.

At the end of the assessment procedure, the psychologist also made a global evaluation of the mother-child relationship. The psychologist assigned one the following evaluations: favorable impression, or unfavorable impression. This global rating was not based on any specific scores from the assessment battery, but was a general evaluation in terms of the examiner's observations and impressions of the mother's personality and maternal behavior as revealed in the course of the session. As a group, the women who were highly stressed during pregnancy tended to exert significantly more control over their children and had a much more authoritarian attitude in regard to childbearing. In addition, the highly stressed women revealed greater dissatisfaction with the role of being a mother and evidenced more marital conflict and irritability in relations with their children and husband.
Moreover "high stress" women received significantly lower personality ratings from the psychologists at the eight month assessment—46% as compared to 77% of the "low stress" mothers who received a favorable evaluation. Therefore, it is evident that the psychologist perceived the "high stress" woman as possessing less desirable personality traits and formed a less favorable impression of the mother's behavior with the child in the course of the evaluation.

Davids, Holden, and Gray's (1963) research was a prospective study. In the past, most research that attempted to determine pregnancy experiences and the personality and attitudinal characteristics of mothers of emotionally disturbed or physically handicapped children was done retrospectively. Mothers of schizophrenic, mentally retarded, or cerebral palsy children were interviewed and tested psychologically and on the basis of the findings and the mother's answers about past experiences, the examiner attempted to formulate a picture of her health and her psychodynamics during pregnancy and to discover relationships between the data. However, it was impossible to unravel the problem of which came first—the mother's emotional maladjustment or the child's physical and/or emotional maladjustment. For example, if a mother of a schizophrenic child was found to be stressed or reported having experienced stress years previously, a researcher could never be sure whether this stress resulted from the fact that the mother had been living with a schizophrenic child. In this study, however, the researchers obtained a measure of stress in the mother at a time
before her child was born and, although stress may have been due to a state of being pregnant, it could not be instigated by physical an/or emotional characteristics of the offspring, which she was not to experience until several months later.

Stewart, Werland, Leider, Mangham, Holmes and Ripley (1954) also studied the interaction between parents and infants. These researchers determined that one reason for excessive infant crying was tension transmitted from the mother either prenatally or postnatally.

This interaction was studied in 18 infants from 13 families. Initial interviews were held with 10 mothers prenatally, with one mother at 11 days postpartum, and with two mothers at four weeks postpartum. Prenatally, the 10 mothers were interviewed at monthly intervals and the mothers were also seen several times during their hospital stay.

In this study, infant crying was found to be a response to stress which arose internally from unsatisfied needs or from inappropriate external stimulation. The quantity of this stress was affected by the parent's response as it related to the satisfaction of the infant's needs. This responsiveness was perceived by the infant through the sensory system. The mothers of babies who cried excessively responded inappropriately and inconsistently to their babies' needs with overstimulation or with relative neglect. The excessively crying infants did not develop security in interpersonal relationships to the same extent as those who cried very little. In addition to excessive crying, these infants demonstrated
regurgitation, night walking, growth failure, muscle tension, and gastrointestinal dysfunctions. These infants also had frequent illnesses.

Clearly, emotional stress can be dysfunctional to the system! In contrast, the positive effects of aerobic exercise have been investigated by a number of researchers. The reasons for these benefits are diverse. Most recently, Monteson, Pechai, and Welsh (1984) conducted a study at the Golden Triangle YMCA in Pittsburgh, Pennsylvania. Here, they were to investigate the effects of acute physical activity on the stress levels of adult women. The subjects were 20 women enrolled in a cardiovascular fitness class. The criterion for subject selection was a Trait Anxiety Inventory score that was within one standard deviation of the mean score for adult women.

The score indicated an individual's relatively stable tendency toward stress. The purpose in selecting individuals within a restricted Trait Anxiety Inventory score range was to eliminate those who were extreme in terms of this characteristic. Each of the subjects were randomly assigned to one of two experimental groups. Subjects in the first group received information prior to each class about the positive benefits resulting from regular exercise. Those in the second group received information indicating that neither positive nor negative benefits result from regular exercise. The researchers used this two-group design to control the subjects' expectations of exercise participation.

Before the start of the exercise class, each subject completed
the State Anxiety Inventory. Then each individual participated in the 45-minute cardiovascular fitness class which included the following:

1. warm-up: flexibility, light jogging
2. strength/flexibility: stretching, calisthenics, weight lifting
3. cardiovascular: walk/jog, aerobic activities

Each subject monitored and recorded her exercise heart rate every seven minutes during the class session. The instructor used the heart rates to modify the intensity of the activity on an individual basis. Immediately following the cool-down phase, each individual completed the post State Anxiety Inventory. This procedure was repeated eight times during the 10 week fitness class.

Statistical analysis of the data indicated a significant reduction in the state anxiety for groups one and two between the pre- and post-test scores of each class session. Further analysis of the data failed to indicate any significant difference between the groups based on pre-exercise instruction. Apparently, the acute physical activity and not the pre-exercise information on the benefits of exercise was responsible for the significant decrease in state anxiety among the women.

In addition, Bortz, Angwin, Mefford, Boarder, Noyce, and Barchas (1981) found that physical conditioning programs facilitated beta-endorphine release. Parkman and Baker (1980) suggested that the release of enkephalin could produce a feeling of euphoria. Merzbacher (1979) concluded that increased oxygenation of blood
circulating to the brain enhanced cerebral functioning. Several researchers indicated the possibility of physiological events such as corticosteroids, glucose, amines, androgens, and lactic acid (Pitts & McClure, 1967; Ismail & Young, 1977; Brown, Ramirez, & Taub, 1978). Cantor, Zillman, and Day (1978) hypothesized that increased capillarization and oxygen consumption was the basis for psychological benefits. Heaps (1978) claimed that physical improvement was useful for improving psychological well-being only to the extent information about the change was communicated and assimilated. Folkins (1976) also suggested that reduced electrical activity in the muscles occurring after increased fitness was cognitively perceived as an indication of reduced stress. Folkins, Lynch, and Gardner (1972) concluded, upon reviewing pertinent research, that physical activity could reduce stress emotions (e.g., fear, anxiety, tension, anger, depression). Finally, in Collingwood's (1972) study, it was expected that those subjects who were receiving physical training would demonstrate greater positive changes not only in physical fitness, but in body attitude, self-concept, and physical, intellectual and emotional-interpersonal behaviors than those subjects who were not receiving such training. The subjects were 25 matched pairs using a rehabilitation counselor's judgment in terms of behavioral and emotional difficulties and need for a physical training program. From each pair, one subject was selected randomly for the physical training program. The control group received the standard rehabilitation training program. Subjects spent one hour every day, five days a week, for four weeks.
in the the program for a total of 20 hours. Collingwood (1972) concluded that the experimental subjects demonstrated greater significant increases, over a matched control group, in physical fitness performance, body attitude, positive self-attitude, self-acceptance and positive physical, intellectual and emotional-interpersonal behaviors.

