CHILDREN'S PERCEPTION OF THE ENVIRONMENT
AND ITS RELEVANCE TO THE DESIGN OF PLAYSCAPES

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A practicum completed at the University of Manitoba
as partial requirement for the degree of Master of Landscape Architecture

by BEVERLEY MEHNER WINDJACK

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MASTER OF LANDSCAPE ARCHITECTURE

We are guilty of many errors and many faults but our worst crime is abandoning the children, neglecting the fountain of life. Many things we need can wait. The child cannot. Right now is the time his bones are being formed, his blood is being made and his senses are being developed. To him we cannot answer "Tomorrow". His name is "Today".

Gabriel Mistral

ABSTRACT

This report is based on the premise that most design guidelines for playscape/open space development do not adequately address the developmental needs of children. It identifies several aspects of the physical environment that influence a child's physical growth and activity development. As well, it explores the child's perception of space, his sensory awareness, his socialization patterns, and the significance of colour, visual, audio, tactile, and olfactory perception in his daily life. Design implications concerning each of these factors are presented at the end of each section. The report culminates with suggestions for appropriate design responses to each implication identified.

ACKNOWLEDGEMENTS

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TABLE OF CONTENTS

INTRODUCTION

1.1 THE PROBLEM

A number of distinguished bodies in various countries have recently turned their attention to the health and welfare of children in the urban environment. Based on the premise that children do not cope with their environment in the same way as adults, and therefore, must be considered separately, a portion of current child research is geared towards stimulating the young, in mind, body and creative ability in order to prevent the ills that later require extensive remedies at great societal cost. With respect to the field of landscape architecture, such research is a positive step and most Canadian cities have adopted design guidelines and policies for play-scape/open space development. The problem lies in the fact that research into children's environments has not yet taken a significant step towards determining the design implications of such open space requirements. Until designers understand the developmental needs of children, and guidelines and concurrent designs respond to such needs, we cannot consider them to be successful.

According to many contemporary environmental behaviourists such as Caplan (1973) and Piaget (1962), play is the most important factor in a child's mental and physical maturation. The primary objective of open space systems for children, therefore, should be to create an atmosphere that facilitates and encourages play. Environmental stimulation becomes particularly important to the physically or mentally disabled child whose activity space, and experience, is limited. Although many existing playgrounds are being adapted for disabled children, experience tells us that this cannot improve the situation. Today's playgrounds are, for the most part, poorly designed, unstimulating environments which inhibit the development of creative expression. User groups studies repeatedly show that playgrounds are low,

if at all, on the list of children's preferred areas to play.

It we accept the theory that a child is a product of his environment, we must begin to design childrens' open space with their full potential development in mind. Assuming every child has the right to grow and develop, to play, explore and socialize, every designed playscape must respond to those developmental requirements common to all children in the community.

1.2 INTENT OF THE PRACTICUM

The intent of this practicum is twofold. First, it is to identify those factors in the outdoor physical environment which influence behaviour in early childhood and, second, to determine the design implications of such factors on the open space requirements of young children.

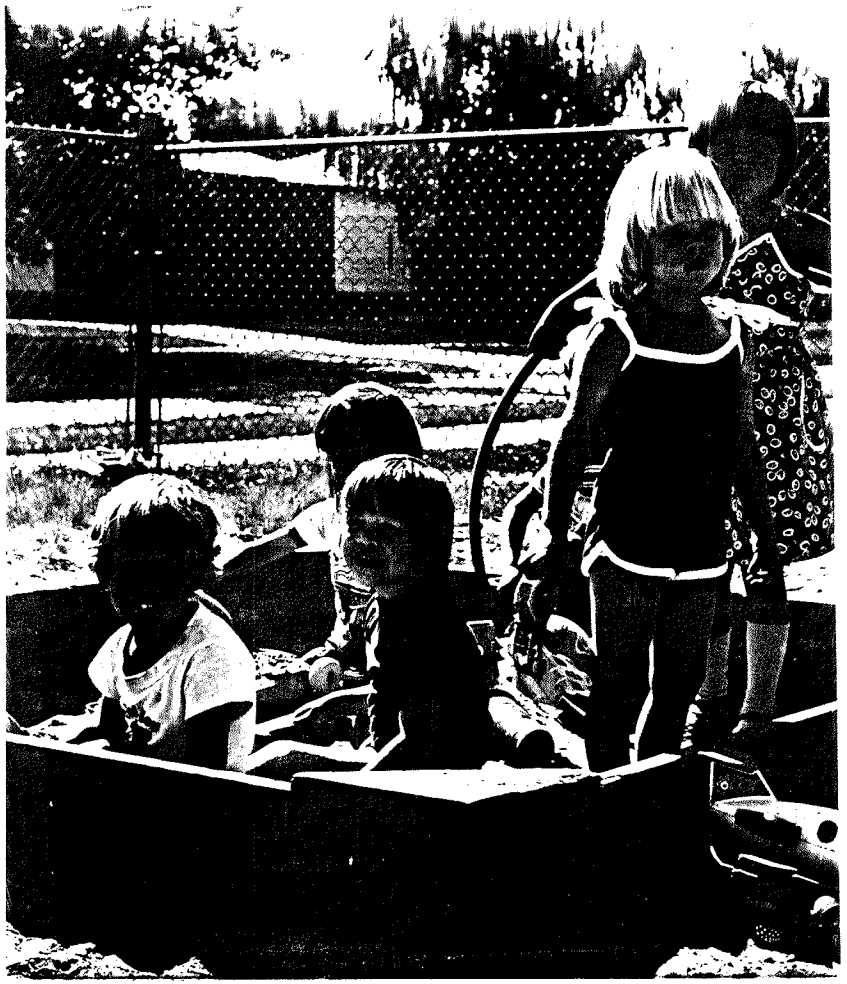


Figure 1 The games of children.....are their most serious business.
Michel de Montaigne

1.3 WHAT IS PLAY ?

Play is a medium for maturation, physical and mental growth. Play is a creative endeavour involving the child as a person with all his capacities. Play is pleasurable.[1] Play is an agent for perceptual and motor exploration and development.[2] "Play is learning the rules of the game of adult survival. Play is learning how to communicate both verbally and by means of the accepted gestures, tones and expressions which serve us so well. Play is an opportunity to experiment, to improvise, to create, to go beyond the fringe."[3] "Play is the way a child learns what no one can teach him."[4] "Play is the business of childhood."[5] And so the list continues...

Though prominent early childhood education theorists collectively agree that the importance of play to a child's total development must not be underestimated, play is not easily defined. We can, however, understand the lack of a concise definition when we interpret play as a means to some end rather than as an end in itself. Play is not definitive; it has no fixed parameters. Play is, as Froebel states, the highest expression of human development in childhood. It is the critical activity which prepares children for their future, future being everything beyond the immediate moment. Because of this, play is most easily discussed in terms of its importance.

In recent years early childhood education theorists have presented a variety of views on play which create a solid foundation for understanding its educational value. Most of these theses are extrapolations or variations on Jean Piaget's comprehensive body of play theory. In Piaget's words (1962),

> the individual is constantly striving to find an equilibrium between himself and his environment. Two processes are involved in this adaptive effort - assimilation and accommodation. When meeting a new experience the individual first accommodates to the actual stimuli, taking in the

> event through his senses. The individual then assimilates the event, basing his reaction on the way the event makes him feel, his perception of the event. Equilibrium occurs when the individual has accommodated an event and then assimilated it, producing a new mental structure of scheme. Play is almost pure assimilation and is a way of practising that which one has met and come to know.[6]

Of great importance is Piaget's belief that play is essential to the evolution of intelligence. This is in contradiction to past theorists, such as Freud, who assumed the child was a passive recipient of information from a 'real' world. In Piaget's opinion the concept of adaptation is found in all organisms; man's intelligence is not inherited, but is formed through his process of adaptation. Simply put, Piaget identifies changes in behaviour that result from experience as intellectual development or learning.

Similarly, Jerome Bruner (1976) describes play as a means of minimizing the consequences of one's actions and of learning in a less risky situation. This is most often accomplished through imitation, the recreation of an action someone else has performed. In this way children can try combinations of behaviour which might otherwise be frowned upon. According to Garvey, "imitation itself is a gradually emerging achievement that rests on both mental and physical development."[7]

Sara Smilansky defines the most highly developed form of imitation as 'sociodramatic'. In her work on disadvantaged children (1968) Smilansky identified sociodramatic play as a critical factor in bridging the gap between childhood and adulthood. It was also important in establishing social ability and good peer relations. Smilansky demonstrated that children who live in 'deprived' settings did not engage in high levels of sociodramatic or symbolic play. She also reported that nonsymbolic playing children failed to 'play the game' of formal schooling and acquire such basic skills as reading in the elementary grades.

Smilansky's theory is supported by Lieberman

(1965) and Hutt and Bhavnani (1972) (Barnett, Quest, 1976) who have suggested that a tightly-structured environment which provides little freedom and contains few sensory experiences fosters retardation in development, both physically and socially.

THE PHYSICAL AND SOCIAL ENVIRONMENT

2.1 BASIC GROWTH

> From all points of view, the child
> is truly the father of the man.
> Rene Dubos, Environments for Man

Early childhood is the start of a life long process of attaining self awareness, self reliance, autonomy and competence. Exploratory behaviour is perhaps the single most important factor in achieving these goals. As such it occupies a great deal of the child's attention and efforts. Exploratory activity and search is motivated by novel situations where an attachment figure, usually the mother, is present. Novel objects also encourage exploration when placed in a relatively familiar environment. As the child grows his exploration or play evolves from solitary play, where children are independant of others, to parallel play, associative play and cooperative play. Play is, thus, a measure of personal and social development. According to Piaget, it is also a measure of intellectual and perceptual development.

In his theory on intellectual development Piaget states that development results from environmental experience, especially from continuous interaction between the child and environmental forces. The child seeks increasingly stimulating environments which he interprets according to his experience and maturity. Interpretation is a function of intellectual development and naturally progresses with experience. It is believed that a child does half his learning before four years of age, an additional thirty percent before eight years of age and the remaining twenty percent during elementary and secondary education.

The Piagetian theory divides the pre-school and early school years into a comprehensive theoretical framework which details intellectual development from birth to adolescence. Piaget's three major stages with various substages are outlined on Table One. Table Two compares Piaget's

categories of cognitive development with those of two other early childhood theorists, Brunner and Smilansky.

As can be seen, the categories of cognitive development compare favourably although Piaget and Bruner do not view construction play as a distinct stage. In Piaget's view, construction play goes beyond the intellectual period of age two to seven and occupies a position somewhere between play and work. While Bruner's view is unclear, Smilansky describes construction play as that short period of change from goalless (functional) play to purposeful play which occurs around twenty-two to twenty-four months of age.

The three agree that symbolic play begins by the end of the child's second year. Socializing and the knowledge of how to relate to others starts at birth and is recognized by a smile, cry, laugh or hug. From about four months of age exploratory activity is motivated by novel situations and toys. These, in turn, provide a channel for interaction with adults and other children. By age two the child is in a world which does not satisfy his intellectual and affective needs. Because he cannot accommodate himself in 'reality', he enters the world of make-believe (symbolic play).

Smilansky (1968) has identified the most highly developed form of symbolic play as socio-dramatic play. Briefly, her six criteria for well-developed sociodramatic play are as follows: 1) the child must undertake a make-believe role, 2) movements or verbal descriptions are substituted for real objects, 3) verbal descriptions are substituted for actions and situations, 4) the activity must persist for at least ten minutes, 5) there must be at least two players involved, and 6) verbal interaction must take place.[8]

The importance of symbolic play cannot be overemphasized for it encourages creativity and intellectual growth and is instrumental in the

Table 1 Piaget's Period's of Intellectual Development

	Approximate Age Range
Sensorimotor period - six stages	
1. Exercising the readymade sensorimotor schemata (eg. orientation towards light, sucking and grasping)	0 - 1 month
2. Primary circular reaction (eg. repitition wholly for the sake of pleasure.	1 - 4 months
3. Motor responses or Secondary circular reactions (eg. actions which affect an object)	4 - 8 months
4. Coordination of secondary shemata (eg. application of learned actions to new situations)	8 - 12 months
5. Tertiary circular reactions (eg. experiment in order to produce results)	12 - 18 months
6. Invention of new means through mental combinations (eg. symbolic and make-believe play)	18 - 24 months
Concrete operations period	
Preoperational subperiod	2 - 7 years
Concrete operations subperiod	7 - 11 years
Formal operations period	

Adapted from Frost and Klein
Children's Play and Playgrounds

Table 2 Categories of Cognitive Play

Approximate Age Range	Bruner (1957)	Piaget (1967)	Smilansky (1968)
0-24 months	Enactive mode (child's understanding of objects corresponds to the activities he performs with them. Ionic mode (level of perceptual development where child 'becomes' what he sees)	Practice games (sensorimotor period; repetition of actions)	Functional Play
2-7 years	Symbolic mode	Symbolic games (preoperational period in which child cannot separate action from thought)	Construction Play Symbolic Play (incorporates both functional and construction play and builds; Sociodramatic play is most highly developed form)
7 and up	Games with rules	Games with rules (beginning of true cooperative play; by age 11 child's thought as logical as it will be)	Games with rules

