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AUTHOR Moore, Gary T.: And Others
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ABSTRACT

The purpose of this project was to research and develop two design guides on environments important to child development: child care facilities and outdoor play areas, and to specify new, research-based criteria for the planning and design of these facilities for military bases around the world. The current paper is a synopsis of parts of this project. The paper summarizes the following: (1) the applied research methods used to generate the data-base for the new planning and design guidelines; (2) key findings in the areas of policy, planning, and architecture for both child care facilities and outdoor play areas; and (3) example design applications of the new patterns and criteria for the design of prototypical new facilities, renovations of existing facilities, and adaptive reuse of older buildings. The two design guides described in this paper represent a humanistic approach to architecture based on an examination of children's needs and the role of the physical environment in child development and experience. They are based on recent research in child development, environment and behavior, and architecture. The work also incorporates ideas on child care facilities and play settings from around the world. Most of the information in these documents, while generated for specific application in family housing areas on U.S. military installations, is considered generalizable to child care facilities and outdoor play environments for children. (Author/PH)

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DESIGN PATTERNS FOR CHILDREN'S ENVIRONMENTS:
SYNOPSIS OF A TWO-YEAR RESEARCH AND DESIGN PROJECT

Gary T. Moore and Uriel Cohen
Environment-Behavior Research Institute
University of Wisconsin-Milwaukee

Tim McGinty
Community Design Center, Inc., Milwaukee

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ABSTRACT

The need for more and better environments for children, and the need for better design guidance were the impetus for this applied research project. The objectives were to develop two design guides--one for child care facilities and one for children's play areas. The approach was to focus on developmentally-appropriate environments for children--settings which support and foster physical, intellectual, and social development. A three-step research procedure included field research and post-occupancy evaluation, literature review, and pattern and criteria development. The patterns and criteria included in the two design guides represent a humanistic approach to design based on examination of children's needs and the role of the physical environment in child development. A number of new design ideas, patterns, and recommendations are included in these guides. Examples in the child care guide include the notion of HOME BASES; the importance of the ENTRY SEQUENCE; PORCHES AS ACTIVITY SPACES; the development of RESOURCE-RICH ACTIVITY POCKETS FOR 2 TO 5 CHILDREN; CIRCULATION WHICH OVERLOOKS ACTIVITIES; LEARNING BATHROOMS; EATING CLUSTERS FOR 4 TO 5 CHILDREN, and so on. Examples from the play area guide include organizing principles like SEPARATED BUT LINKED ZONES; LOOPED CIRCULATION; CONTINUITY AND BRANCHING; DEGREES OF SHELTER; the importance of AMBIGUITY in the environment; PACED ALTERNATIVES; and A RANGE OF SOCIAL SCALE.

INTRODUCTION

The purpose of this project was to research and develop two design guides on environments important to child development--child care facilities and outdoor play areas--and to specify new, research-based criteria for the planning and design of these facilities for military bases around the world.

The current paper is a synopsis of parts of this project. The paper summarizes the following:

1. the applied research methods used to generate the data-base for the new planning and design guidelines;
2. key findings in the areas of policy, planning, and architecture for both child care facilities and outdoor play areas; and
3. example design applications of the new patterns and criteria for the design of prototypical new facilities, renovations of existing facilities, and adaptive reuse of older buildings.

PS 011312 CONTEXT

The project responded to two problems affecting the children of military families (about 1,000,000 children). First, the Army maintains the largest number of employee-sponsored child care facilities in the country (close to 200). As is the case everywhere in the country, demand for child care far exceeds supply. Existing centers are totally inadequate, often shoe-horned into old barracks. Second, outdoor playgrounds and informal play areas are seriously lacking in most family housing areas, both in military and civilian settings.

These problems must be seen against the background that the early preschool years are the time of most rapid and formative development for the child. Many children spend 8 to 10 hours a day in child care facilities; they are also the greatest users of public outdoor space. It is recognized, furthermore, that early childhood development can be stimulated through the better design of the landscape of childhood.