Similarly, Kitzinger (1980) and Shrock (1984) have concluded that exercise during pregnancy promotes mental well-being. Shrock (1984) claims that birth is a normal, natural physiologic process. Therefore, supporting the premise that "pregnancy is a state of health," both physical and mental aspects of body changes need to be considered. Feelings of well-being and confidence, which result from exercise of the whole body on a regular basis, enable the pregnant woman to approach childbirth with positive expectations.

In addition, physical exercise can improve the mother's circulation, appetite, digestion, and elimination. All of these are affected throughout pregnancy, and in return are mirrored in the mother's mental attitude. Regular exercise is recognized as a contributor toward a healthy and more comfortable pregnancy. Also, self-esteem is reduced immeasurably after childbirth, when the woman is upset by her "ruined figure and additional folds of flesh." Exercise during pregnancy, and then again after delivery, ensures quicker post partum recuperation, with renewal of positive body image and self-esteem. These feelings of well-being and additional energy enable the new mother to better face the responsibilities of parenthood. Therefore, it is logical that aerobic exercise be used
as a vehicle to reduce stress among the population of expectant mothers. This will benefit both the mother and her developing child.

Research Hypothesis

Pregnant women who exercise aerobically three days or more per week will score low on the trait portion of the State-Trait Anxiety Inventory (Spielberger, 1983) in their last trimester, but pregnant women who do not exercise aerobically will score high on the same inventory in their last trimester. (G.H. McGlynn, Franklin, Lauro, & I.K. McGlynn, 1983). The independent variable for this hypothesis is aerobic exercise. The dependent variable is anxiety which was measured by the trait portion of the State-Trait Anxiety Inventory.
CHAPTER III

STUDY DESIGN

This research was quasi-experimental and used the Solomon Four-Group Design (Ary, Jacobs, & Razavich, 1979) which is illustrated in the following way:

<table>
<thead>
<tr>
<th>Group</th>
<th>Pretest</th>
<th>Independent Variable</th>
<th>Posttest</th>
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<tbody>
<tr>
<td>E</td>
<td>$y_1$</td>
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<td>$C_1$</td>
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<tr>
<td>$C_3$</td>
<td>-</td>
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</tr>
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where

E = Experimental Group
$C_1$ = Control Group 1
$C_2$ = Control Group 2
$C_3$ = Control Group 3

The author selected the Solomon Four-Group Design for the two following reasons: (1) subject availability limitations which necessitated the use of intact groups and precluded the random assignment of subjects to groups and (2) inaccessibility to the $C_2$ and $C_3$ groups for pretesting.

The strength of this design is that it incorporates the advantages of several other designs as well as its own unique contribution. The first two groups were identical to the pretest-posttest design. The third group was a second control and
thereby overcame the difficulty inherent in the pretest-posttest design—namely, the interactive effect of pretesting and the experimental manipulation. When the fourth group was added, there was control over contemporary effects that may have occurred between pretesting and posttesting. The last two groups represented the two-group posttest-only design, so for the purpose of this study, the Solomon Four-Group Design was a combination of the pretest-posttest quasi-experimental-control design with the simple nonrandomized-subjects design. In addition to the strengths of each design taken separately, the replication feature provided by the two experiments is also apparent. This replication took advantage of the information provided by the pretest-posttest procedure and at the same time showed how the experimental condition affected an unpretested group of subjects. In other words, the Solomon Four-Group Design actually involved conducting the experiment twice, once with pretests and once without pretests.

In the Solomon Four-Group Design, it was possible to make several comparisons to determine the effect of the experimental treatment (exercise) on anxiety test scores. If the posttest mean of the experimental group, E, was significantly less than the mean of the first control group, C₁, and if the C₂ posttest mean was significantly less than the mean of C₃, the effectiveness of the experimental treatment was evident. The influence of the experimental treatment on a pretested group was determined by comparing the posttests of E versus C₁ or the pre-post changes for E and for C₁. The effect of the experiment on an unpretested group was
found by comparing the posttest means of $C_2$ and $C_3$. If the average differences between posttest scores, for $E$ versus $C_1$, and $C_2$ versus $C_3$, were nearly the same, then the experiment must have had a comparable effect on the pretested and unpretested groups.

In addition to anxiety scores, the following demographic information was obtained from each subject: age, occupation, family income, general physical and mental health, education, lifestyle, and previous exercise history. Bradley (1983) used all of these demographic variables (except for exercise history) in her study regarding psychological consequences of intervention in the birth process. However, she found no significant differences among her Canadian subjects in terms of their age, occupation, or level of family income (maximum $F$ obtained, $F(2, 249)=2.89$, $p>0.1$). She also found that no differences were identified between reported state of mental health and physical health prior to birth (Bradley, 1983). The author examined these demographic variables for their association with anxiety levels.

Subjects

The experimental group consisted of women who participated in the Borgess Fitness Center's Pregnancy Fitness program for the duration of their pregnancies. The Borgess Fitness Center is located in Kalamazoo, Michigan. The pretesting of these women took place by the end of their first trimesters and the posttesting occurred during their last trimesters. A total of 12 Pregnancy Fitness women were tested because this was the number of women in 1987 who participated
in the Pregnancy Fitness program at the Borgess Fitness Center for the duration of their pregnancies.

The first control group consisted of women participating in a New Beginnings class at the Borgess Fitness Center. This class is a requirement for women wanting to use the birthing center at the Borgess Medical Center. A total of 12 women were in this group; this number was the same as for the experimental group for statistical purposes. These 12 women confirmed that they did not participate in a fitness program during their pregnancies. However, they were pretested and posttested identically to the experimental group.

Control groups 2 and 3 together consisted of 130 women enrolled in the Lamaze program at the Borgess Fitness Center during 1987. Subjects indicating that they aerobically exercised at least three days per week were classified as control group 2 and were considered physically fit. Those indicating that they aerobically exercised two days or less per week were classified as control group 3 and were considered physically unfit. The criterion for subdividing these Lamaze women was Bailey's (1978) definition of fitness. Bailey (1978) asserts that if a woman performs aerobic exercise for at least three days per week, her fitness is maintained; if her frequency is two or less days per week, her fitness is lost.

Internal Validity

According to Campbell and Stanley (1966), internal validity is achieved by the random assignment of experimental units to experimental conditions. If random assignment is possible, internal
validity is controlled. However, the subjects in this research were not randomly assigned. Therefore, there were internal validity limitations. There may have been events affecting groups E and C1 between the pretest and posttest. For example, some subjects may have a more active lifestyle than others. Baling hay versus a desk job might cast some doubt on the validity of the researcher's assertion that the prenatal exercise alone reduced anxiety. An active lifestyle is a source of possible internal invalidity which Campbell and Stanley (1966) classify under "Selection."