Construction Play

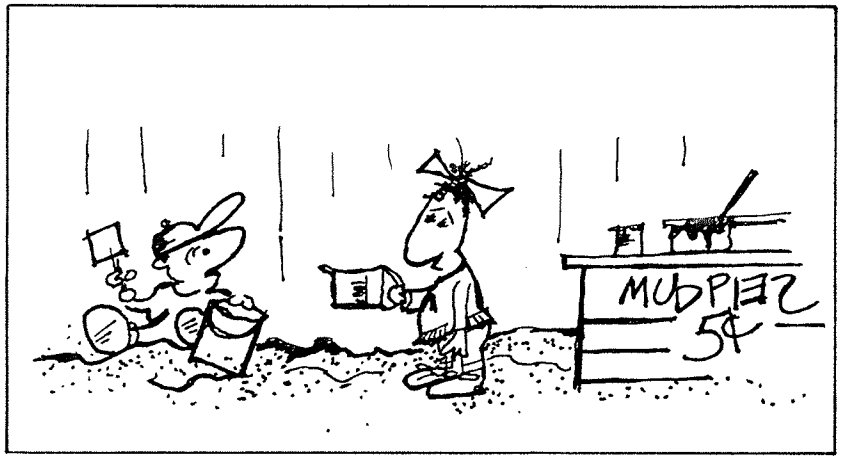


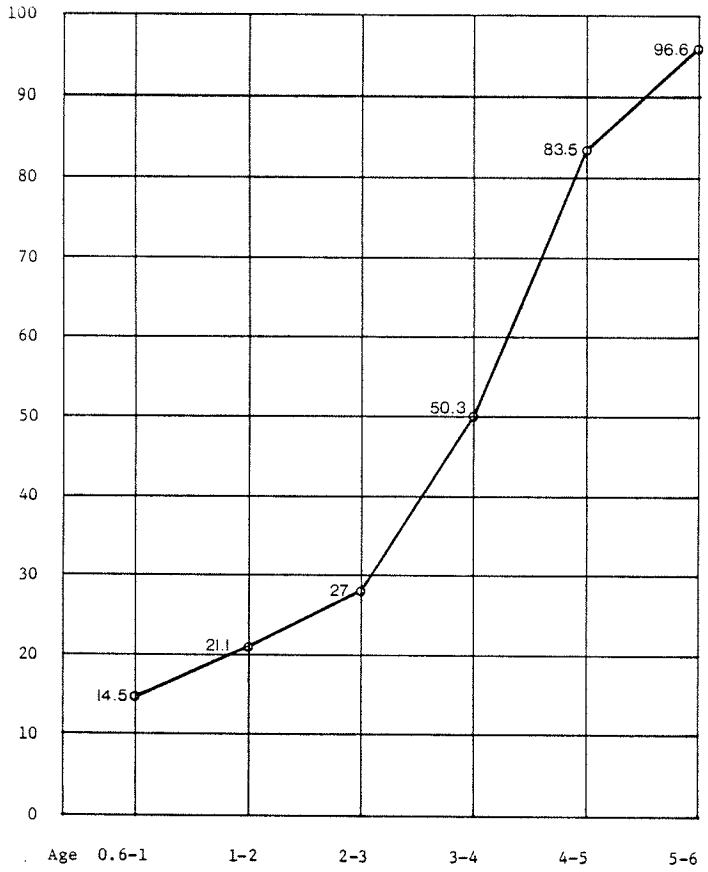
Figure 2 May I borrow a cup of dirt? I just ran out.

acquisition of social skills. Symbolic play is especially important for establishing a child's interaction with co-equals. Theorists collectively agree that it is largely through interaction with peers that life's most important attitudes and behaviours are shaped. Some criticism of the Montessori method of pre-school education is based on this belief.

Among Montessori's key ideas is her "belief in the senses as the source of all intellectual growth and her conviction that intellectual development is, therefore, directly dependant upon the training of the senses."[9] "Some critics fear that excessive reliance on interaction with materials rather than with peers may have a deleterious effect on social development; that insistence on the prescribed methods of doing things may stifle potential creativity; that reliance on didactic materials rather than on verbal interaction between child and teacher may impede the development of important verbal skills; and that independence of children may be tempered by the authoritarianism of the method."[10] However, it is only fair to point out that the criticisms summarized here are largely based on speculation. Montessori success stories seem to be based on speculation, as well.

By the end of their third year children are social individuals, preferring to play in small groups of two or three than alone. They can climb up and go down small slides and are especially interested in manipulative materials such as blocks, sand and water.

Graph 1 Maximal Duration of Play in Terms of Averages for Each Age Group



Source: Zaporozhets and Elkonin
The Psychology of Preschool Children

Around the ages of four and five, children engage in persistent investigation and furious activity. In fact, they are so full of energy that upon release from set tasks they typically exhibit a phenomenom known as rough and tumble play. This is generally described as a spontaneous outburst of vigorous activity and movement. During rough and tumble play children segregate into groups of one sex only; boys move towards the periphery of the playlot while girls stay in a more restricted area close to staff and playground equipment. A sex comparison of this age group suggests that girls are attracted to more sedentary activities with toys or art materials, that they tend to talk more and that they spend a great deal of time with only one or two partners. Boys race more, have more and shorter social contacts, and focus less of their play on material items.[11]

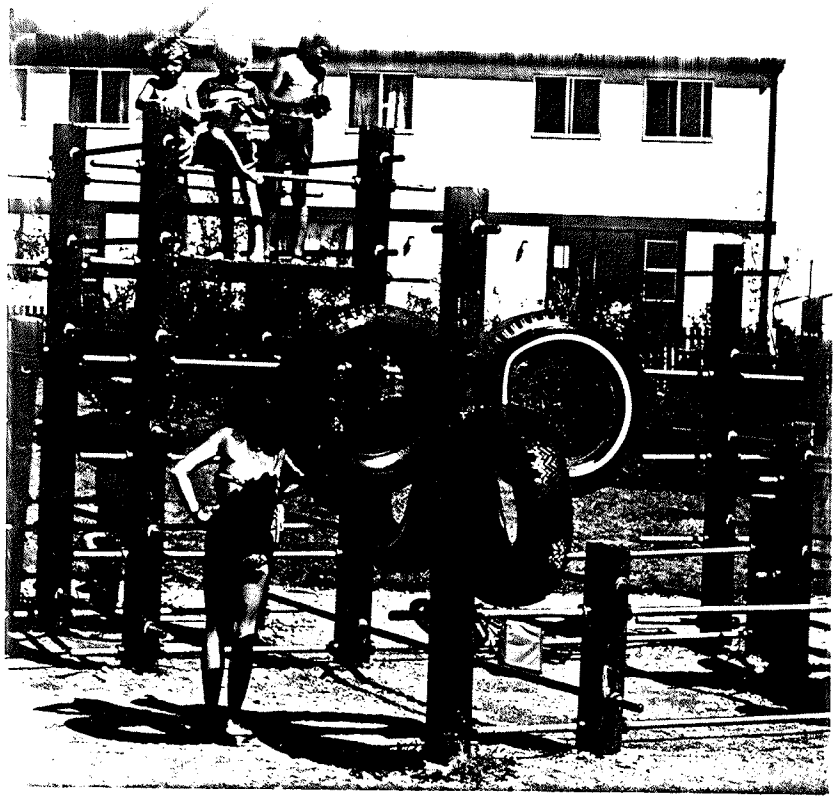


Figure 3
Preschoolers are social animals and prefer to play in small groups of two or three than alone.

While preschoolers spend most of their time engaged in creative play which provides for social encounters and physical challenge, school age children are interested in organized sport and competitive games. Beginning at age six or seven the peer group plays an increasingly important role. The 'group' evolves informally, without rules, and consists of whomever shows up. By the age of eight children associate mainly with same-sex peers and game rules are being carefully established. By the age of ten, the play group is highly structural and of such importance that the preadolescent child hates to play alone. These early school years span the highest form of play development and are known as the stage of 'games with rules'. During this period children learn to control their behaviour within limits. Their personal activity space expands to include environments further and further from home and friendships cease being the result of haphazard and random opportunities.

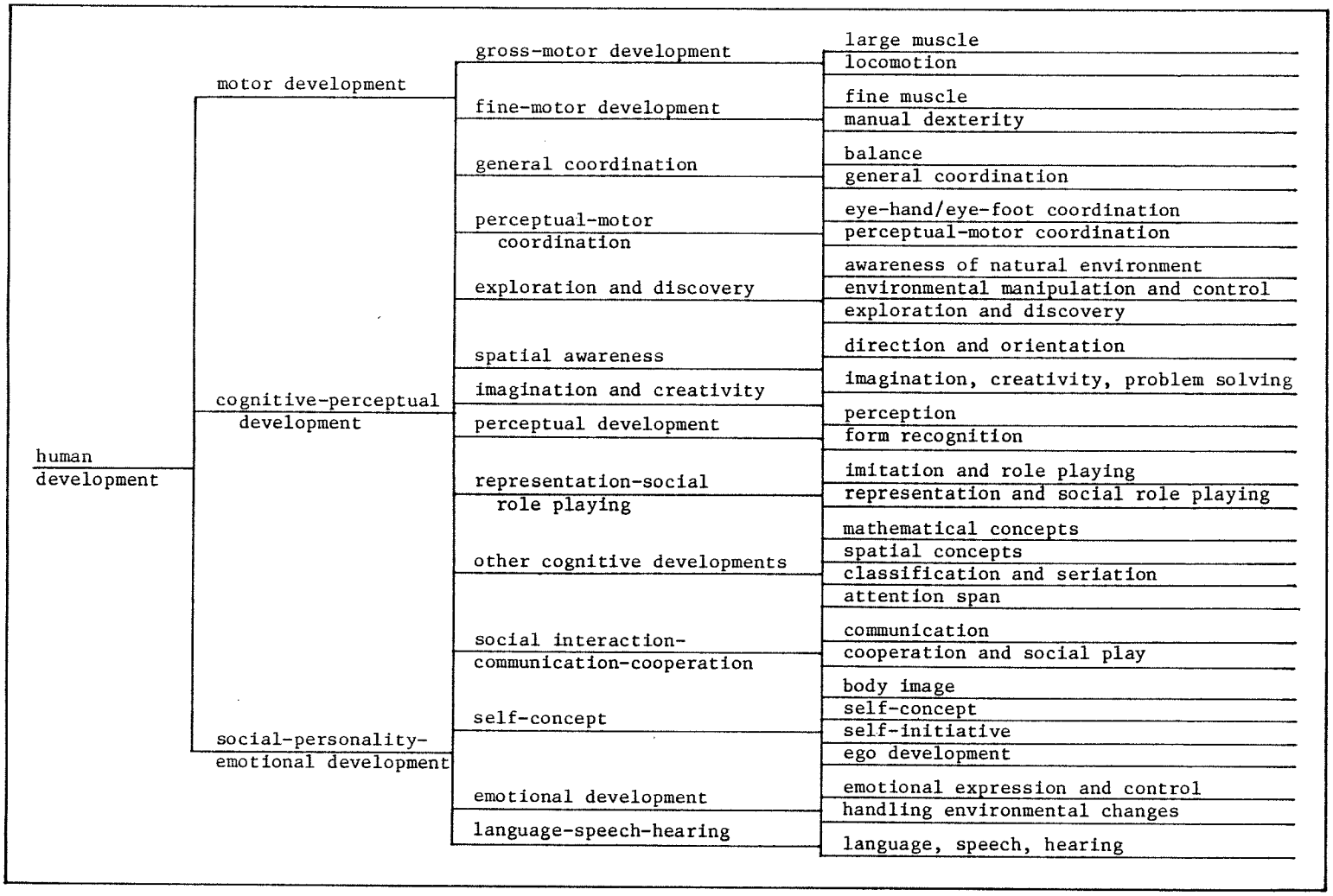
As children move into the 'youth'age group, they want autonomy, but they also seek some structure with adults as backup agents. Their

spatial needs are identical to an adult's because their physical size is the same and they are imitating the maturity of their elders.[12]

Figure 4

The preadolescent child engages in games with rules that are often more competitive than cooperative.

Table 3 Hierarchy of Main Areas of Child Development and Major Developmental Goals



Source: Moore, Cohen, Oertel, Van Ryzin
Designing Environments for Handicapped Children

DESIGN IMPLICATIONS

With few exceptions, basic growth follows a fixed pattern of developmental stages, each with its own relevant list of design implications. Because sections 2.1 to 2.5 of this document outline the design implications specific to children's disabilities, motor development and colour, environmental, audio, visual, tactile and olfactory perception, design implications described here are limited to children's spatial requirements.

The first stage of basic growth, identified by theorists as a period of sensorimotor development, parallels the period of infancy lasting from birth to approximately twenty-four months of age. It is typically characterized by the child's interaction with his environment, wholly for the sake of personal pleasure. During this stage children require and actively maintain proximity with their 'mother figure'. Consequently, sensory stimuli and environmental opportunities must be linked to the predominant location of mother. As the ability to hear is accurate to a distance of only twenty feet in both the six month old child and the adult, the concept of proximity in the early stage may be limited to this extent. However, by the end of the second year, proximity will expand to include the 'knowledge' that mother is close at hand.