The military has recognized the need for more and better facilities and for better design guidance. They anticipate expending considerable resources over the next decade for new construction, renovation, and adaptive reuse to provide better children's environments.

The research behind this project has been broadly based, however, it is not restricted to military settings but is applicable to the country as a whole (over 75 million children).

OBJECTIVES

The project focuses on developmentally-appropriate environments for children, optimal settings for stimulating physical, intellectual, and social development. We asked the questions: What architectural factors contribute to developmentally-oriented child care? And what factors contribute to outdoor play environments which will enhance all areas of the child's growth and development? Old models of traditional "playgrounds" and institutional "baby sitting centers" were rejected as we searched for new ways to think about--and design--environments for the developing child.

Specific objectives were the following:

- to identify key design features and physical patterns which facilitate child development
- to assess a sample of military and civilian children's settings
- to interpret the latest research on children's environments from around the world
- to develop behaviorally-based criteria and design patterns for child care centers and outdoor play environments
- to produce two planning and design guides for use by architects, landscape architects, child care directors, recreational personnel, and housing and neighborhood planners in the contexts of master planning, programming, design, and evaluation

RESEARCH PROCEDURE

To research the basis for the development of new design guidelines, a three-phase procedure was followed:

1. Field Research and informal Post-Occupancy Evaluation
2. Literature Review
3. Pattern and Criteria Development

POST-OCCUPANCY EVALUATION

Field research and informal post-occupancy evaluations were conducted at 50 children's environments around the U.S. and Canada.¹ The sample was comprised of 15 civilian and 8 military child care centers, and 20 civilian and 7 military play areas, and included playgrounds for handicapped children, Montessori child development centers, infant care centers, adventure playgrounds, and a children's museum. The settings varied in geography, climate, rural-urban context, program philosophy, type and size of building or play area, budget, and degree of community involvement, and included disasters as well as award-winning projects.

Research instruments used at each of the 50 sites included:

- architectural inventory of the site, building or play area, subsystems, and construction details, including sketches and photographs
- observing and recording the spatial behavior of children, staff, parents, and other participants in the setting
- focused interviews with staff, program directors, administrators, base planners and architects, and some parents and children

In addition, interviews were conducted with nationally-known experts.



field research

All data was analyzed and summarized into a case study on each facility. Emphasis was given to the results from the user observations and interviews. Assessments were made of special strengths and weaknesses of different building types and design features relative to educational philosophies and child development goals.

The results of this phase of the project were reported in a case study report and technical appendix (Cohen, Moore, & McGinty, 1978).

LITERATURE REVIEW

A systematic search was made of all research and design literature pertaining to the planning and design of children's environments. Emphasis was placed on empirical research on children's needs relative to the physical environment, effects of the environment on children's behavior and development, and post-occupancy evaluations of child care centers, playgrounds, and related settings. Supporting information was also sought from programming studies, building type studies, and expert opinion. Finally, manufacturers' brochures, and military, national, and state codes and licensing regulations were consulted.

The standard indexes and print bibliographies in child development, early childhood education, environment-behavior studies, architecture, and planning were consulted, and a computer search was conducted through the ERIC system and other computer-based indexes.

The project staff collected and catalogued over 1500 sources, including books, research papers, building type studies, conference presentations, and brochures. Over 5000 slides and hundreds of black-and-white photographs were collected of significant architectural examples around the world.

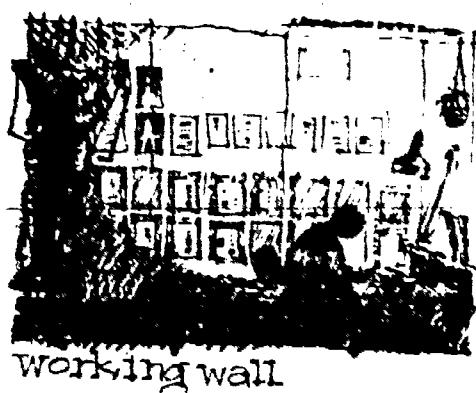
Two interim reports were prepared from this phase of the research--abstracts of the 40 most important works (Hill, Lane, Cohen, McGinty, & Moore, 1978) and a master bibliography (Moore, Lane, & Lindberg, in preparation).