Since the subjects in this study were not randomly assigned, Selection-Maturation Interaction (Campbell & Stanley, 1966) may also have been a problem. This type of interaction may occur in a quasi-experimental study, such as this one, where the experimental and control groups are not randomly selected but instead are preexisting intact groups. Even though a pretest may show that the groups are equivalent, the experimental group may have a higher rate of maturation than the control group. In effect, it is this increased rate of maturation that accounts for the observed effect. More rapidly maturing subjects are "selected" into the experimental group and it is the selection-maturation interaction that may be mistaken for the effect of the experimental variable.

External Validity

In 1967, Bracht and Glass identified two types of external validity: "Population Validity" and "Ecological Validity." Population validity asks the question, what population of subjects
can be expected to behave in the same way as did the sample experimental subjects? Ecological validity asks the question, under what conditions (settings, treatments, experimenters, dependent variable, etc.) can the same results be expected?

With regard to population validity, it is argued that the findings of this research can be generalized from the experimental groups of Kalamazoo pregnant women to a much larger population of pregnant women. The ideal would have been a sample of all pregnant women, but this, of course, is impractical. In addition, Ary (1979) suggests that it is better to have reliable knowledge about a more restricted population and to have the resulting uncertainty of extending this knowledge to the target population than it is to define the experimentally accessible population so broadly as to be uncertain about inferring from the accessible sample population.

The first requirement for ecological validity is that the researcher provide a complete description of the operations and the experimental setting involved in the study. Regarding this study, each class of the Pregnancy Fitness program at the Borgess Fitness Center was an hour in duration. Pregnant women were eligible to participate upon consent of their physician and after filling out a screening form on site. The class began with static stretches. The pace increased slowly to a 20 minute aerobic workout tailored for pregnant women. Time then was spent cooling down. Exercises to benefit the women during their pregnancies and deliveries were performed next. The class ended with a few minutes of relaxation. All exercising was done to music. There was also a short break.
between the aerobic workout and the cool down exercises. These classes met four days a week at various times. Women and their helpers attended the Borgess Fitness Center's Lamaze either on Monday or Thursday evening for two hours.

New Beginnings is a class sponsored by the Borgess Medical Center. It is a prerequisite for women who intend to use the Borgess Birthing Center. The Birthing Center is an alternative labor and birthing area. The environment is a "homey" atmosphere; it contains a kitchen, family room, bedroom, and a bathroom. Women are allowed to use the Birthing Center for 24 hours. If there are no complications, the women can deliver their babies in the center and go home after the 24 hour period. New Beginnings is a two week course. The first week briefs the women on the birthing process. The second week is a lecture on nutrition during pregnancy and postpartum recovery. The course is intended for women in their first trimesters of pregnancy.

Lamaze is a natural childbirth class. The pregnant women are instructed in breathing, relaxing and pushing techniques that will aid in labor and delivery. Ideally, no medication will be needed if the women can apply the Lamaze techniques. However, the women are given information pertaining to labor and delivery medicines should they need them later. The women also are given information about diet, postpartum recovery, and nursing. Each Lamaze session lasted six weeks.

Another lack of external validity may have been a reactive effect due to the experimental arrangements. The subjects' knowledge
that they were participating in an experiment may have altered their responses to the State-Trait Anxiety Inventory. However, according to Campbell and Stanley (1966), the external validity concern regarding the interaction of testing and the experimental treatment is controlled with the Solomon Four-Group Design. This is true because the Solomon Four-Group Design has control groups with and without pretesting. Therefore, if testing was a factor, it would have been apparent by differences across these controls.

Instrumentation

For this research, the State-Trait Anxiety Inventory (Spielberger, 1983) was used as the instrument to test trait anxiety in pregnant women who did and did not aerobically exercise. The State-Trait Anxiety Inventory consists of 40 items--20 to assess state anxiety ("how you feel right now"), and 20 to assess trait anxiety ("how you generally feel"). Items are presented in counterbalanced order relative to anxiety. The scoring reverses the direction of the nonanxiety items so that a high score suggests a high degree of state or trait anxiety.

According to a review in Buros' (1978) Eighth Mental Measurements Yearbook, test-retest reliabilities are reported for state and trait scores. The high reliabilities (.84 and .76) for trait scores--following one hour of "relaxation training, a difficult IQ test, and a film depicting accidents resulting in serious injury or death"--suggests that trait scores measure considerable state anxiety, even allowing for predicted fluctuations in trait anxiety.
Validities for trait scores, .75, .80, and .52, are estimated by correlating the scores with the IPAT Anxiety Scale, Manifest Anxiety Scale, and Affect Adjective Checklist, respectively.

For the state measure, both item and total score comparisons between presumable stressful states are given, with mean scores reflecting changes in the correct directions. Alpha coefficients, (.83 to .92 for state scores, and .86 to .92 for trait scores) for stressful and nonstressful conditions remain substantially the same indicating internal consistency.

In addition, a number of experiments have been performed on subjects in different states of mental stress, and the state scale has turned out to be a reliable measure of increases in the state of anxiety resulting from the experimental manipulations (Buros, 1978).

The State-Trait Anxiety Inventory (Spielberger, 1983) has been used successfully with populations of pregnant women in various studies. Bradley (1983) determined that both state and trait group means were within the normal range regarding psychological anxiety during pregnancy and in the postpartum period. Lewis (1983) compared state and trait anxieties of mothers previously bereaved by cot death with those of nonbereaved mothers and investigated the effects of anxiety in both groups of mothers on the emotional security of their infants. An analysis of variance performed on the state anxiety scores demonstrated the significant effect of bereavement (F=25.06 df=58 p<.005) and of anxiety (F=10.84 df=58 p<.002). The interaction was also significant (F=6.531 df=58 p<.01).

The State-Trait Anxiety Inventory (Spielberger, 1983) has also
been used to test anxiety levels in nonpregnant subjects who aerobically exercise. G.H. McGlynn, Franklin, Lauro, and I.K. McGlynn (1983) reported test-retest reliabilities for the trait scale ranging from .73 to .86 over periods from one hour to 104 days. State test-retest reliabilities were low, ranging from .16 to .54, as one would expect, given the fluctuating nature of anxiety states. Both measures were internally consistent with Alpha coefficients ranging from .83 to .92. After reviewing the previous three studies, the author elected to use the State-Trait Anxiety Inventory (Spielberger, 1983) to test trait (but not state) anxiety levels in exercising and nonexercising pregnant women. This decision was due to the low state test-retest reliabilities for state anxiety.

Data Analysis

Three types of data analysis were used for this research: analysis of variance, paired-sample t tests for differences of means, and nonparametric Chi-Square tests for the demographic variables associated with each group.