The second stage of basic growth is the period most relevant to overall social and intellectual maturation. It can be described as a period of assimilation and is characterized by the development of such social skills as sharing, verbalization and progressive peer interaction. As exploratory experiences expand and children become increasingly aware of others, their dependency on peers to provide stimulation increases. Since peer cooperation is to be encouraged, places and equipment appropriate in

size and scale for two or more children, larger groups and child-adult combinations must be provided. Manipulative materials, activities which promote risk taking and decision making abilities and complex play structures are also necessary for full socialization development.

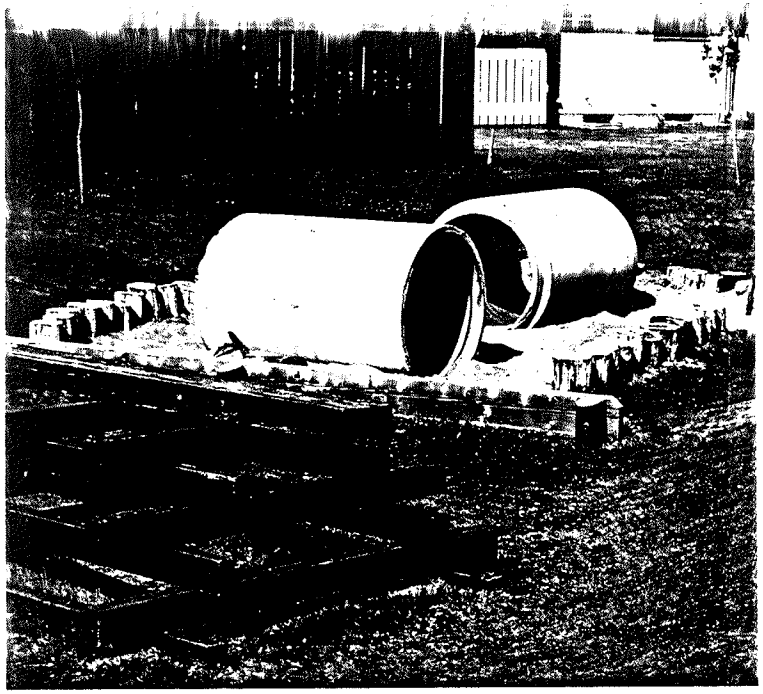


Figure 5

Play Structures which do not promote risk taking and decision making abilities have minimal play value.

At the same time, quiet, out of the way intimate niches must be available for children seeking privacy and space for solitary play. The environment should also accommodate hard surface games such as skipping, marbles, and hopscotch and the use of 'adult' equipment such as bicycles and roller skates.

The third stage, games with rules, encompasses the period of middle childhood to old age. It is characterized by highly-structured group play which is often more competitive than cooperative. Environments for children within this age group should provide opportunities for group interaction, self-devised challenges and freedom from adults. In order to meet the complexity of the child's needs at this stage, it is imperative that his environment provide some aspect for interaction. The preadolescent child does not want to be a casual observer.

2.2 ENVIRONMENTAL PERCEPTION

> My experience is what I agree to attend to. Interest alone gives accent and emphasis, light and shade, background and foreground - intelligible perspective, in a word. It varies in every creature, but without it the consciousness of every creature would be a grey chaotic indiscriminateness, impossible for us even to conceive.
>
> William James,
> The Principles of Psychology

The major stumbling block to determining the important factors in a child's perception of his environment is the lack of data. Although research correlating play activities with environmental perception is currently being undertaken, limited results are available at this time. Further, data which is available is largely untested and is occasionally based on research with animals. However, the immediate concern to improve play environments in housing contexts, parks and other open space suggests that today's designers and planners must act upon that information which is available.

Most contemporary researchers support the hypothesis that perception is a learned activity, an activity that improves with practice. It is accepted, further, that interference with the perceptual learning process results in perceptual disability. One theory by Zaporozhets (1960) suggests that there are three fundamental stages in normal perceptual development. First, in early infancy the eye roams haphazardly. Later, the hand teaches the eye to focus on an object and to trace its contours. Finally, the eye independently orients itself and anticipates the function of the hand.[13] It is the development in the second and third stages of this theory which is crucial to full perceptual awareness.

Contemporary environmental behaviourists generally agree that the essence of perceptual learning is in storing information so that subjects may be recognized by recalling the minimum amount of information necessary. As the

ability to selectively recall is developed, the ability to selectively obliterate is also developed. For example, when trying to identify a figure on a crowded street an individual will block out conflicting stimulus such as passersby and noise, and concentrate on the most distinctive features of the selected figure. With experience, a familiar subject can be identified in a few seconds while an unfamiliar subject must be studied.

In some instances, the environment may contain too much information to be handled in the perception process and the result is an uncomfortable feeling of overstimulation. Research implies that this is why we feel more comfortable with simple lines and organized patterns than haphazard mixtures of colour and geometry. Overstimulation often results in an approach-approach conflict, a form of stress which develops when a decision between two or more equally appealling activities cannot, yet must, be made.

In the other extreme, barren, unstimulating environments cause maladaptation of attention and perceptual motivation. The sensory-deprived individual is often timid and unable to cope within a complex environment. He is described as having stimulus hunger, surely a misnomer as his hunger for stimuli is diminished to non-existant. His curiosity and sensory awareness does not develop and he does not learn to discriminate critical from irrelevant aspects of the environment.

In the past, sensory deprivation has been a particular hazard to institutionally-raised children, children who have been hospitalized for extensive periods of time and children of neglectful parents. Numerous sources (for instance: Solomon and Lessac, 1968; Melzak, 1962)[14] indicate that early stimulus deprivation can result in the

deterioration of capacities to attend selectively to stimulation. According to Dennis (1960)[15] perceptual deprivation alone might be responsible for intellectual manifestations of retardation. Further, recent studies on employment environments (especially factories and industrial mills) suggest that prolonged explosure to sterile and unsociable environments can lead to mental stress and ultimately mental breakdown.

Assuming early sensory stimulus has taken place and environmental perception is developing in a healthy fashion, what does the child perceive? First, it is natural for all human beings to perceive the world with themselves as the centre; the child does this from a very innocent point of view. To the child the environment is made of components. He sees the tree, the rock, the house, but not the yard. Eventually he will see the yard but not the street and so forth. This way of perceiving is clearly shown in children's drawings and explains why their art is used as a measure of perceptual development. For examples see figures 6 and 7.

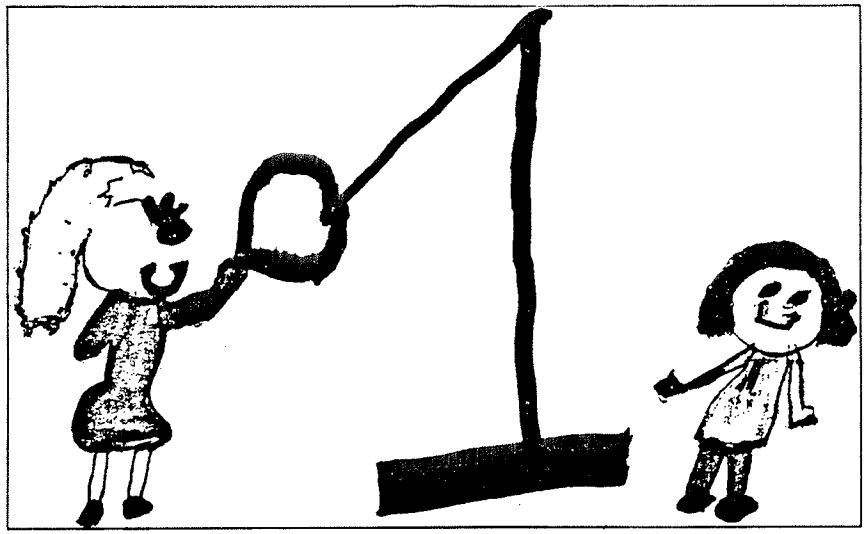


Figure 6 'The Playground' by Leah Craven, age 10

A second measure of a child's perceptual development is his response to moving things. At first the clouds, the stars, the sun and moon, bicycles, and automobiles will have minds of their own. According to Piaget, the process which leads to understanding that only the animal

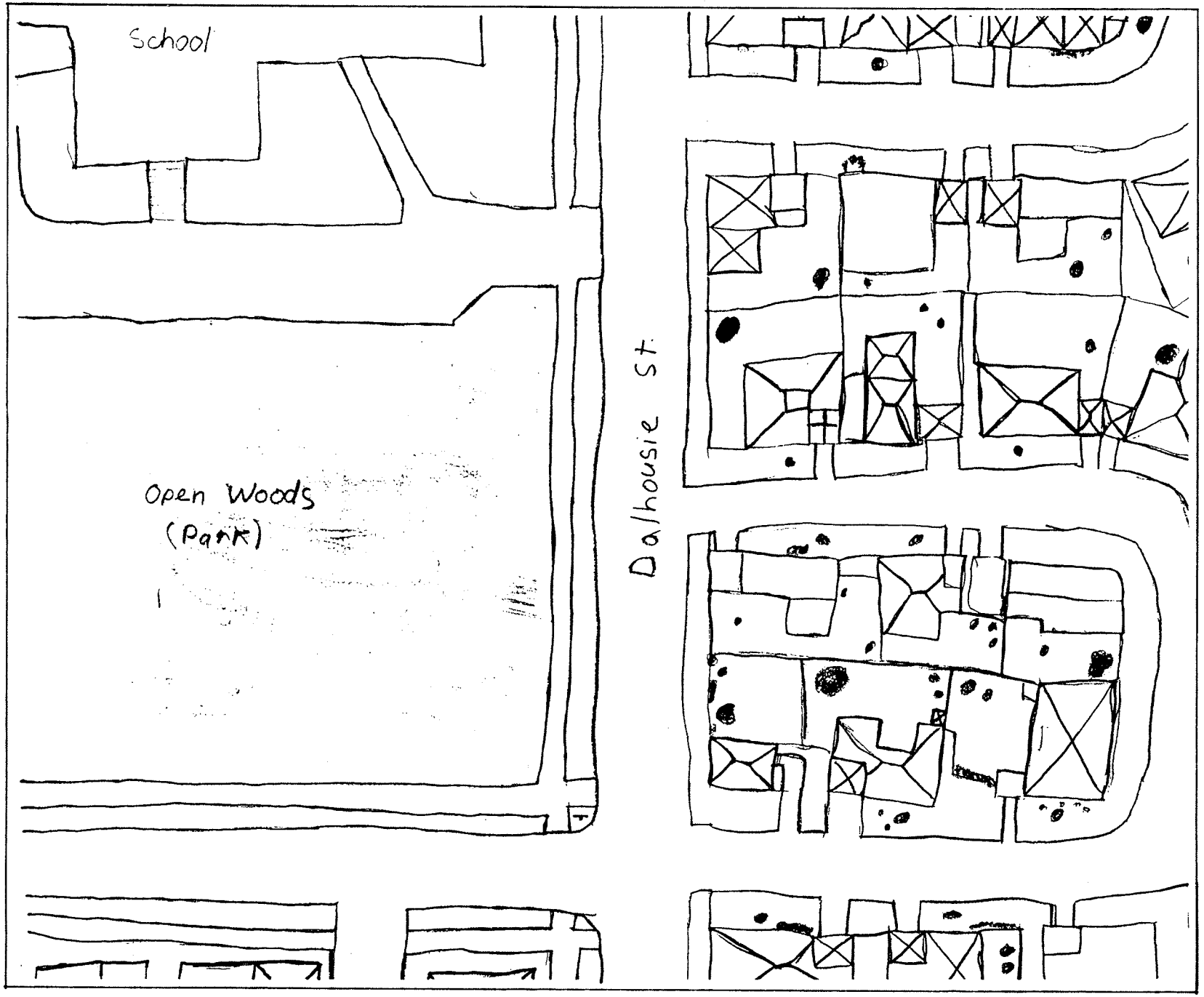


Figure 7 'The Neighbourhood' by David Juck, age 12

world thinks independently can be divided into four distinct age groups. It is sufficient, however, to state that a number of current researchers agree that by six years of age, most children believe that only bodies which move of their own accord are conscious. This belief includes animals, the sun and moon, and the stars. By the age of ten most children believe the heavenly bodies are stationary but turn to follow people; shortly thereafter, they discover (through adult influence) the basics of science. As the child becomes more aware of personality in himself he negates the possibility of personality in other things.

In an intensive two year study of children's perception of their environment, Roger Hart (1979) determined that aesthetic values and environmental quality were not perceived by children.[16] Favourite places were rivers, brooks and frog ponds, woods, trees, sand piles, quarries, hiding and lookout places and small patches of dirt. These were chosen because of their versatile play opportunities (opportunities clearly not available in the typical urban environment).[17] Although numerous playgrounds did exist in the community Hart studied, the single most popular place to play was the ball field, presumably because of its attraction to a wide range of age groups and its distinction as a centre of child activity.

In the same study, Hart observed that a strange environment was often perceived as hostile or distressing unless a familiar or endearing object, such as mother, was present. He determined that the presence of a familiar object has the ability to change a strange environment into a novel environment - one which elicits exploration and topographic learning.[18] This theory is generally supported by both contemporary environmental and behavioural researchers. It is

understood that perception changes with familiarity and memory.