PATTERN AND CRITERIA DEVELOPMENT

Based on the accumulated data from these two phases, planning and design criteria were developed in a six-step procedure:

- Identification of behaviorally-based design issues. Sources included the research literature, field research, previous research experience of the principals, and consultants. Example issues are reducing anxiety which children feel when being dropped off at a child care center, or providing safe yet challenging neighborhood play areas.
- Assembly of relevant information. Data was assembled for each issue by the project staff into packets tacked to a large working wall. Emphasis was given to empirical research, but building type studies, the 5000 slide collection, and the case studies were also culled for examples of particular designs solving the identified problem.
- Generation of patterns. The team used the collected information as the starting point in proposing solutions to the various issues. Some patterns could be deduced directly from existing empirical research (e.g., from the effects of crowding on children's behavior in day care) while other patterns had to be arrived at inductively (working hypotheses) in order to resolve conflicts between environment and behavior (e.g., children's need for creative challenge versus the paucity of stimulation).

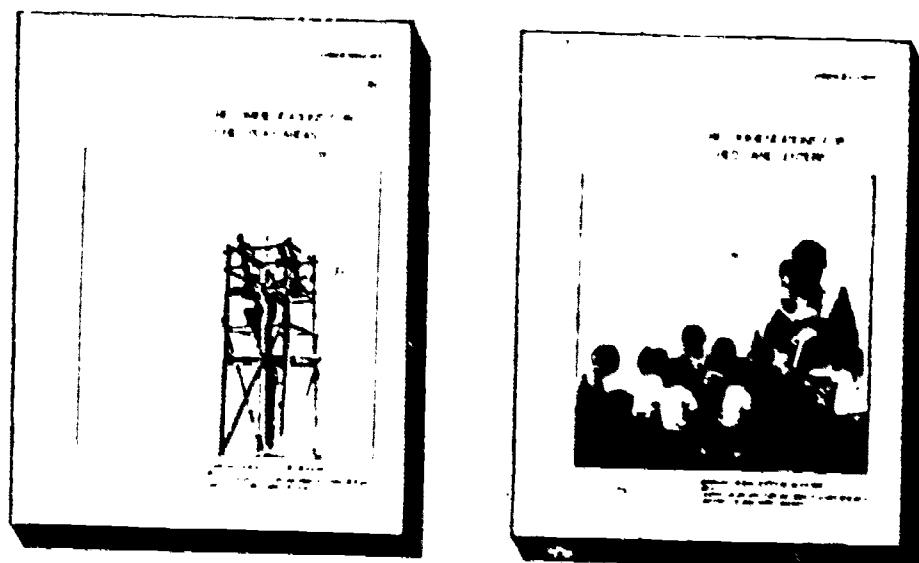
provided by most playgrounds). Sample solutions and their issues include HOME BASES FOR 8 TO 16 CHILDREN in response to group size and CONTINUITY AND BRANCHING in response to attention span.



Working wall

- Development of technical criteria. Elaboration to each pattern to aid in its implementation, including square footage, adjacencies, construction materials, fire safety regulations, etc.
- Refinement and illustration of each pattern.
- Organization of the patterns into a logical sequence for policy making, planning, and design.

The output from this process is a set of 115 patterns for child care facilities and 75 patterns for outdoor play environments, together with supporting evidence, illustrations, and introductory material.³



KEY FEATURES OF THE DESIGN GUIDES

Each design guide is organized in four major parts.

Introduction

This section represents the minimum necessary introduction to child development theory and types of program options. The assumption is made that most designers will not go beyond these guides, and thus all the background information is furnished together in one place.

- nature of child development
- role of the architectural environment
- nature of and different types of play and child care programs
- conceptual typology of different types of child care facilities and play environments
- emerging national and international trends

Planning

The goals of this section are to enable base master planners or facility engineers to prepare overall master plans for child care facilities and outdoor play areas for the base or region as a whole, and to program and cost particular facilities in active collaboration with child care directors and recreation personnel.