Analysis of Variance

In analysis of variance (ANOVA), a ratio of observed differences/error term is used to test the hypothesis. This ratio, called the F-ratio, uses the variance of group means as a measure of observed differences among groups. The basic rationale for an ANOVA is that the total variance of all subjects in an experiment can be divided into two sources, variance between groups and variance within groups (Ary, Jacobs, & Razavich, 1979).
The variance between groups is incorporated into the numerator in the F-ratio. Variance within is incorporated into the error term which is the denominator. The F-ratio increases as the variance between groups increases. However, the F-ratio decreases as the variance within groups increases. In addition, the number of subjects influences the F-ratio; the larger the number, the larger the numerator becomes. When the numerator and denominator are equal, the differences between the group means are no greater than would be anticipated by chance alone. If the numerator is greater than the denominator, one refers to the table of F-values to determine whether the ratio is great enough to reject the null hypothesis at the predetermined level of significance (Ary, Jacobs, & Razavich, 1979).

In this research, an ANOVA was used to analyze the pre- and posttest trait anxiety scores for all groups. It also was used to analyze posttest scores for all groups.

**Paired-Sample t Test**

In addition, pre- and posttest trait anxiety scores of the Pregnancy Fitness group (X) and the New Beginnings groups (C1) were analyzed using a Paired-Sample t Test. According to Bolton (1984), the Paired-Sample t Test is a sensitive test and it is even more sensitive if the experimental variability is small. With smaller variability, smaller differences of means are statistically significant.

**Chi-Square**
One of the nonparametric tests of significance, the Chi-Square test for independence, was used to analyze the demographic variables measured in this study. Nonparametrics are used for data that is measured on less than an interval scale—such as the ordinal demographic information collected in this study. In the Chi-Square test, two sets of frequencies are compared: observed frequencies and expected frequencies. Observed frequencies are the actual frequencies obtained by observation. Expected frequencies were computed by multiplying three factors: the row percentage associated with a cell, the column percentage associated with that cell, and the total number of observations (Ary, Jacobs, & Razavich, 1979).

The Chi-Square test was used to test a null hypothesis that there is no significant difference between the proportion of the subjects falling into any number of different categories. In this case, the null hypothesis was that a woman's age, occupation, family income, general physical and mental health, education, lifestyle, and previous exercise history are independent of anxiety level during pregnancy. In other words, the demographic variables and preference for prenatal exercise are unrelated. If the null hypothesis was true, there would have been statistically identical proportions among young, old, and average aged women, for example, when this particular variable was placed in a two-way contingency table.

Summary

The merits of the Solomon Four-Group Design were discussed, as well as the collection of demographic information. The availability
and number of subjects was reviewed as well as the study's internal and external validities. The State-Trait Anxiety Inventory (Spielberger, 1983), the instrument for testing the research hypothesis, was described and evaluated. The chapter concluded with a discussion of the data analysis.
CHAPTER IV

ANALYSIS OF DATA

This chapter presents the results of the State-Trait Anxiety Inventory (Spielberger, 1983) and the results of the demographic survey. The formulation of the hypotheses and the analytical procedures used for testing them were outlined in Chapters II and III, respectively. All statistical analyses of data were done with the Statistical Package for the Social Sciences (SPSS) (Norusis, 1982).

Data Collection

The author administered the pretest and the demographic questionnaire to the experimental group at the beginning of Pregnancy Fitness classes at the Borgess Fitness Center. In regard to the first control group, the author pretested subjects at the beginning of New Beginning classes at the Borgess Fitness Center. These pretest data were collected during each subject's first trimester of pregnancy. Posttest data also were collected by mail from these two groups during the subject's third trimesters of pregnancy. The return rate was 100%. All responses were kept confidential.

Control groups 2 and 3 were posttested only. The author administered the posttest and the demographic questionnaire at the beginning of Lamaze classes at the Borgess Fitness Center.
Frequency Distributions

Subjects

Table 1 lists the number of subjects in each group at the end of data collection.

Table 1
Subjects by Group

<table>
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<tr>
<th>Group Name</th>
<th>Group Type</th>
<th>Number of Subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pregnancy Fitness</td>
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</tr>
<tr>
<td>New Beginnings</td>
<td>Control Group 1</td>
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<tr>
<td>Exercising Lamaze</td>
<td>Control Group 2</td>
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<tr>
<td>Non-Exercising Lamaze</td>
<td>Control Group 3</td>
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Trait Anxiety Scores

Trait anxiety scores ranged from 20 to 78 out of a possible 20 to 80. Table 2 lists the pretest anxiety score frequencies for Pregnancy Fitness and New Beginnings. It also gives the pretest anxiety score frequencies when these two groups are combined.
Table 2
Pretest Anxiety Score Frequencies

<table>
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<th>New Beginnings</th>
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<td>Score</td>
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Table 3 lists the posttest anxiety score frequencies for the Pregnancy Fitness, New Beginnings, Exercising Lamaze and Non-Exercising Lamaze groups. The table also lists the posttest frequencies of all four combined groups.

Table 3
Posttest Anxiety Score Frequencies

<table>
<thead>
<tr>
<th>Score</th>
<th>Non-Pregnancy Fitness</th>
<th>New Beginnings</th>
<th>Exercising Lamaze</th>
<th>Non-Exercising Lamaze</th>
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Table 3—Continued

<table>
<thead>
<tr>
<th>Score</th>
<th>Pregnancy Fitness</th>
<th>New Beginnings</th>
<th>Exercising Lamaze</th>
<th>Non-Exercising Lamaze</th>
<th>Combined Groups</th>
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<tbody>
<tr>
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<td>80</td>
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<tr>
<td>Total</td>
<td>12</td>
<td>12</td>
<td>43</td>
<td>87</td>
<td>154</td>
</tr>
<tr>
<td>Mean</td>
<td>37.75</td>
<td>39.03</td>
<td>35.28</td>
<td>38.45</td>
<td>37.56</td>
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<td>Median</td>
<td>36.00</td>
<td>35.50</td>
<td>34.00</td>
<td>37.00</td>
<td>36.00</td>
</tr>
</tbody>
</table>

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Table 4 shows the age frequencies of the four exercising groups—Pregnancy Fitness, New Beginnings, Exercising Lamaze and Non-Exercising Lamaze—and the age frequencies when these groups are combined.

Table 4
Age Frequencies

<table>
<thead>
<tr>
<th>Age</th>
<th>Pregnancy Fitness</th>
<th>New Beginnings</th>
<th>Exercising Lamaze</th>
<th>Non-Exercising Lamaze</th>
<th>Combined Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>35-44</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>25-34</td>
<td>6</td>
<td>6</td>
<td>20</td>
<td>56</td>
<td>88</td>
</tr>
<tr>
<td>15-24</td>
<td>5</td>
<td>5</td>
<td>19</td>
<td>27</td>
<td>56</td>
</tr>
<tr>
<td>Total</td>
<td>12</td>
<td>12</td>
<td>43</td>
<td>87</td>
<td>154</td>
</tr>
</tbody>
</table>

Table 5 lists the occupational frequencies for Pregnancy Fitness, New Beginnings, Exercising Lamaze and Non-Exercising Lamaze. The table also lists the occupational frequencies of all four combined groups.