DESIGN IMPLICATIONS

Environmental stimulation is directly responsible for the most full potential development in children. It motivates exploratory behaviour which, in turn, expands environmental experience and perceptual awareness, and increases the capacity for cognitive development. Environmental stimulation is typically characterized by subject uncertainty, tonicity and movement, spatial variety and visual, tactile, audio and olfactory appeal. This implies that such factors have an important place in children's environments. However, unless the child is properly prepared, elements of uncertainty and diversity may be perceived as hostile rather than as novel constituents. When this happens, the imagination can give way to discouragement, frustration and eventually vandalism.

The child's environment should be designed to maintain a level of environmental stimulation which will nurture perceptual development. Since the level of stimulation must directly relate to the individual's environmental experience, it might be described as 'paced'. Orderliness and consistency should necessarily balance with novelty, complexity, and excitement at any given moment.

Ideally, very young children should have activity areas adjacent to their private dwellings so that proximity with parents and home can be maintained. Community playgrounds, however, should still be expected to accommodate preschooler's needs along with those of older children. The community play site should be divided into distinct areas of varying degrees of environmental stimulation to give each child the opportunity to participate on an individual level. As well, each specific area should provide versatile play opportunities for the anticipated user. While the private and new spaces within the playground are

important for increasingly experienced children, sight lines telegraphing their location should be provided to prevent scary 'unknowns' for the less-experienced. All environments designed specifically for children must meet certain safety requirements. Swedish research indicates that before the age of eleven or twelve, sight, hearing, the ability to differentiate right from left and the ability to perceive fast or slow and near or far may not be fully developed. Each year hundreds of accidents involving children are blamed on poorly developed environmental awareness. It is important to realize in the design stage that children cannot perceive the need for caution or anticipate danger until they are well into their school years.

2.3 COLOUR PERCEPTION

> Our response to colour is impulsive and emotional and we are generally far more affected by the colour of an object than by its form.
>
> Michael E. Doyle, Color Drawing

While an abundance of information on the perception of colour and colour preference is available, much of the data is suspect due to strong emotional overtones. Birren, for instance, suggests that the individual who dislikes red is frustrated and often distraught.[19] He also suggests that a preference for neutral colours (black, white, grey, brown) is an indication of mental distress.[20] The number of researchers who support the idea that human response to colour is an indication of mental health and perceptual development makes the theory difficult to ignore.

Colour is, without a doubt, an important factor in man's perception. We gain most of our information about our environment visually and, unlike other animals, our vision is binocular and in colour. According to Koffka (1931) and Gibson (1969) an infant's first visual discrimination is between colour and non-colour. He then discriminates between warm and cold colours, and then within warm and cold colours. Finally he perceives the intermediate colours.[21]

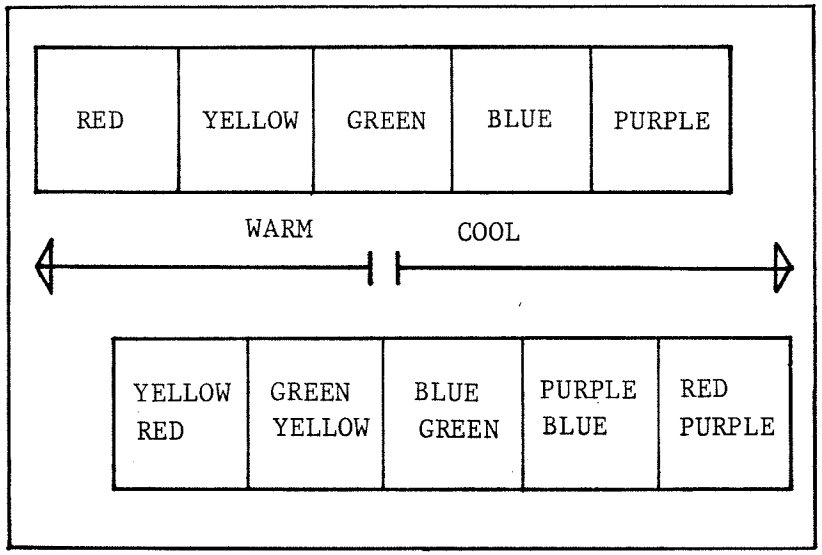


Figure 8 The Primary and Intermediate Colours

Tuan suggests babies respond to colours by three months and that as they grow older their preference for warm colours, particularly yellow declines.[22] This is supported by Birren's colour preference tests where infants appeared to prefer yellow, white, pink and red until about two years of age. As they grew older their preference for yellow faded and they began to prefer red and blue. With maturity, the international preference was for blue and green while red, orange and yellow were least liked. These results were consistent for male and female, black and white, insane and stable test groups.[23] While other researchers (Cheskin, Ertel et. al.) also support the theory that children prefer primary colours, it must be noted that mammals can be trained to prefer certain colours. Therefore, by providing children with objects in predominately primary colours we are influencing their colour preference to some extent. However, since children from a variety of cultures and financial backgrounds indicated the same colour preferences on Birren's tests, external influences may well be insignificant.

Investigators in Russia and Canada agree that "the stimulation of one sense organ will influence all other sense organs to a higher degree of excitability."[24] It is commonplace that musicians, poets and artists are highly sensitive to colour. Ironically, Birren suggests that the effect of colour is most pronounced in neurotics and psychotics.[25] He states that, while it is normal to like any and all colours, undue exuberance over colour may be a sign of illness.[26]

Colour theorists collectively agree that the equilibrium of the human organism is most disturbed by red, least disturbed by blue, and, that there is a corresponding gradient throughout the spectrum. That is not to say that everytime

one sees red they will become excited. However, competent experiments have shown that red light raises blood pressure and the rate of respiration while blue light lowers blood pressure and the rate of respiration. The red end of the spectrum produces eye strain and tension while the blue end of the spectrum reduces eye strain and tension. Loud noises and strong odors and tastes tend to increase the eye's sensitivity to green and to decrease the eye's sensitivity to red.[27] Further, there is so much evidence that suggests extroverts prefer warm colours and introverts cool colours that Birren considers it fact.[28]

Although short lived, colour stimulation, or lack of it, can be very intense. In harmonious, bright settings, spirits are generally lifted and tension decreased. Highly illuminated, predominately white areas tire the eye and reduce the power of clear vision. Over stimulation, such as created by the flashing colours and strobe light effects in discotheques, heightens the senses, increases blood pressure and speeds the respiratory rate. In drastic contrast is the solitary confinement cell, an abyss of sensory deprivation in which the brain runs wild.[29]

Intermediate levels of deprivation may be likened to interrogation rooms, meant to break the spirit while leaving the mind on the verge of control.

Considering the capacity of colour to affect human behaviour it is no wonder that in recent years colour has become one of the most effective treatments for diseases of the mind. For instance, it plays a particularly important role in auratone film therapy. Developed by Rubin and Katz in 1945; (Birren,1978) auratone film therapy is the use of slow, sedative and mildy sad music with films of cool coloured abstract images. Through the use of auratone films, many depressed patients have been

able to ventilate their pent up tensions resulting from conflict and frustrations.[30] As well, red light has been used to treat low blood pressure and dizziness. Blue light has been used in the treatment of headaches, and yellow light in the treatment of a variety of psychiatric illnesses.

DESIGN IMPLICATIONS

Research indicates that children discriminate predominately by colour until the age of seven and that colour plays a significant role in their perceptual development. Consequently, it is important to understand and effectively use existing theories of colour perception when designing children's environments.

Through the selective use of colour, a child's level of stimulation and physical activity can be anticipated. Generally, objects in bright primary colours and objects with high tonal contrast will elicit curiosity and exploratory behaviour while objects in neutral colours and objects with low tonal contrast will evoke little response. This implies that environments specifically designed for children are particularly well-suited to high tonal contrast and bright primary colours while environments which are potentially dangerous to children warrant low tonal contrast and neutral colours. In light of this, the colour schemes of items such as fire-engine-red garbage bins (typically found behind fast food stores) and unpainted wood play structures should be re-evaluated.

Environments for children who do not have conventional responses to colour must be treated individually whenever possible. Highly-stimulated and hyperactive children are often disturbed by the solace of blue monotonal environments while subdued, depressed children have difficulty operating within bright polychromatic environments. Both groups are most comfortable in surrounds of mid-range colours with low tonal contrast. In

comparison, strong tonal contrast is imperative to the visually impaired child's mobility. For instance, the child who is unable to fully see the step of a ladder may still be able to negotiate the climb if rungs are opaque against their background.

Finally, the use of colour should be considered as a viable alternative to existing 'written' signage. Since colour discrimination is present at birth, colour is a practical media for communicating with those who, for one reason or another, cannot read. This includes many of the mentally retarded, the partially sighted, the learning impaired, the aged and the very young.

2.4 VISUAL, AUDIO, TACTILE AND OLFACTORY PERCEPTION

> Our enjoyment of the mere sensations of different hues and their combinations may be considerable, but it is meager as compared with the expansion of seeing.
>
> Walter Sargent,
> quoted in Color Drawing

How important are visual, audio, tactile and olfactory cues to development? This is a difficult question to answer since the typical infant does not communicate his perception and frequently prefers to sleep rather than to participate in psychological investigations. Only recently (Haith, 1966; Fantz; 1965; Eisenberg, 1964; Wertheimer, 1961) have we dispelled Dr. Spock's theory that newborns are both blind and deaf. The evidence is that a newborn's perceptual equipment differs in only relatively minor ways from an adult's. At birth the child is sensitive to odours, varying intensities of light, and a wide range of sounds. He can also detect the location of sound and visually follow a slowly-moving object. His capacity to taste or to feel pain is limited to nonexistant. Very rapidly the child develops coordination, the ability to accommodate, depth perception, and the recognition of spatial relationships. Apparently, by the age of six months, the child perceives the world in much the same way as an adult. Of course, he does not have the experience or knowledge to enable him to interpret his perceptions.

In The Urban Nest, Anne-Marie Polloway describes the human being's two most relevant sensory receptors for our environmental concern as the eyes and the ears. These, she states, are man's two most important sources for receiving and interpreting spatial information. Additional research suggests that audio cues may be most important and visual cues least important to man's perceptual discrimination development. Yi Fu Tuan, in his book Topophilia, suggests that man gains most of his information about the environments through his eyes although he is often more touched by what he hears than by what he sees.[31] For

instance, the roll of thunder, the cry of a loon and the roar of a waterfall have an auditory appeal that cannot be matched visually. Despite this, our preliminary sense of perception is visual and our visual perception continually improves with experience.

Table 4 Visual Acuity of Children

Age (years)	Mean Distance (cm)
6	299
7	326
8	350
9	355
10	360
11	375
12	404
13	440
14 - 15	475

Source: Zaporozhets and Elkonin
The Psychology of Preschool Children

In 1982, Linda Schneekloth undertook a study to determine the effect of blindness in the play habits of young children. Her results support the theory that blind and visually-impaired children are entirely capable of the same activities as able children. Schneekloth noted a delayed motor efficiency in the blind and more complex passive behaviour in the sighted but no difference in manipulative behaviour.[32] Understanding that the blind typically spend fifty percent more time alone than do the sighted, Schneekloth attributed delays in the blind to lack of experience. She felt that the lack of experience could be easily reduced or eliminated through frequent integrated play periods and more complex structures. Schneekloth observed that the most complex play in both the sighted and the blind study groups took place on the most complex equipment. However, at the same time, Segal and Yahraes (1979) point out that the environment is more than normally complex and puzzling to the handicapped individual. They suggest that the increased difficulty of coping with a complex environment can lead to what is termed environmental stress. This may then work with genetic inheritence to promote mental illness.

The effect of deafness on the development of young children is evidently more critical.

It is an accepted theory that language facilitates concept learning and that verbal communication is necessary for social and conceptual development. The results of an experiment by Bruner and Kenney (1966) strongly support their contention that language provides more than a means for representing reality or expressing thoughts - it is the means by which individuals are capable of analysis, synthesis, abstraction and generalization.[33] Montessori and others have observed that deaf children are often retarded four to five years at the conclusion of their secondary education.[34]

Table 5 Olfactory Sensitivity of Preschool Children

	Number of Children Reaching Errorless Identification of Smell	
Age (years)	Less Than 10 Trials	More Than 10 Trials
7	8	2
6	7	3
5	6	4
4	2	8

Source: Zaporozhets and Elkonin
The Psychology of Preschool Children

Although a child's sound localization is established by the end of the first year, man's auditory perception is generally not well developed. Unlike visual acuity, auditory acuity does not continually improve with experience. From birth a child's hearing ability is comparable to that of an adult's, it is very efficient to a distance of twenty feet. Tonal discrimination peaks in man at about age fourteen. At this time the human being is most sensitive to a pitch which is similar to a child's cry.

Tactile awareness is a third sensory receptor at man's disposal. Results of several anthropological and scientific studies suggest that its continued development may be evolutionary in nature. In a recent experiment designed to determine the reaction of Stumptail monkeys to other animals and novel objects, Bertrand found that texture was the stimulus which elicited the greatest reaction.[35] After some months in isolation, each monkey in the

experiment was frightened by the introduction of brown and pink furry stuffed bears of varying sizes. These same monkeys, however, repeatedly approached a smooth brown plastic bear. Texture was perceived as a sensory stimuli and played a role in eliciting exploratory behaviour.