- policy decisions
- site surveys and location decision making
- regional master planning criteria and processes
- techniques for developing facility programs including user participation and for estimating site development and building costs

Design

The patterns in this section parallel the design process, that is, they evolve from siting and broad concepts of design to individual space criteria, building subsystem recommendations, and technical details. This is the section which would be most intensively used by design architects.

Each pattern presents all the necessary information for design with the child in mind, but only presents that information derived from considerations of child development--no attempt has been made to include standard operating procedures, as other technical references are available. Thus, information on duct sizing is not given, while suggestions on child-scaled building materials are given.

- general design criteria
- site design principles
- architectural design criteria, from general to specific, from overall organizing principles to patterns and criteria for specific activity spaces
- building subsystem recommendations
- furnishings (child care centers) and site details (play areas)

Applications

This section illustrates the process of applying the patterns and criteria in the development of both child care facilities and playgrounds for a range of situations--different climates and topographies, different size populations, different educational philosophies and program types. The focus is on how to use the planning and design patterns in an actual project context, how to develop a specific architectural program based on the generic guidelines, how to estimate need and facility size given a particular population, how to site a facility and develop the immediate environs, and how to design and detail particular facilities.

- location planning for a child care network
- campus plan concept for a very large child care center
- design of a neighborhood child care center
- renovation for family child care homes
- location planning for a network of play areas
- planning for a family housing park, including a comprehensive playground
- designs for creative playgrounds, nature play areas, and adventure playgrounds at elementary schools and neighborhood child care centers

TYPICAL PATTERN

The format for each pattern allows use by a variety of users--designers, child care directors, recreation supervisors, base planners, even future researchers. The patterns are stated independently of each other so that programmers and clients can specify which patterns are appropriate for their particular building program. This also allows the designer to develop his or her own design path through the information.

As developed specifically for this project, each pattern has six parts. A sample pattern for child-care centers is shown below.

NUMBER AND NAME

A number and an evocative name for ease of memory. Stated in general terms, but always specifying some quality the environment should have.

ISSUE

A statement of the problem to be solved and the context for the pattern.

JUSTIFICATION

Analysis of the problem and the rationale for the pattern and criteria, including a summary of supporting data and references.

PATTERN

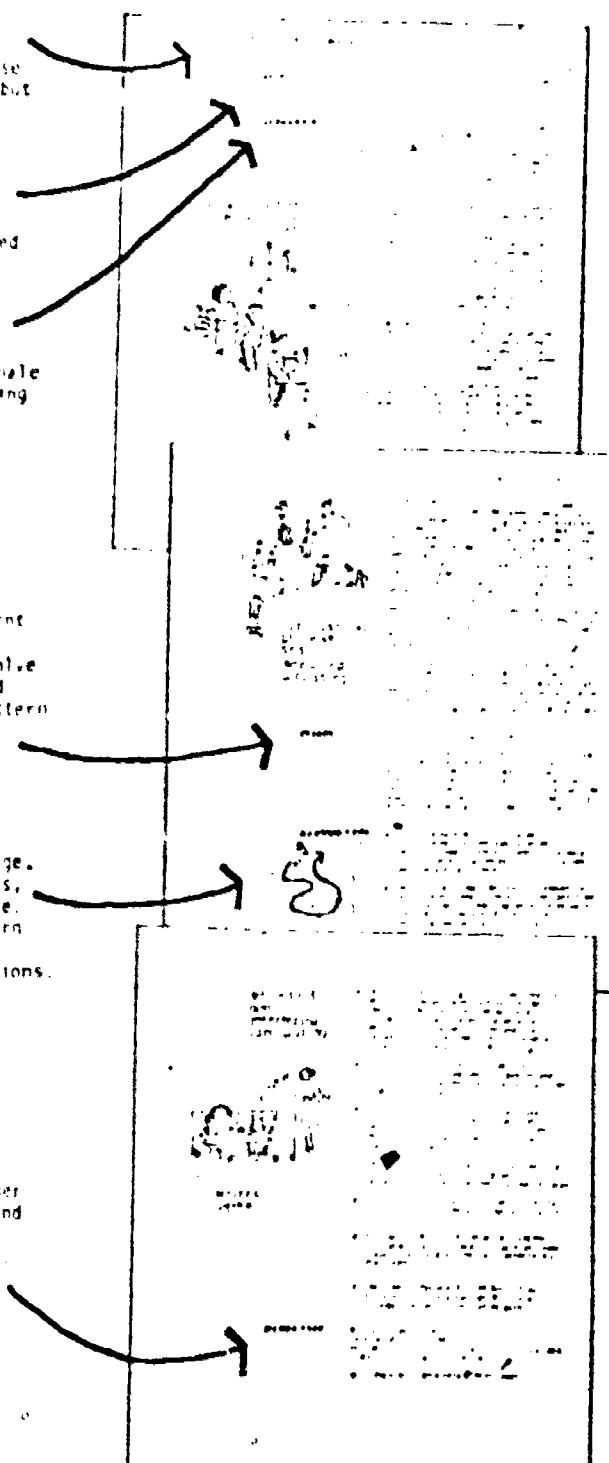
The pattern itself, a succinct statement of the basic characteristics the environment should have in order to solve the identified problem. Evocative and open-ended, but directional. Each pattern is stated verbally and is illustrated.