Table 5
Occupational Frequencies

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Pregnancy Fitness</th>
<th>New Beginnings</th>
<th>Exercising Lamaze</th>
<th>Non-Exercising Lamaze</th>
<th>Combined Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Executives, Major Professionals</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>6</td>
</tr>
</tbody>
</table>
Table 5—Continued

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Pregnancy Fitness</th>
<th>New Beginnings</th>
<th>Exercising Lamaze</th>
<th>Non-Exercising Lamaze</th>
<th>Combined Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managers, Lesser Professionals</td>
<td>3</td>
<td>2</td>
<td>7</td>
<td>18</td>
<td>30</td>
</tr>
<tr>
<td>Administrators, Semi-Professionals</td>
<td>2</td>
<td>1</td>
<td>5</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>Clerical &amp; Sales Workers, Technicians</td>
<td>1</td>
<td>4</td>
<td>8</td>
<td>17</td>
<td>30</td>
</tr>
<tr>
<td>Skilled Workers</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>15</td>
<td>22</td>
</tr>
<tr>
<td>Semi-Skilled Workers</td>
<td>1</td>
<td>2</td>
<td>5</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Not Employed</td>
<td>3</td>
<td>2</td>
<td>15</td>
<td>22</td>
<td>42</td>
</tr>
<tr>
<td>Total</td>
<td>12</td>
<td>12</td>
<td>43</td>
<td>87</td>
<td>154</td>
</tr>
</tbody>
</table>

Table 6 lists the income frequencies for Pregnancy Fitness, New Beginnings, Exercising Lamaze and Non-Exercising Lamaze. It also gives the income frequencies when these four groups are combined.

Table 6

<table>
<thead>
<tr>
<th>Annual Income</th>
<th>Pregnancy Fitness</th>
<th>New Beginnings</th>
<th>Exercising Lamaze</th>
<th>Non-Exercising Lamaze</th>
<th>Combined Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>$50,000 +</td>
<td>2</td>
<td>5</td>
<td>6</td>
<td>13</td>
<td></td>
</tr>
</tbody>
</table>
Table 6—Continued

<table>
<thead>
<tr>
<th>Annual Income</th>
<th>Pregnancy Fitness</th>
<th>New Beginnings</th>
<th>Exercising Lamaze</th>
<th>Non-Exercising Lamaze</th>
<th>Combined Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>$49,000-40,000</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>5</td>
<td>11</td>
</tr>
<tr>
<td>$39,000-30,000</td>
<td>1</td>
<td></td>
<td>3</td>
<td>16</td>
<td>20</td>
</tr>
<tr>
<td>$29,000-20,000</td>
<td></td>
<td>4</td>
<td>9</td>
<td>29</td>
<td>42</td>
</tr>
<tr>
<td>$19,000-10,000</td>
<td>5</td>
<td>3</td>
<td>11</td>
<td>15</td>
<td>34</td>
</tr>
<tr>
<td>$9,000-0</td>
<td>4</td>
<td>2</td>
<td>12</td>
<td>16</td>
<td>34</td>
</tr>
<tr>
<td>Total</td>
<td>12</td>
<td>12</td>
<td>43</td>
<td>87</td>
<td>154</td>
</tr>
</tbody>
</table>

Table 7 lists the general physical health frequencies of the four groups—Pregnancy Fitness, New Beginnings, Exercising Lamaze and Non-Exercising Lamaze—and the general physical health frequencies when these groups are combined.

Table 7
General Physical Health Frequencies

<table>
<thead>
<tr>
<th>Physical Health</th>
<th>Pregnancy Fitness</th>
<th>New Beginnings</th>
<th>Exercising Lamaze</th>
<th>Non-Exercising Lamaze</th>
<th>Combined Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>8</td>
<td>8</td>
<td>35</td>
<td>66</td>
<td>117</td>
</tr>
<tr>
<td>Average</td>
<td>3</td>
<td>4</td>
<td>8</td>
<td>21</td>
<td>36</td>
</tr>
<tr>
<td>Poor</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>12</td>
<td>12</td>
<td>43</td>
<td>87</td>
<td>154</td>
</tr>
</tbody>
</table>

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Table 8 lists the general mental health frequencies for Pregnancy Fitness, New Beginnings, Exercising Lamaze and Non-Exercising Lamaze. It also lists the general mental health frequencies when these groups are combined.

Table 8
General Mental Health Frequencies

<table>
<thead>
<tr>
<th>Mental Health</th>
<th>Pregnancy Fitness</th>
<th>New Beginnings</th>
<th>Exercising Lamaze</th>
<th>Non-Exercising Lamaze</th>
<th>Combined Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>9</td>
<td>9</td>
<td>39</td>
<td>81</td>
<td>138</td>
</tr>
<tr>
<td>Average</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>6</td>
<td>16</td>
</tr>
<tr>
<td>Poor</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>12</td>
<td>12</td>
<td>43</td>
<td>87</td>
<td>154</td>
</tr>
</tbody>
</table>

Table 9 lists the education frequencies for Pregnancy Fitness, New Beginnings, Exercising Lamaze and Non-Exercising Lamaze. It also lists the education frequencies when these groups are combined.

Table 9
Education Frequencies

<table>
<thead>
<tr>
<th>Education</th>
<th>Pregnancy Fitness</th>
<th>New Beginnings</th>
<th>Exercising Lamaze</th>
<th>Non-Exercising Lamaze</th>
<th>Combined Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graduate Professional Training</td>
<td>2</td>
<td>1</td>
<td>8</td>
<td>12</td>
<td>23</td>
</tr>
</tbody>
</table>
Table 9—Continued

<table>
<thead>
<tr>
<th>Education</th>
<th>Pregnancy Fitness</th>
<th>New Beginnings</th>
<th>Exercising Lamaze</th>
<th>Non-Exercising Lamaze</th>
<th>Combined Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>College or University Graduate</td>
<td>4</td>
<td>4</td>
<td>15</td>
<td>25</td>
<td>48</td>
</tr>
<tr>
<td>Partial College Training</td>
<td>3</td>
<td>3</td>
<td>9</td>
<td>20</td>
<td>35</td>
</tr>
<tr>
<td>High School Graduate</td>
<td>3</td>
<td>3</td>
<td>8</td>
<td>30</td>
<td>44</td>
</tr>
<tr>
<td>Partial High School</td>
<td>1</td>
<td>3</td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Junior High School</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less Than 7 Years of School</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>12</td>
<td>12</td>
<td>43</td>
<td>87</td>
<td>154</td>
</tr>
</tbody>
</table>

Table 10 lists the lifestyle frequencies for Pregnancy Fitness, New Beginnings, Exercising Lamaze and Non-Exercising Lamaze. It also lists the lifestyle frequencies when these groups are combined.