Anthropological research also suggests that man's perfect proportion of finger to thumb has been evolutionary in nature. While this proportion enables him to grasp, handle and maneuver objects with unmatched precision among animals, its influence in perceptual development is unclear.

From birth man has the capacity to locate approximate position with his fourth sensory receptor, his sense of smell.[36] Although data establishing the role of this sense in childhood development is unavailable, its importance cannot be ignored. Olfactory perception intensifies visual images, sounds and other sensory experiences. We identify roses and carnations by their fragrance and gasoline and chlorine by their odour. The circus, the theatre and the private home each have a distinct and personal scent. By the very fact that smell is a sensory experience, it must play a significant role in a child's perceptual experience, especially since children's noses have a close approximation to the ground.

DESIGN IMPLICATIONS

In respect to visual, audio, tactile and olfactory perception, development can be categorized under two headings: children under five and children over five. Both categories must be considered separately in the design process.

During the first five years of life, when the ability to discriminate between objects by single, physical characteristics is developing, it is of great importance that children's environments accommodate their need to touch,

hear, see and smell a wide variety of environmental stimuli. At this stage, learning to identify and to discriminate between objects in the environment is easiest if the child is given more than one sensory cue. It is especially valuable if children receive visual information along with a combination of all or any tactile, audio or olfactory cues.

For instance, children are typically attracted by the everyday sounds of traffic, lawn mowers, and other children playing. When fences or walls eliminate the visual cues normally associated with these specific sounds, discrimination on an audio basis can still take place but the ability to correctly identify the object is delayed.

Conversely, although visual cues may be available, children cannot be expected to fully understand the concepts of wet and dry or smooth and rough unless they are given the opportunity to explore the situation through touch. Children under five are attracted by, and comprehend most easily, large bold shapes, bright colours, simple, obvious textures and highly distinguishable sounds and smells. Because their ability to receive and interpret sensory information is in a rudimentary stage, subtle blends and advanced shapes are not perceived and may even appear monotenous.

By the age of six, stimulation levels are closely related to a child's ability to perceive complexity in his environment. Because more complex behaviour results from a more complex environment and an individual's ability to perceive complexity increases with experience, stimulation levels and perceptual ability are ultimately dependent upon experience. Consequently, it is critical that environments for young school aged children do more than entertain. They must provide a contingent for progressive involvement.

Children over five should be provided with environments which encourage fine detail

differentiation, sharpened acuity and abstract thought. Since the rate of perceptual development slows considerably after the age of eight, it is imperative that children encounter as many sensory experiences as possible before that time. The role of challenge and opportunity cannot be underestimated.

2.5 MOTOR DEVELOPMENT

> Movement is the key to growth and development, to sensory inputs and motor outputs, to sensing, knowing, and learning. If information or experience doesn't get into the muscle it doesn't get into the brain.
>
> R.C. Orem,
> Montessori and the Special Class

Motor development, cognitive/perceptual development and social/personality development comprise the three main areas of concern in the overall development of the child. Although environmental experience of all kinds helps a child organize space into a cognitive system of up, down, left, right, front and back, research has shown that muscular development, power, body balance and fine motor skills are, for the most part, genetically determined.[37] There is little evidence, however, that heredity controls the gross motor skills such as throwing, catching, jumping, kicking or swinging.

Gross motor skills are developed in accordance with perceptual abilities. Sensory awareness relies, in part, on the opportunity to physically explore the environment; motor development relies, in part, on the perception of sensory stimulation. Like most skills developed during childhood, perceptual-motor abilities improve with experience and practice.

Investigators in the disciplines studying growth and development have recently recognized that body dimensions influence a child's developing motor ability. Evidently, physiological makeup is intrinsic to gross motor development. In his report 'Physiological Pecularities of Children', Dr. Donald Paterson notes that while muscular strength is obviously less in the child than in the adult it is also proportionately less relative to the child's dimensions.[38] This means that a child's muscular strength, even when corrected for body size, is not as well developed as an adult's. Paterson also states that a child's ability to use oxygen is not as well developed as expected for his size and, therefore, rest breaks

are needed during intense or lengthy periods of exercise.

Research suggests that children have only a developing ability to regulate their body temperatures and to tolerate heat. "The child has a larger surface area to body mass ratio than the adult, and therefore, a greater heat transfer to or from the body".[39] The result is that, the younger the child, the greater the surface area for heat loss (in proportion to body mass) and, therefore, the greater the cooling rate. It is not until the child reaches the age of seven or eight that he has developed enough stamina to cold temperatures to fully enjoy recreational activities during a Canadian winter.

DESIGN IMPLICATIONS

Gross motor development is encouraged by environments which provide versatile opportunities for moving the body through space. Because gross

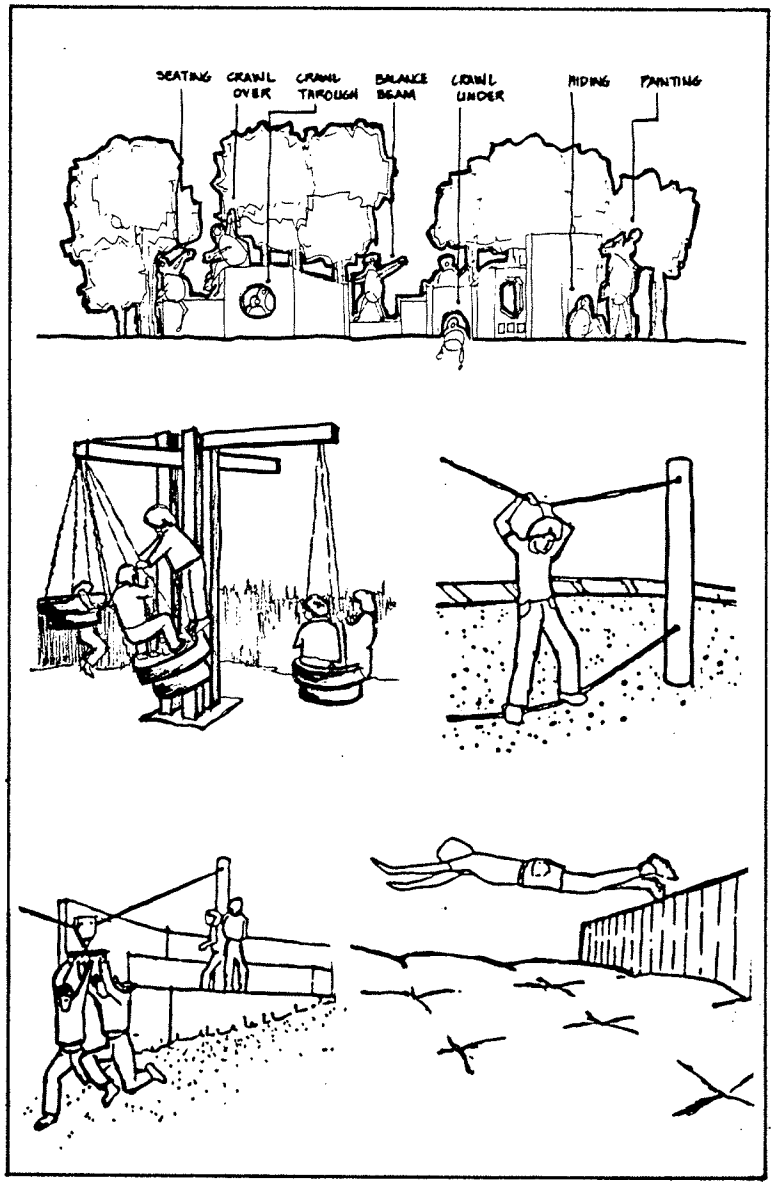


Figure 9 Versatile opportunities for moving the body through space

motor development occurs in accordance with perceptual development, the child must be able to perceive his body in relation to the surrounding environment in order to achieve a high level of motor success. This means that he must attain an understanding of the location, size and weight of his body in space; he must understand the concepts of up, down, front, back, over, under and through; and, he must acquire temporal and spatial experience and knowledge in order to make effective decisions and judgements. Complex equipment which balances stimulation and challenge with the opportunity for success is particularly valuable for nurturing such awareness. However, it must be remembered, that, gross motor abilities improve with experience and open space for practicing such skills as kicking, jumping, throwing, catching and swinging is also important.

Simple play equipment should be provided for children under five as complex equipment may place unreasonable demands on their physiological makeup. Similarly, extended outdoor activity in the Canadian winter may be unreasonable for children under seven unless their environment is modified to create some climatic protection.

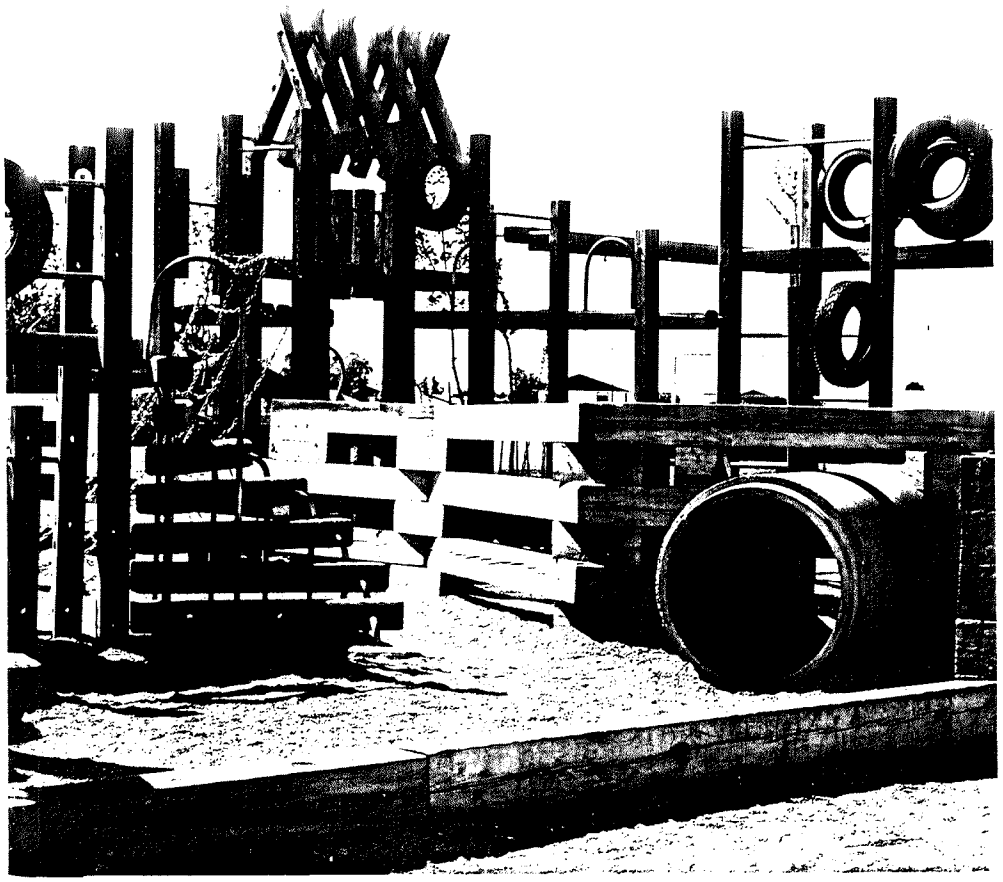


Figure 10 Complex equipment is valuable for gross motor development

2.6 COMMON DISABILITIES

Come look us over
Give us a chance,
Put us in clover
Not behind the fence.
We're on the move now,
There's no fear or shame.
A little bit slow at the gate, perhaps,
But still we're in the game.
1974 Special Olympics.
Winnipeg, Manitoba.

In 1969 the Canadian Commission on Emotional and Learning Disorders in Children published the report "One Million Children." It showed that 15% of Canadian children between the ages of 1 and 19 suffered from disorders of body, mind and intellect. It also indicated that fewer disabled children were being institutionalized; the majority remained with their families in a community setting. However, a quick review of community playgrounds suggests that the general environment may not be well-suited to the needs of this disabled population. This hypothesis, combined with our understanding that play is fundamental to physical, cognitive, social and emotional development, makes the immediate need for integrated recreational opportunities apparent.

To begin the design of the integrated play space it is imperative to understand the characteristics of potential users. According to Statistics Canada (1977) it can be expected that the majority of handicapped children living in the community will be physically disabled. These children are commonly recognized by one or more of the following impairments: poor motor and locomotor function, loss or limited use of body parts, poor balance or poor co-ordination. Of these, few will have disabilities which cannot be minimized by the use of orthopedic appliances, mobility aids, wheelchairs, walkers, crutches or prostheses. Though assistive, these aids contribute to restrictions physically disabled children experience in their daily life.

Briefly, some of the restrictions are as follows. For easy propulsion wheelchairs are limited to hard, flat, non-interrupted, non-skid surfaces. They require a minimum space width of

3'-0" from which to turn into a space 2'-8" wide. Wheelchairs limit their user's reach and maneuverability and inhibit independent function in some design situations. Similarly, children wearing orthopedic appliances or using mobility aids have increased difficulty on soft ground, on interrupted surfaces, on climbing apparatus and on slopes, stairs and ramps.