RECOMMENDATIONS

Detailed and specific recommendations including areas required, square footage, adjacencies, anthropometrics, materials, and construction details as appropriate. Recommendations elaborate on the pattern and give it specific shape and form. Includes one or more summary illustrations.

RELATED ITEMS

Related patterns which define the larger context into which this pattern fits and which help to give it shape by further defining specific detailed parts of it.



Typical pattern and its basic organization

SAMPLE KEY FINDINGS AND RECOMMENDATIONS

The following is offered to give a sample of a few of the most crucial findings and resultant patterns and recommendations from the 190 patterns in the two design guides. The first three are given in some detail--one each in the areas of policy, planning, and design--followed by seven other key findings given in summary form.

CHILD CARE CENTERS: POLICY RECOMMENDATIONS

Neighborhood Centers for 60-75 Children

Issue. The single most important decision to be made in policy planning for child care facilities is the number of children to be served under one roof. The total number of children served in one child care facility is directly related to the quality of child care services offered.

Justification. A number of studies have found that the optimal number of children in a center at one time is between 45 and 75 children. Evans, Shub, and Weinstein (1971) found that the optimal number was between 45 and 60 children and that this size allowed teachers to feel close to one another while still being a large enough group to allow for sharing of materials, cooperative program development, and substitution in case of absence. In addition, they also found that it is the optimal grouping in which a single supervisor can be effective; fewer children will not make full use of a supervisor's time and expertise, and more children will dilute his or her benefits or require an assistant director or supervisor, with the attendant increase in bureaucracy. Similarly, centers with fewer than about 45 children find they cannot economically make ends meet without very high fees or massive outside assistance.

In another nationally recognized study, Prescott and Jones (1976) found that center size was a reliable predictor of program quality. The variety and quality of children's developmental experiences were directly affected by the size of the facility. In centers which served over 60 children, major emphasis tended to be placed on rules and routine guidance, while teacher emphasis on these concerns was found to be significantly lower in smaller centers. Opportunities for "pleasure, wonder, and delight" were significantly higher in centers under 60 children. In subsequent studies, Prescott and Jones (1976) and Prescott and David (1977) also noted that large centers rarely offered children the experiences of participating in wide age-range groups. Mixing of ages in smaller centers offered opportunities for older children to serve as models and facilitators for the younger children, as well as enriching the overall play possibilities. The play areas of large centers were rated low on organization, variety, and amount of things to do per child. Children were seldom observed to be highly interested or enthusiastically involved.