Table 10

<table>
<thead>
<tr>
<th>Lifestyle</th>
<th>Pregnancy Fitness</th>
<th>New Beginnings</th>
<th>Exercising Lamaze</th>
<th>Non-Exercising Lamaze</th>
<th>Combined Groups</th>
</tr>
</thead>
</table>

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Table 10--Continued

<table>
<thead>
<tr>
<th>Lifestyle</th>
<th>Pregnancy Fitness</th>
<th>New Beginnings</th>
<th>Exercising Lamaze</th>
<th>Non-Exercising Lamaze</th>
<th>Combined Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active</td>
<td>3</td>
<td>7</td>
<td>26</td>
<td>17</td>
<td>53</td>
</tr>
<tr>
<td>Moderately Active</td>
<td>8</td>
<td>4</td>
<td>16</td>
<td>68</td>
<td>96</td>
</tr>
<tr>
<td>Sedentary</td>
<td>1</td>
<td>1</td>
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<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>12</td>
<td>12</td>
<td>43</td>
<td>87</td>
<td>154</td>
</tr>
</tbody>
</table>

Table 11 lists the previous exercise history frequencies for Pregnancy Fitness, New Beginnings, Exercising Lamaze and Non-Exercising Lamaze. It also lists the previous exercise history frequencies when these groups are combined.

Table 11

Previous Exercise History Frequencies

<table>
<thead>
<tr>
<th>Exercise History</th>
<th>Pregnancy Fitness</th>
<th>New Beginnings</th>
<th>Exercising Lamaze</th>
<th>Non-Exercising Lamaze</th>
<th>Combined Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exercise Daily</td>
<td>1</td>
<td>11</td>
<td></td>
<td></td>
<td>12</td>
</tr>
<tr>
<td>Exercise 3 Days</td>
<td>11</td>
<td>32</td>
<td></td>
<td></td>
<td>43</td>
</tr>
<tr>
<td>Days or More Per Week</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exercise 2 Days</td>
<td>8</td>
<td>35</td>
<td></td>
<td></td>
<td>43</td>
</tr>
<tr>
<td>Days or Less Per Week</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exercise History</td>
<td>Pregnancy Fitness</td>
<td>New Beginnings</td>
<td>Exercising Lamaze</td>
<td>Non-Exercising Lamaze</td>
<td>Combined Groups</td>
</tr>
<tr>
<td>------------------</td>
<td>-------------------</td>
<td>----------------</td>
<td>-------------------</td>
<td>-----------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>Exercised Before Pregnancy but Not Since</td>
<td>4</td>
<td>34</td>
<td>38</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never Exercised</td>
<td></td>
<td>18</td>
<td>18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>12</td>
<td>12</td>
<td>43</td>
<td>87</td>
<td>154</td>
</tr>
</tbody>
</table>

**Research Hypothesis**

As mentioned in Chapter II, the research hypothesis for this study was that pregnant women who exercise aerobically three days or more per week will score low on the trait portion of the State-Trait Anxiety Inventory (Spielberger, 1983) in their last trimester but pregnant women who do not exercise aerobically will score high on the same inventory in their last trimester. The null hypothesis was that there would be no difference in trait anxiety scores whether the pregnant women exercise or not.

When pre- and posttest trait anxiety scores for all groups were tested using an ANOVA, the null hypothesis was retained. Table 12 shows the results of this analysis.
Table 12
Pre- and Posttest Trait Anxiety Scores for All Groups: ANOVA

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F_{calc.}</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between</td>
<td>5</td>
<td>562.0676</td>
<td>112.4135</td>
<td>0.9367</td>
</tr>
<tr>
<td>Within</td>
<td>172</td>
<td>20641.1684</td>
<td>120.0068</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>177</td>
<td>21203.2360</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

F_{calc.} < F_{crit.} value of 2.27 at the .05 level

An ANOVA was also used to analyze posttest scores alone for all groups. Once again, the null hypothesis was retained. Table 13 shows the results of this analysis.

Table 13
Posttest Trait Anxiety Scores for All Groups: ANOVA

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F_{calc.}</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between</td>
<td>3</td>
<td>320.6390</td>
<td>106.8797</td>
<td>0.8601</td>
</tr>
<tr>
<td>Within</td>
<td>150</td>
<td>18639.3351</td>
<td>124.2622</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>153</td>
<td>18959.9740</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

F_{calc.} < F_{crit.} value of 2.44 at the .05 level

However, the research hypothesis was supported when the Pregnancy Fitness (X) and New Beginnings (C) pre- and posttest trait anxiety scores were compared using the Paired-Sample t test. These statistics are the result of analyzing the difference between each woman's pretest score versus her own posttest score. (Pretest data

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were unavailable for the two Lamaze groups.) Table 14 shows these results:

Table 14

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>df</th>
<th>T Value</th>
<th>Critical Value</th>
<th>1-Tail Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>X Pretest</td>
<td>40.92</td>
<td>11</td>
<td>2.23</td>
<td>1.80</td>
<td>0.024 *</td>
</tr>
<tr>
<td>X Posttest</td>
<td>37.75</td>
<td>11</td>
<td>2.23</td>
<td>1.80</td>
<td>0.024 *</td>
</tr>
<tr>
<td>C Pretest</td>
<td>34.58</td>
<td>11</td>
<td>-2.04</td>
<td>1.80</td>
<td>0.033</td>
</tr>
<tr>
<td>C Posttest</td>
<td>39.08</td>
<td>11</td>
<td>-2.04</td>
<td>1.80</td>
<td>0.033</td>
</tr>
</tbody>
</table>

* significant at the .05 level

Demographic Hypothesis

As mentioned in Chapter III, the null hypothesis for the demographic survey was that a woman's age, occupation, family income, general physical and mental health, education, lifestyle, and previous exercise history were independent of anxiety level during pregnancy. To test this hypothesis, trait anxiety scores were cross tabulated (analyzed by the Chi-Square method) with each of the variables in the demographic survey.

For cross tabulation purposes, anxiety scores 20 through 35 were classified as low anxiety scores, and scores 36 through 80 were classified as high anxiety scores. (* was the mean/median anxiety score across all six data sets.) Eliminating the last category
(response of 3) was required for the physical and mental health cross tabulations since there were zero or one responses for each cell in that category and its inclusion would have violated the requirement that 90% of the cells in a Chi-Square have expected frequencies of at least five (Bolton, 1984).