Clearly, the integrated play space must accommodate the physically disabled child's orthopedic and mobility aids. It must also attempt to minimize hazards which contribute to apparatus malfunction. Major problems are sand and water, both excellent manipulative components of child's play. Sand grinds into wheelchair gears as well as unprotected prostheses and orthopedic aids. Though the physical apparatus can be cleaned and repaired, both sand and water create skin and stump irritation and discomfort and thus increased disability.

Figure 11 Sand and water are excellent manipulative components of child's play.

The most common child's prosthesis (according to J. Marinic of the Rehabilitation Centre for Children, Winnipeg) is the battery operated forearm with hand. The mechanical system is well-protected in two 'skins' of plastic and, with care, can survive all environments a child normally encounters. The second most common prosthesis is a manually operated forearm with hook and, the third, a manually operated lower leg and foot. Though the manual systems are not as sensitive to water as the battery operated systems, the skin

and stump enclosed by the prosthesis remain extremely sensitive and the uncovered hook is easily clogged with sand and dirt. Shoulder and hip prostheses are less common and considerably more restrictive. They are generally limited to upward motion directly in front of or at 90° to the body, and arm reach is never beyond the 10:00 or 2:00 position. Though all prostheses are very difficult to climb with, and lower body prostheses can be difficult on slopes, stairs and ramps, prostheses restrict a child's activity very little.

Orthopedic aids used to support or stablize the body can severely restrict mobility, but aids which create moderate (and often only temporary) impairment are most common. Again, difficulty is encountered when climbing and traversing ramps, steps and slopes. Because the weight of an orthopedic appliance or prothesis can tire children quickly, rest is an important aspect of the physically disabled child's day. Easily accessible shady areas with benches, tables and drinking water source should be available. Though all children require solar protection in varying amounts, those on medication tend to be more susceptible to sun stroke, heat sickness and dehydration than others.

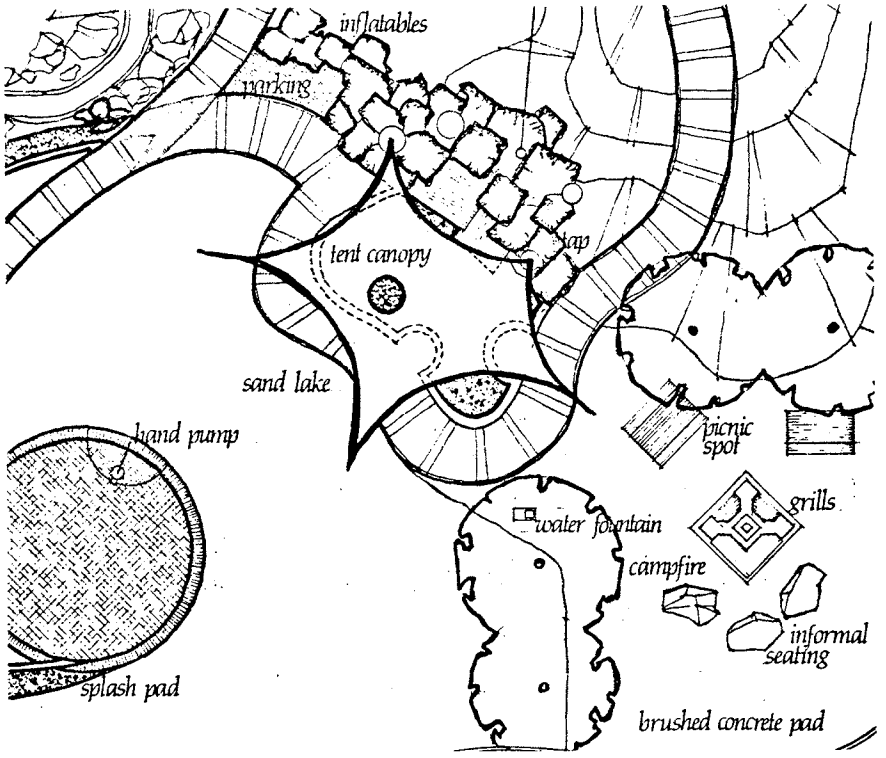


Figure 12

Easily accessible shady areas with benches, tables and a drinking water source should be available in children's play spaces.

Other characteristics common to disabled children are less easily identified, though frequent. In fact, many children have one or a combination of the following characteristics although they are not commonly considered disabled. The number of children with tendancies towards a non-physical disability surpasses the total number of children with disabilities.

Stone and Church (1975) describe the second most common disability as antisocial behaviour in boys and mental retardation in girls. Best (1978) describes the second most common disability as mental retardation and speech defects in both boys and girls, and Statistics Canada (1977) describes the second most common disability as blindness and poor visual perception and the third most common disability as deafness. Evidently a 'second most common' disability cannot be defined although the characteristics of all the afore mentioned can be expected in children on a community playground.

Antisocial behaviour is, perhaps, the most easily recognized. It results from numerous disabilities and is typified by one or a combination of the following: hitting, kicking, biting, yelling, and pant-wetting. It may also appear as severe apathy, however, moderate apathy is characteristic of a variety of disorders and therefore quite common. Antisocial behaviour surfaces most often when a child is frustrated.

Mental retardation, on the other hand, is typically recognized by a child's inability to focus on specific clues within the environment. The mentally retarded child opeartes at his full potential and is, therefore, seldom frustrated. He, therefore, does not as a rule, display undue antisocial behaviour. He tends to focus on a broad class of stimuli and is more attentive to form and symmetry than colour and asymmetry.[40]

The term blindness is generally used to describe children who cannot detect a radius of

less than thirty degrees when holding a hand rail, children who have difficulty with figure/ground differentiation and left/right progression, and children whose angular visual field is twenty degrees or less. It has been observed that children with visual and audio impairments often lack imagination and have considerable difficulty amusing themselves. Further, blind children frequently show a delayed motor efficiency although they are ultimately capable of the same activities as sighted children. According to Linda Schneekloth, blind children typically spent 66% of their time alone while sighted children spend, on average, only 13% of their time alone. Delayed motor efficiency in the blind may, therefore, be attributed to lack of experience.[41] Similarly, the deaf child is frequently retarded four to five years at the conclusion of his secondary education. Montessori suggests that such environmental retardation is due to early intellectual deprivation.[42] It is ironic that children with severe audio impairments are discomforted by loud and sharp sounds. They are also particularly susceptible to visual problems later in life. Similarly, children with severe visual impairments are unusually sensitive to bright light and glare.

Drooling, stuttering, noisy breathing, articulatory problems and poor volume control is typical of children with speech disability. While these characteristics are not of an anti-social nature, children with speech difficulty seem to show aggresive behaviour more often than other children. This is believed to be caused by their extreme frustration when communication circuits break down.

The perceptually disabled child suffers from an inability to operate in group situations and has trouble discriminating between play objects

and the surrounding environment. He is typically apathetic, timid and uncomfortable within a complex environment.

Although not common, some other characteristics displayed by children with disabilities are self-abuse, body-rocking, quick fatigue, extreme sensitivity to pain and temperature, indifference to pain and temperature, obesity, extreme withdrawal and a reduced sense of reality.

Table 6 Categories of Handicaps and Their Consequences

Category	Specific Handicaps	Social and Personal Consequences
Physical	Crippled Birth defects Blind and partially sighted Neurological disorders Cerebral palsy Eplilepsy Health impaired	The child has problems with: Mobility Experiencing the world through all of his senses Mastering his physical and human environments People who are too helpful or too demanding People who do not understand his difficulties in gaining mastery of over his world Isolation Diminished energy
Communication	Speech Deaf and hard of hearing Language disorders of childhood Severe language delay Multihandicapped	The child has problems with: Learning or using verbal symbols to think and communicate about his world Isolation Dealing with academic learning which requires the use of verbal symbols
Development and learning	Mental retardation Behavior disorders Specific learning disabilities	The child has problems with: Reduced interest in the world Difficulty in relating positively to children and/or adults Developing internal controls Failure to live up to expectations Rejection and isolation

Source: Joe Frost and Barry Klein
Children's Play and Playgrounds

DESIGN IMPLICATIONS

Integration means respecting all individuals' freedom and equality by providing for all, the opportunities and conditions of everyday life which are as close as possible to the norms and patterns of the mainstream of society. It is not intended to be the wholesale elimination of specialized services for children with exceptional needs. However, it is essential that the means for achieving integration be normative.

For instance, although the typical community has fewer disabled children than able children, disabled children often have disproportionate amounts of free time and are, therefore, potentially, the most frequent users of community play space. This implies that special provisions should be made to create a climate in which the able and disabled child are 'equal'. The disabled child or, more commonly, the child with characteristics of disability, should have the opportunity to establish or maintain a personal interaction with the environment in the same way as an able child. Solutions of adapted facilities which create 'disabled' and 'normal' patterns of use are ill-conceived.

The community playground should provide a variety of possibilities for every child, regardless of ability or experience to achieve something in a pleasurable atmosphere. The success of the environment is dependent upon its ability to open doors to participation and growth. In order to nurture the child's intellectural, social and motor development, a full range of supportive resources may be necessary.

Paced levels of interaction and challenge so that children can make decisions before taking the next step, continuous circulation which directs the flow of play from one activity to the next, and the selective use of sensory stimuli and all

modes of communication are important factors in enriching children's experience and increasing their opportunity for cognitive and physical learning. Circulation routes of hard, uninterrupted surfaces, are important for accommodating orthopedic aids, wheelchairs, tricycles, and both the downwardly and fully mobile. Strong tonal contrast and edge differentiation are equally important to the blind. While all children benefit from shade devices and rest areas with sources of drinking water, such factors are especially valuable for children on medication and with protheses. Redundancy, repetition and reoccurrence of spatial types may be helpful to exceptional children. Ultimately, the play space should offer opportunities for success and evoke confidence and self esteem in a comfortable, safe and stimulating setting.

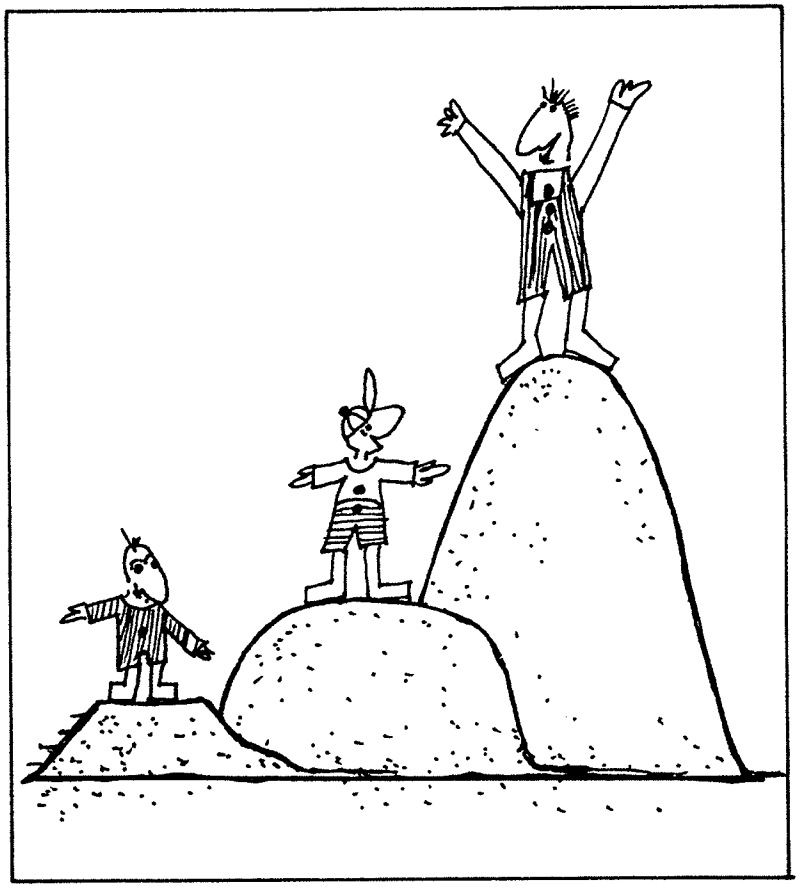


Figure 13 Paced Alternatives

SUMMARY AND CONCLUSION

SUMMARY AND CONCLUSION

All applied research is stimulation.
Corwin Bennett,
Spaces for People

It is evident that designers must re-direct their efforts to create environments which are conducive to the healthy development of young children. Environments that deny the child, that offer no chance of involvement, participation or manipulation, that are devoid of choice, complexity and interaction are of little value. While children may not respond to environmental or aesthetic quality, it is believed that colour, spatial variety, vision, sound, touch and smell influence behaviour in early childhood. Furthermore, there is evidence that a large portion of perceptual ability is achieved gradually through experience and that such ability improves with practice.

The process of sensory training can be spontaneous and unorganized with relatively unproductive results. However, if one succeeds in organizing sensory training according to the theories of childhood development, the effectiveness of this training may be substantially increased. By balancing the proper amount of environmental stimulation with each stage of childhood development, a child's full potential may be reached.

Following are the specific design implications and appropriate design responses for each environmental factor discussed in this report.