Corroboration for the above findings comes from a related domain--elementary schools and high schools. Barker and Gump (1964) found that the opportunities per student were considerably greater in small as compared to large schools (see also Gump, 1975).

Further support comes from Australia, where the Regulations of the Child Welfare Act of 1939, which have been found to be appropriate and therefore are still in effect, specify that:

The maximum number of children who may be cared for in the licensed premises at any one time shall be 60. (Kindergarten Union of New South Wales, Regulations of the Child Welfare Act of 1939)

Pattern. New policies should be established to limit the size of child care centers to 60 to 75 children. Where larger numbers cannot be avoided, policies should dictate the construction of a campus plan of semi-autonomous modules of 60-75 children each. (Moore et al., 1979; Child Care Patterns 410 & 504)

small groups work best



CHILD CARE CENTERS: PLANNING RECOMMENDATIONS

Seams Between Neighborhoods

Issue. Location can make or break a child-care program.

Justification. Many parents are reluctant to have their very young children attend child care in an unfamiliar, distant locale. In a study using trade-off techniques with 390,000 families in Massachusetts, Rowe et al. (1972; cited in Prescott & David, 1976) found that given a choice between paying extra for child care next door versus having free care one-half hour away, 58% of families (226,000 families) were willing to pay for neighborhood proximity, 33% opted for free care even if driving was involved, and 9% didn't care.

Other studies (e.g., Ruderman, n.d.; cited in Emlen, 1970) indicate that distance from home is associated with dissatisfaction with child-care arrangements.

An important study by English environmental psychologist Terrance Lee (1963) has shown that children who are passively taken to schools in cars or buses develop a much less detailed understanding of their urban and natural environments than children who actively walk to school and interact with nature, people, and the built settings along the way. Such a finding supports Piaget's general theory of child development (e.g., 1963), which stresses that for the young child, knowledge is concrete and active, that it arises from actions on objects, not abstract considerations of them (cf. Hirsh & Moore, 1973). The conclusion seems to be that children should be able to walk between home and child care facilities.

Other experts have stated that the maximum walking distance is about one-quarter mile (Bengtsson, 1970).

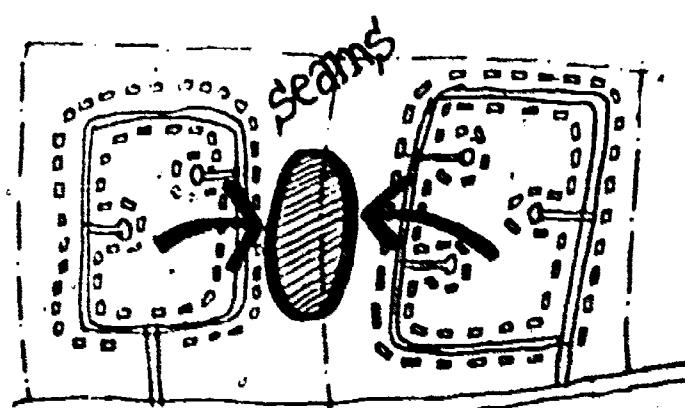
This general position is reinforced by the existing national child care standards. Both the standards of the Child Welfare League of America (1973) and the U.S. Department of Health, Education, and Welfare (Cohen, 1975) state that the ideal location for day care--whether a center or a family home--is in the neighborhood of the children served (Cohen, 1975, p. 55; Child Welfare League of America, 1973, p. 76).

The argument can be made, however, that such a position is socially regressive in that, given de facto housing segregation, integration cannot happen without some strategy for permitting and encouraging mixing of children from different residential areas.

In theory, the resolution of this conflict is not difficult, though in practice it can be very difficult. If new construction is anticipated, or even renovation of found facilities, it is possible and desirable to locate child care centers within walking distance of the homes of children who will be using them and at the same time on the seams of at least two residential areas or communities.

Such a solution has other benefits. Parents may be more likely to drop in and participate in the program if it is close to home.