Table 15
Crosstabulation of Trait Anxiety Scores by Variables in Demographic Survey: Chi-Square Values

<table>
<thead>
<tr>
<th>Variable</th>
<th>df</th>
<th>Chi-Square</th>
<th>Critical Value</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>2</td>
<td>4.01</td>
<td>5.99</td>
<td>0.13</td>
</tr>
<tr>
<td>Occupation</td>
<td>6</td>
<td>8.59</td>
<td>12.59</td>
<td>0.20</td>
</tr>
<tr>
<td>Income</td>
<td>5</td>
<td>6.58</td>
<td>11.07</td>
<td>0.25</td>
</tr>
<tr>
<td>Physical Health</td>
<td>1</td>
<td>14.97</td>
<td>3.84</td>
<td>0.00 *</td>
</tr>
<tr>
<td>Mental Health</td>
<td>1</td>
<td>7.82</td>
<td>3.84</td>
<td>0.01 *</td>
</tr>
<tr>
<td>Education</td>
<td>4</td>
<td>7.35</td>
<td>9.49</td>
<td>0.12</td>
</tr>
<tr>
<td>Lifestyle</td>
<td>2</td>
<td>4.27</td>
<td>5.99</td>
<td>0.12</td>
</tr>
<tr>
<td>Exercise History</td>
<td>4</td>
<td>4.85</td>
<td>9.49</td>
<td>0.30</td>
</tr>
</tbody>
</table>

* Significant at the .05 level

Summary

This chapter was divided into four major presentations. The first section provided a summary of the data collection procedure. The second provided frequency distributions of trait anxiety scores and demographic responses. The third focused on the research hypothesis. Lastly, the results of the demographic survey were...
presented. Chapter V presents conclusions drawn from this study, limitations of the study, and recommendations for further research.
CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

This chapter summarizes the statistical results of the research as well as the interpretation and implications of these results. In addition, recommendations for future research are presented.

Summary of the Results

Research Hypothesis

As mentioned in previous chapters, the research hypothesis for this study was that pregnant women who exercise aerobically three days or more per week will score low on the trait portion of the State-Trait Anxiety Inventory (Spielberger, 1983) in their last trimester but pregnant women who do not exercise aerobically will score high on the same inventory in their last trimester. The null hypothesis was that there would be no difference in trait anxiety scores whether the pregnant women exercise or not. When pre-and posttest trait anxiety scores for all groups (Pregnancy Fitness, New Beginnings, Exercising Lamaze, and Non-exercising Lamaze) were tested using an ANOVA, the null hypothesis was retained, $F_{calc} = 0.9367 < F_{cv} = 2.27$ at the 0.05 level. An ANOVA was also used to analyze posttest trait anxiety scores alone for all groups. Once again, the null hypothesis was retained, $F_{calc} = 0.8601 < F_{cv} = 2.44$ at the 0.05 level. However, the research hypothesis was supported when the
Pregnancy Fitness (X) and New Beginnings (C₁) pre- versus posttest trait anxiety score differences were compared using the Paired-Sample t Test. For X, $T_{\text{calc}} = 2.23 > T_{\text{cv}} = 1.80$ at the 0.05 level, and for C₁, $T_{\text{calc}} = -2.04 < T_{\text{cv}} = -1.80$ at the 0.05 level.

Demographic Hypothesis

As mentioned earlier, the null hypothesis for the demographic survey was that a woman's age, occupation, family income, general physical and mental health, education, lifestyle, and previous exercise history were independent of her anxiety level during pregnancy. To test this hypothesis, trait anxiety scores were cross tabulated with the variables in the demographic survey. Two variables, general physical and mental health, were significant at the 0.05 level. For physical health, $\text{Chi-Square}_{\text{calc}} = 14.97 > \text{Chi-Square}_{\text{cv}} = 3.84$ at the 0.05 level, and for mental health, $\text{Chi-Square}_{\text{calc}} = 7.82 > \text{Chi-Square}_{\text{cv}} = 3.84$ at the 0.05 level. The other variables were not significant.

Interpretation of the Results

Research Hypothesis

When the research hypothesis was statistically analyzed using an ANOVA, the null hypothesis was retained. However, when it was analyzed using the Paired-Sample t Test, the null hypothesis was rejected. The data analysis using the Paired-Sample t Test supports the research of Monteson, Pechai, and Welsh (1984). As mentioned in
Chapter II, these researchers investigated the effects of physical activity on the stress levels of adult women. The treatment in Monteson, Pechai, and Welsh's (1984) research was a 45-minute cardiovascular fitness class, and the researcher's instrument was a Trait Anxiety Inventory. Each subject was pre- and posttested during the 10 week fitness class. Monteson, Pechai, and Welsh (1984) found that the exercise class was responsible for a significant decrease in anxiety among the women. The conclusions drawn from the results of the Paired-Sample t Test also supports the research of Folkins and Amsterdam (1977). These researchers concluded that physical activity could reduce stress emotions (e.g., fear, anxiety, tension, anger, depression).

Demographic Hypothesis

When the demographic hypothesis was statistically analyzed by the Chi-Square method, trait anxiety was dependent on general physical and mental health. The Lambda values were as follows: trait anxiety level dependent on general physical health 0.25333; trait anxiety level dependent on general mental health 0.10667. This finding is in accord with the research of Collingwood (1972). As mentioned in Chapter II, Collingwood (1972) concluded that subjects who received physical training demonstrated greater positive changes not only in physical fitness but also in self-concept and in physical, intellectual, and emotional-interpersonal behaviors. Similarly, Kitzinger (1980) and Shrock (1984) concluded that exercise during pregnancy promoted mental well-being. Shrock (1984) claimed...
birth was a normal natural physiologic process. Thus, supporting the premise that "pregnancy is a state of health," both physical and mental aspects of body changes were considered. Feelings of well-being and confidence, which resulted from exercise of the whole body on a regular basis, enabled the pregnant women to approach childbirth with positive expectations.

Implications of the Study

The Paired-Sample t Test demonstrated that aerobic exercise does reduce stress levels among pregnant women. (It was explained in Chapter I that for the purposes of this study, the term "stress level" is synonymous with the term "trait anxiety level.") This is an important finding because maternal states of stress can have a strong effect on the developing child by means of physiologic pathways (Birren, Kinney, Schaie, & Woodruff, 1981). These strong effects were discussed in detail in Chapter II. Therefore, a vehicle to reduce maternal stress, such as an aerobic exercise program, will be beneficial to the mother and her unborn child.

It is the author's conclusion from past research, and on the basis of this study, that aerobic exercise during pregnancy should be encouraged as part of the total prenatal care package. The author recognizes aerobic exercise as a contributor toward a healthy and more comfortable pregnancy. Exercise during pregnancy enhances self-esteem and a positive body image. It is the author's opinion that these feelings of well-being and additional energy enable the new mother to better face the responsibilities of parenthood.
Recommendations for Future Research

As mentioned in the limitations section of Chapter I, this study was restricted to Kalamazoo, Michigan pregnant women. A future researcher may wish to replicate this study in another city similar to Kalamazoo to see if the results are the same. In addition, the author recommends conducting this study in a city dissimilar to Kalamazoo (in terms of population number, ethnic background, industry, etc.) and comparing the results.