ENVIRONMENTAL FACTOR	DESIGN IMPLICATIONS	DESIGN RESPONSE
Spatial Variety	From age 0 to 24 months children require and actively maintain visual and acoustical proximity with a mother figure. During this period children usually play alone.	Play area must be directly associated (visually and acoustically) with mother figure. It should be scaled to comfortably accommodate a child playing alone. Play areas for preschoolers should encourage and facilitate the safe, spontaneous, exploration of the near environment.
	From age 2 years to 7 years children develop social skills such as sharing, verbalization and peer interaction. During this period children prefer to play in groups and are often quite noisy.	Play areas and equipment should be appropriate in size for two or more children. They should be located in easily accessible places so that children can use them unaccompanied by an adult. They should <u>not</u> be located in the proximity of childless households. Provisions for preschool and school aged children should be considered separately but should not be segregated. Manipulative materials and items which demand self initiated activity and encourage cooperative interaction are recommended. A variety of spaces should be easily accessible from other activity areas for free, spontaneous and solitary play.
	From age 7 years to old age, group play dominates. It is usually more competitve than cooperative. Preadolescent children are the same size as adults and imitate their elders.	Spatial needs for preadolescent children are identical to the spatial needs of adults.

ENVIRONMENTAL FACTOR	DESIGN IMPLICATIONS	DESIGN RESPONSE
		Preadolescent children should be able to interact with their environment, have some freedom from adults, and have the opportunity to create and self-devise challenges.
		There should be enough grass area in the play space for children to play team sports. Likewise, there should be enough hard surface area to ride bicycles, bounce balls and play hopscotch.
	Exploratory activity and search is motivated by novel situations where an attachment figure, usually the mother, is present. As well, novel objects encourage exploration when placed in a relatively familiar environment. In an unfamiliar environment, or when an attachment figure is not present, elements of uncertainty and diversity may be perceived as hostile rather than as novel constituents.	The child's environment should provide the opportunity for children to interact and operate comfortably, in accordance to their past environmental experience. Paced levels of stimulation are recommended.
		Orderliness and consistency must be balanced with the need for novelty, complexity and excitement.
	Before the age of 11 or 12 years, children cannot perceive the need for caution or anticipate danger. Where streets are children's only play areas there are likely to be more accidents.	Children's play environments should be clearly designated.
		Play areas should be adequately enclosed to prevent children from carelessly running out and onto the street.
	Overstimulation in the environment reduces the child's capacity to concentrate, to focus, and to make decisions. Barren, unstimulating environments also cause maladaptation of attention.	Overstimulation should be avoided at decision points.

ENVIRONMENTAL FACTOR	DESIGN IMPLICATIONS	DESIGN RESPONSE
		The play environment should be designed to stimulate and advance children's skills but not put unreasonable demands on their abilities. Variety in height and composition of the playground landscape should be encouraged. At the same time, sequence and scheduling of activities should be clear. As far as possible, elements with set functions and meanings should be minimized and controlled ambiguity should be maximized.
Colour Perception	An infant's first visual discrimination is between colour and non colour. Children discriminate predominately by colour until the age of 7 years. Infants appear to prefer yellow, white, pink and red until 2 years of age. Preschoolers and young school aged children show a strong preference for bright primary colours, especially red and blue. With maturity, the international colour preference is for blue and green. Bright primary colours and high tonal contrast elicit exploratory behaviour. Neutral colours and low tonal contrast seem to evoke little response.	Colour perception is present at birth and is, therefore, a practical media for communicating with all persons who cannot read. Environments for children may be separated into areas for specific age groups through the use of colour. Environments specifically designed for children are well-suited to bright primary colours and high tonal contrast. Environments which are potentially dangerous to children warrant low tonal contrast and neutral colours.

ENVIRONMENTAL FACTOR	DESIGN IMPLICATIONS	DESIGN RESPONSE
	High tonal contrast provides visual cues for the partially sighted and children with visual perception problems. However, highly stimulated and hyperactive children, and subdued and depressed children are least comfortable in surrounds of high tonal contrast.	Environments for children who do not have conventional responses to colour must be treated individually whenever possible.
Visual Perception	A child's preliminary sense of perception is visual and visual perception continually improves with experience.	Due to lack of experience, subtle blends and advanced shapes are not easily discerned by children under 5 years of age. They may even be perceived as monotonous! Simple bold shapes with strong contrasts are therefore recommended.
	During the first 5 years of life the ability to discriminate between objects by single, physical characteristics develops. Such learning is easiest when the child receives a visual cue along with one or more audio, tactile, or olfactory cues.	It is especially important that children be able to see, hear, touch and smell a wide variety of stimuli during their first five years. There should be a planned amount of redundancy, repetition and reoccurrence of sensory stimuli to help the young child learn basic discrimination between objects. After the age of 6 years the child requires a more complex environment to retain his interest. The most complex behaviour results in the most complex environment.

ENVIRONMENTAL FACTOR	DESIGN IMPLICATIONS	DESIGN RESPONSE
Audio Perception	From birth a child's hearing ability is comparable to that of an adult's. It is very efficient to a distance of twenty feet.	During their first two years of life, children require environmental opportunities within 20 feet of their mother figure.
	While audio interpretation must naturally be learned, auditory acuity does not continually improve with experience.	Children under 5 years of age comprehend highly distinguishable sounds most easily. Varied audio stimuli are most important to a child during his first 5 years of life when object discrimination is developing.
Tactile Awareness	Texture is an important factor in learning to discriminate between objects. It also contributes to an object's stimulation value.	Simple, obvious, textures are helpful in the development of discrimination in children under 5 while intricate textures are stimulating to children over 5.
Olfactory Perception	Olfactory perception intensifies visual images, sounds, and other sensory experiences.	Children under 5 are attracted to, and comprehend most easily, highly distinguishable smells. As the child matures, subtle olfactory cues contribute to the environment's sensory appeal.
Motor Development	Fine motor skills are, far the most part, genetically determined. Gross motor skills are developed in accordance with perceptual abilities and continually improve with experience.	The child's environment should provide versatile opportunities for spatial experiences such as crawling through spaces, climbing up through different shapes, looking up into and down from spaces, and so on.

ENVIRONMENTAL FACTOR	DESIGN IMPLICATIONS	DESIGN RESPONSE
	Motor development relies, in part, on the perception of sensory stimulation.	Some activities should promote risk taking and decision making activities. However, alternatives should be offered so that children can make decisions before taking the next step. The choice of options should be presented immediately at the end of each activity or cycle of activities. Fixed equipment allows only one-way action and thus limits children's activities within a more or less rigid framework. All play environments should have sections with manipulative materials that children can move and act upon.
	Physiological makeup of children under 5 years of age does not enable them to successfully interact on very complex equipment or within the unprotected Canadian winter environment.	Simple equipment should be provided for children under 5. Play areas for preschoolers should be sheltered and face the most comfortable orientation. The play environment should offer opportunities for success and evoke confidence and self esteem.
	The most complex behaviour is elicited by the most complex equipment.	Children over 5 should be provided with more complex and challenging equipment than preschoolers. The play environment should provide for similar activities to occur at different rates (for different age groups) without interfering with each other.

ENVIRONMENTAL FACTOR	DESIGN IMPLICATIONS	DESIGN RESPONSE
		For each type of activity there should be several levels of accomplishments, e.g. climbing a ladder, climbing a cargo net, climbing a rope.
Common Disabilities	Design for disabled children is not conceptually different than design for able children. All children have a great need to establish peer relations, to create a positive self image and to gain self confidence. To do this children must be able to establish goals which are achievable; goals which have an element of guaranteed success. Repeated failure leads to frustration and gives rise to anti-social behaviour.	Activity areas should provide opportunities for repetition, imitation, and problem solving as these promote learning and help children find order and meaning in the environment. Adequate environmental cues should be provided for children to understand where to go, how to use equipment, and how to understand the environment in general. Equipment should encourage mutual involvement by able bodied and disabled children. Although in conflict with the overall need for obtaining challenge, the following requirements represent the real needs of a child temporarily backsliding or caught in a cycle of frustration: a) Undemanding equipment must be provided as a relief from too great a challenge. b) Some activities and equipment should provide easily attainable success, requiring little skill or effort.

ENVIRONMENTAL FACTOR	DESIGN IMPLICATIONS	DESIGN RESPONSE
	The majority of handicapped children in the community playground will have physical disabilities which are minimized by the use of orthopedic appliances, mobility aids, wheelchairs, crutches, walkers or prostheses.	Major circulation routes should provide full access to the downwardly mobile. Playscapes should be accessible by an hard surface, safe route, other than a roadway.
		Access within the playground should include a system of hard, flat, non-interrupted, non-skid surfaced paths.
		Where possible activity areas should be elevated to accommodate children in wheelchairs.
		Steps on all equipment must be wide enough to accommodate children with limited muscle control, children in braces and children who are obsese. Steps 2'-6" to 3'-0" wide are recommended.
		The angle of steps on equipment should be 45 degrees or less to accommodate children with balance problems and children with limited use of their legs. Steps should be spaced no more than 6" apart.
	The extra weight of an orthopedic appliance or prostheses can be very tiring to the handicapped child. As well, certain disabilities and medications cause some children to become particularly susceptible to sun stroke, heat sickness and dehydration.	Rest spots with shade, drinking water, and benches should be provided on the play site. Water controls should be those requiring very little pressure to operate and benches should have back and arm rests.

NOTES

NOTES

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[30]Birren, Color and Human Response, p. 50.

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APPENDICES

APPENDIX A : AUTONOMOUS PLAY OPPORTUNITIES

An International Year of Disabled Persons Project designed by B. Mehner-Windjack for the St. James-Assiniboia Parks and Recreation Department, City of Winnipeg.

DESIGN SCENARIO

Children enter the playground through a brightly coloured train station and follow the track to a variety of play areas. The track is continuous and encourages play to flow from one activity to the next. This enriches the child's experience and increases the opportunity for cognitive and physical learning.

The 4'-0" track is made of brushed concrete with inset railway ties. It accommodates wheel chairs, bicycles, braces, crutches and canes as well as persons who are arthritics, amputees, spastics or fully ambulatory. Texture changes denote intersections in a tactle and visual form. Rails define track edges and a train whistle audio cue draws attention to the track-street sidewalk intersection. Paths have no slope and ramps do not exceed a slope of 6 percent (a rise of one foot over a distance of seventeen feet). All ramps and raised platforms have handrails at two heights to aid the mobility impaired and add a measure of safety. Ramps along retaining walls have curbs to contain wheelchairs and persons with visual difficulties.

The playground is a protected site where hills, trees, snow, water, sand and other natural features can be safely enjoyed. In its site layout the design has equal amounts of forested and open space. This encourages children to observe and experience nature firsthand. As they play they learn. The ropes and fort activity areas are enclosed by trees while other play areas selectively use trees for shade and

and aesthetic value. Open space activity areas are divided by surface treatment (natural and constructed) and grade changes. Grassy areas can be used by pre-schoolers, wheelchair users who are not confined to their chair, adolescents and parents or supervisors who just want to sit and engage in quiet conversation, read a book or play with younger children. Children can climb, run or roll down small grassed hills or they can sit on top of the hills and "watch the world go by". The hills elevate children beyond the level of the surrounding fence.

In two separate spaces tall native grasses have been planted. One section is ideal for individualistic and quiet retreat play while the other encircles a swing tree and is suitable for more active social play. The swing tree holds four swings, each composed of a large tire on top of a smaller tire and horizontally suspended. This type of swing provides play opportunities for all children and is especially helpful for children who require trunk support.

Two types of sand play occur in the playground. The sand river begins at the splash pad, flows under the track and into the sand lake. A hand pump which can be worked from outside the splash pad and a platform for sitting on make the splash pad an individual play area within a circuit. The water trough along the river is filled from the hand pump in the pad and a similar trough around the lake is filled from a tap in that activity area. Water is necessary for those children who dehydrate easily due to medications they are taking and provides the moisture necessary for creative sand play. A brightly coloured tent canopy provides shade on the hottest summer days. This is essential for children whose medication reduces their tolerance to the sun. The sand lake is raised and indented so that children in wheelchairs can

enjoy sand play while sitting in their chairs. A chair/bicycle parking lot is provided for those children who wish to clamber over inflatables to the lake. The variation in size, color (red being especially attractive to children, or semi-transparent, which is said to give a sense of security), and shape of the inflatables encourages social play. Close proximity to the lake does, however, make quiet play on the inflatables equally suitable.

The inflatables are sited so that children can lay on them and play in the sand or climb, balance, bounce and explore spatial relationships without hurting themselves. Those less active can investigate at leisure the tactile values of these objects. The inflatables also serve as a landing pad for children playing on the cable ride.

From the sand lake the turf climbs to a gentle hill five feet high. At its summit the hill becomes a paved deck from which the cable ride beings. The cave below the deck can be entered down a fireman's pole or at grade. Ventilation and natural lighting through a series of openings enhance the cave's interior character, making it a warm, private place. The cave has a brushed concrete floor to ensure accessability by all.

An amorphous tunnel connects the main circulation track with a vehicular track and also serves as an entrance to the fort play area. Here the need for nonambiguous expression when trying to reach into the remote world of the mentally disabled is specifically addressed with an "I like you" inscription on the tunnel exterior. The contrast of the tunnel's cold, rough, exposed concrete and the fort's wood structures encourages children to become aware of their surroundings.

The most intensively designed area in terms of activity and structure is the fort. For some, play here will be a free spontaneous activity but others may require assistance. Access is

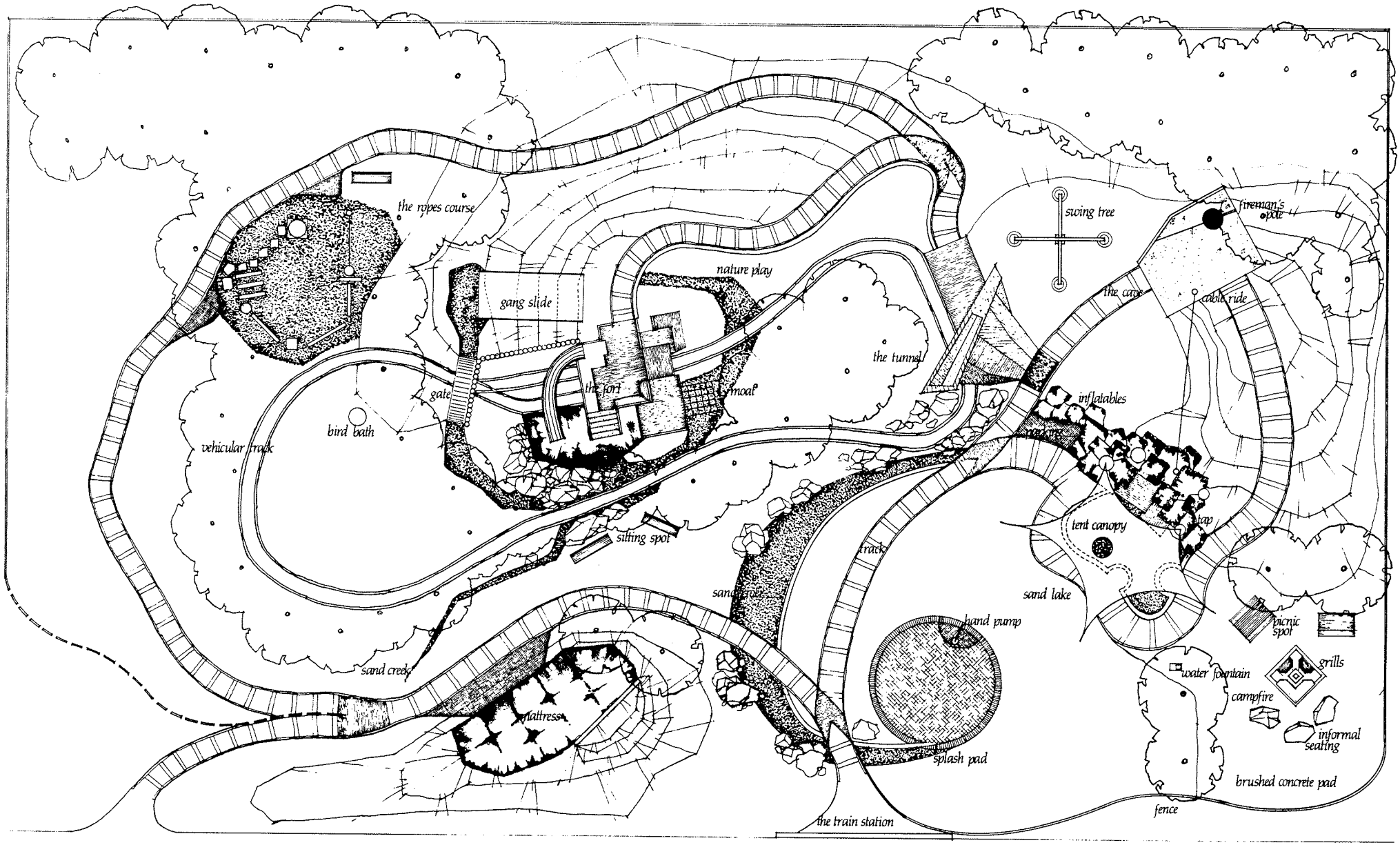
provided in two forms. A vehicular track creates physical equality between able and disabled children by providing transportation without therapeutic aid. The cars may be pedalled by foot or propelled by hand via an overhead line. Switch back tracks are used to create transfer areas where children can get in and out of cars safely. A second track into the fort follows a retaining wall which defines the fort interior. The other side becomes a gentle hill used for rolling, sledding and gang slides. The gang slides become part of a circuit which moves around and through the fort play area. This circuit is broadly defined by a sand moat and includes crossing the fort's gate, the rubble pile, the landing pad and the fort platforms. A second play circuit exists within the fort proper. In it, the slide empties onto the landing pad which is connected to the slide platform by way of a carpeted ramp. The ramp may be walked, crawled or bumped up to the platform where children choose a path. One option is to follow a shallow slide to the main slide - this eliminates any need to stand, walk or crawl. The second option is to take the level platform to the main slide, to the track along the retaining wall or to other platforms.

The ropes course provides challenge directly related to skill. It is comprised of stepping stones and logs, tarzan swings, rope walks, and fixed and mobile balance beams at various heights. Play on the ropes course is especially suited to gross motor muscle development. Although there are no rules for using the individual components, movement on and between them requires upper body strength, balance and coordination. The circuit is designed so that it can be completed entirely above grade. A pea gravel base was selected specifically for its non-compacting characteristics. This provides maximum absorption

for falls and reduces ponding in wet seasons. Because pea gravel does not adhere to the soles of shoes it decreases the risk of slipping on the course components.

An all weather (heavy duty bonded vinyl) mattress built into the street side berm provides a terraced play surface for young and severely disabled children. With the mattress children can balance, sit, crawl and explore space without hurting themselves. The mattress is essentially flat with just a hint of slope for run-off. It is neutral in shade in order that objects placed on it may be easily seen by children with visual disturbances.

Because the playground is designed for a residential setting, special consideration has been made for neighbourhood interaction. A picnic site somplete with picnic table (one without a bench seat for use by persons in wheelchairs), water fountain and tap is provided on a brushed concrete pad near the street face. This not only allows groups to extend their day of play over a meal hour, but promotes community involvement. The fire pit is designed as a barbecue with two grills on one side and as a campfire on the other. Small boulders provide informal seating for social gatherings. The space is also intended for use as a play area. Games such as four square, hopscotch and marbles require the hard surface. The surrounding fence has potential for bouncing balls, pitching boards and basketball hoops.


the ropes course
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fireman's pole
the cave
cable ride
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tent canopy
tap
sitting spot
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sand lake
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picnic spot
grills
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AUTONOMOUS PLAY OPPORTUNITIES
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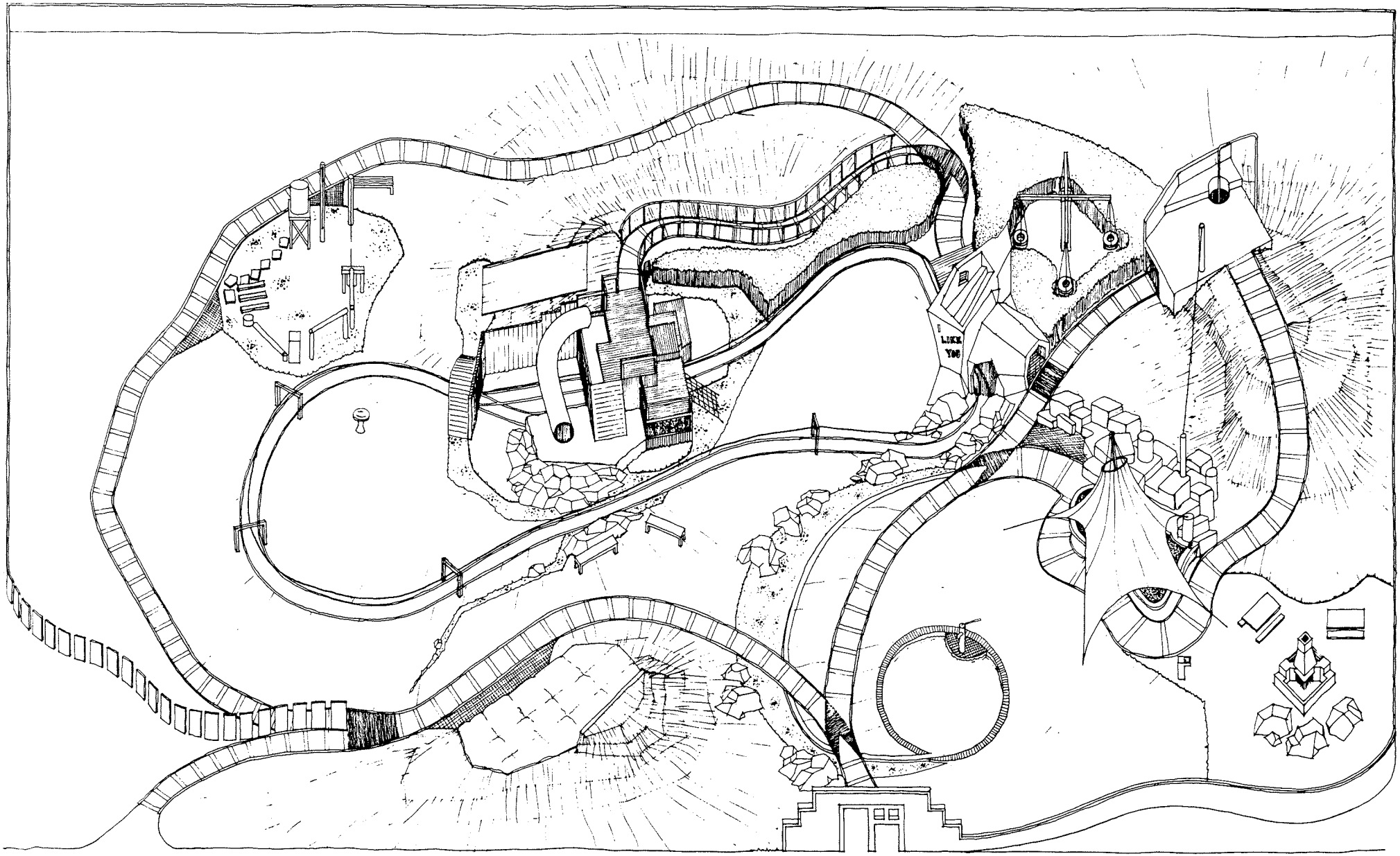
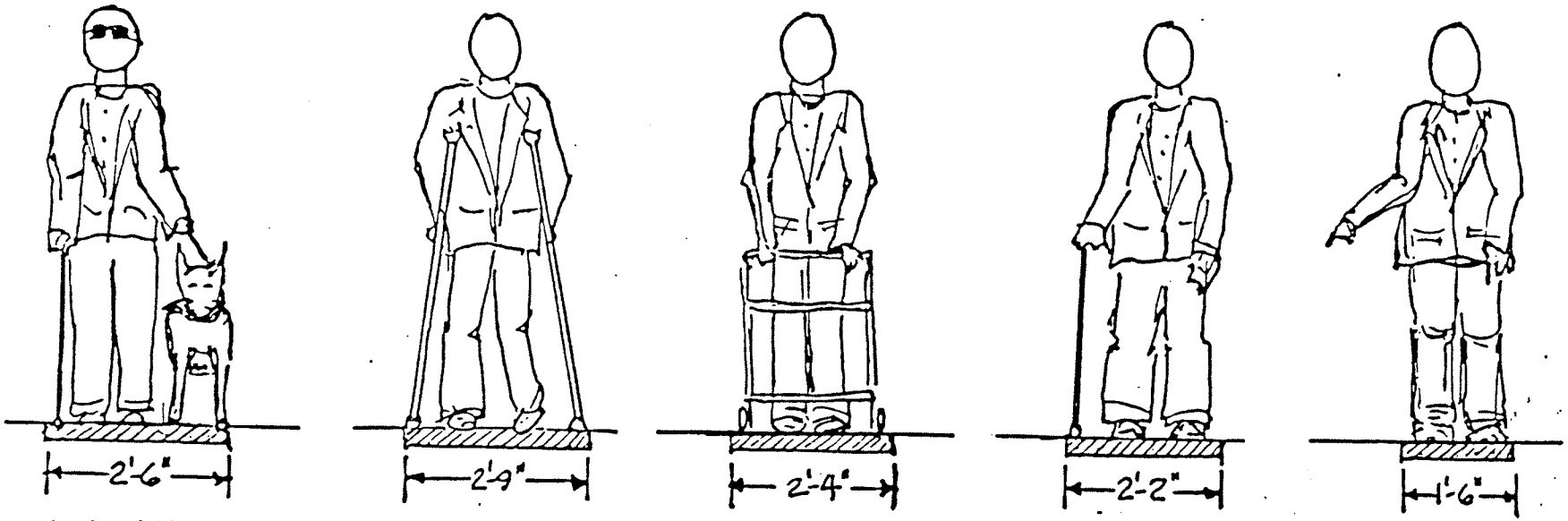


AUTONOMOUS PLAY OPPORTUNITIES *isometric*

APPENDIX B: DIMENSIONS FOR PEOPLE OUTDOORS



Blind with Guide Dog | Crutches | Walking Aid | Cane | Braces

Source: U.S. Dept. of Housing and Urban Development
Barrier Free Site Design

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