The validity problems mentioned in Chapter III were due to the use of nonrandomized groups. The author suggests a future researcher replicate this study with randomized groups.

This study was also limited in the number of subjects in the experimental and first control groups. This limitation was due to a time factor. However, the author recommends a longer study that could follow more women through the duration of a pregnancy fitness program.

The predetermined completion of this study was the last trimester of pregnancy. Future research should follow the births and postpartum recoveries as well. It may be possible to conduct a long-term study based on the ones conducted by Stott (1973) and Davids, Holden, and Gray, (1963). These two studies are discussed in detail in Chapter II.

Summary.

The first chapter of this dissertation dealt with the research
problem, operational definitions, and objectives. The conceptual framework and the limitations of this study concluded the chapter.

The second chapter was a literature review that was divided into four sections: biophysical, cognitive, social, and affective domains. This chapter concluded with the research hypothesis.

The third chapter dealt with the research design used for this study, the Solomon Four-Group Design. Chapter III also addressed the internal and external validity of this research. A description of the four groups tested—Pregnancy Fitness, New Beginnings, Exercising Lamaze, and Non-exercising Lamaze followed the validity discussion.

The fourth chapter gave a summary of the data collection procedure. It also presented the results of the State-Trait Anxiety Inventory (Spielberger, 1983) and the results of the demographic survey.

Finally, the fifth chapter presented a summary of the statistical results of the research and demographic hypotheses. Both the research and demographic results were interpreted. Implications of this research and recommendations for future research finished the chapter.
Appendix A

Letter of Protocol Confirmation
TO: Janet L. Fourman  
FROM: Ellen Page-Robin, Chair  
RE: Research Protocol #87-04-03  
DATE: April 9, 1987

This letter will serve as confirmation that your research protocol is now complete and has been signed off as approved by the HSIRB.

If you have any questions, please contact me at 383-4917.
Appendix B

Subject Consent Letter
April 1987

Dear Potential Research Participant:

As a part of my dissertation for a doctor's degree in education (Ed.D.) at Western Michigan University, I am conducting a research investigation.

Researchers in the field of prenatal education have identified risk factors for babies born to mothers who smoke, drink, use drugs, have poor nutrition, who lack adequate prenatal care, or who experience situational stresses. However, in the past decade, the general public has become more conscious of their health behaviors. It logically followed that questions about aerobic exercise during pregnancy would arise, and this has indeed been true. Yet in the past, research done on the effects of exercise during pregnancy has concentrated on physiological outcomes. Psychological aspects of prenatal exercise have gone unnoticed. Therefore, this study will investigate the effects of aerobic exercise on trait anxiety level for pregnant women.

The first stage of this research involves participant completion of the State Trait Anxiety Inventory. This is a multiple choice inventory that assesses individual trait anxiety. The second aspect of the investigation involves completion of a demographic survey. From this survey, the following demographic information will be obtained from each potential subject: age, occupation, family income, general physical and mental health, education, lifestyle, and previous exercise history.

Please be assured that the data collected will remain anonymous. You will be assigned an identification number only so that I can keep track of the number of participants.

Thank you for your time. I greatly appreciate your help in enabling me to conduct this research for the completion of my degree.

Sincerely,

Jan Fourman
EDLD Graduate Student
Appendix C

Permission to Reproduce State-Trait Anxiety Inventory
In response to your request of 5/9 by telephone (Date) permission is hereby granted you to reproduce the State-Trait Anxiety Inventory for inclusion in the appendix of your doctoral dissertation, and allow it to remain there upon microfilming, subject to the following restrictions:

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Appendix D

State-Trait Anxiety Inventory (Trait Portion)
SELF-EVALUATION QUESTIONNAIRE

DIRECTIONS: A number of statements which people have used to describe themselves are given below. Read each statement and then blacken in the appropriate circle to the right of the statement to indicate how you generally feel. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe how you generally feel.

21. I feel pleasant .......................................................... §  m  c< e
22. I feel nervous and restless ......................................... §  m  c  a
23. I feel satisfied with myself ......................................... §  m  c  a
24. I wish I could be as happy as others seem to be ........ §  m  c  a
25. I feel like a failure .................................................... §  m  c  a
26. I feel rested .............................................................. §  m  c  a
27. I am calm, cool, and collected” ................................. §  m  c  a
28. I feel the difficulties are piling up so that I cannot overcome them §  m  c  a
29. I worry too much over something that really doesn’t matter .... §  m  c  a
30. I am happy .............................................................. §  m  c  a
31. I have disturbing thoughts ......................................... §  m  c  a
32. I lack self-confidence ............................................... §  m  c  a
33. I feel tense ............................................................... §  m  c  a
34. I make decisions easily ............................................. §  m  c  a
35. I feel inadequate ...................................................... §  m  c  a
36. I am content ........................................................... §  m  c  a
37. Some unimportant thought runs through my mind and bothers me §  m  c  a
38. I take disappointments so hard that I can’t put them out of my mind .......................................................... §  m  c  a
39. I am a steady person ............................................... §  m  c  a
40. I get in a state of tension or turmoil as I think over my recent concerns and interests .......................................................... §  m  c  a
Appendix E

Demographic Survey
Demographic Survey

Please circle the appropriate number.

AGE
1) 35-44
2) 25-34
3) 15-24

OCCUPATION
1) Executives and proprietors of large concerns, and major professionals
2) Managers and proprietors of medium-sized businesses and lesser professionals
3) Administrative personnel of large concerns, owners of small independent businesses, and semiprofessionals
4) Owners of small businesses, clerical and sales workers, and technicians
5) Skilled workers
6) Semiskilled workers
7) Not employed
ANNUAL INCOME

1) $50,000 or more
2) $49,000 - 40,000
3) $39,000 - 30,000
4) $29,000 - 20,000
5) $19,000 - 10,000
6) $9,000 - 0

GENERAL PHYSICAL HEALTH

1) Good
2) Average
3) Poor

GENERAL MENTAL HEALTH

1) Good
2) Average
3) Poor
EDUCATION
1) Graduate professional training
2) Standard college or university graduation
3) Partial college training
4) High school graduation
5) Partial high school
6) Junior high school
7) Less than seven years of school

LIFESTYLE
1) Active
2) Moderately active
3) Sedentary

PREVIOUS EXERCISE HISTORY
1) I exercise daily.
2) I exercise 3 days or more per week.
3) I exercise 2 days or less per week.
4) I exercised before my pregnancy, but I have not since.
5) I have never exercised.
BIBLIOGRAPHY


142


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