Pattern. Child care centers should be provided for every catchment area of approximately 1/2 mile radius, and should be located on the seams between neighborhoods. (Moore et al., 1979; Child Care Patterns 508-511)



CHILD CARE CENTERS: ARCHITECTURAL DESIGN RECOMMENDATIONS

Front Yard and Front Porch

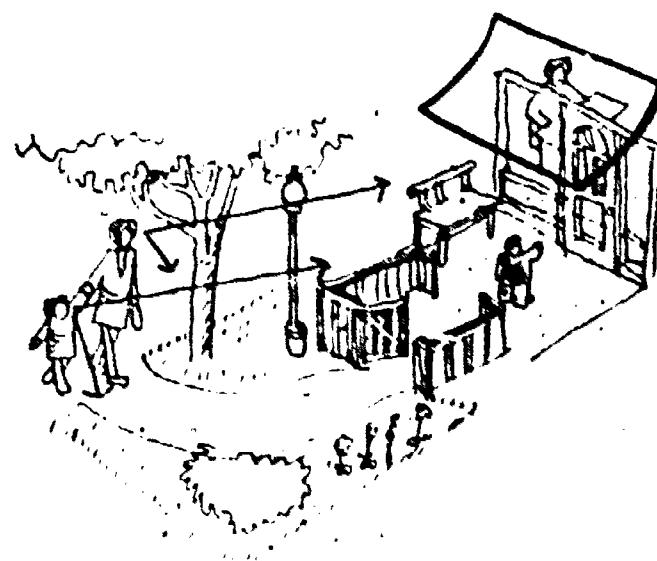
Issue. Children may be more likely to be content and feel less separation anxiety from parents if they are in a familiar setting.

Justification. We know from the work of Ainsworth and her associates (e.g., Ainsworth & Bell, 1970) that separation anxiety increases for the very young child in a strange situation, and that separation anxiety and exploration are inversely related. Both Osmon (1970) and Pollowy (1977) in early design guides have thus extrapolated that children may be more content parting from parents if they are in a familiar setting.

Common sense suggests the following:

- if the transition is gradual
- if the child can see his or her friends before entering
- if the child can see engaging and ongoing activity
- if the child can become engaged in activity before the parent parts, and
- if the parent can wave or look in on the child immediately after leaving, then anxiety may be reduced.

Pattern. The entry sequence to any child care center should be residential in character, should be residentially scaled, friendly, and home-like, should provide a sense of protection and enclosure, and should provide views through to a friendly face and to activities inside. (Moore et al., 1979; Child Care Patterns 803, 914-918)



Home Bases surrounded by Resource-Rich Activity Pockets

Issue. Small groups work best. The size of the group in which the child spends most hours of the day makes the most difference to the quality of child care services offered.

Pattern. Child care centers should be organized in terms of home bases for 8-10 infants or toddlers and for no more than 16 older preschoolers. Resource-rich activity pockets for 2-5 children at an activity should be provided around the home base. (Moore et al., 1979; Child Care Patterns 906-908)

The Infant-Toddler-Preschooler Connection

Issue. The needs and demands of children of different ages often compete and conflict. Yet children learn from contacts both with children their own age and from children younger and older.

Pattern. Partial separation should be provided for different age groups in a modified open space layout, but all indoor and outdoor activity spaces should insure an infant-toddler-preschooler connection with strong visual and circulation connections and with some overlapping spaces. (Moore et al., 1979; Child Care Patterns 905, 909-910)

OUTDOOR PLAY ENVIRONMENTS: POLICY RECOMMENDATIONS

A Variety of Play Experiences in Neighborhood Settings

Issue. Play is essential to healthy social, physical, and intellectual development. Children are the greatest users of public outdoor space, and the majority of children's play occurs in informal neighborhood settings.

Pattern. Policies should be adopted which stress the importance of play and of informal, neighborhood-based play spaces, and which encourage the better design of all public outdoor spaces with the developmental needs of children in mind. (Cohen et al., 1979; Child Play Patterns 101-103)

Playleadership:

Issue. The success of comprehensive play programs depends on advocates for play and on qualified play leaders, both a long-recognized need in Europe.

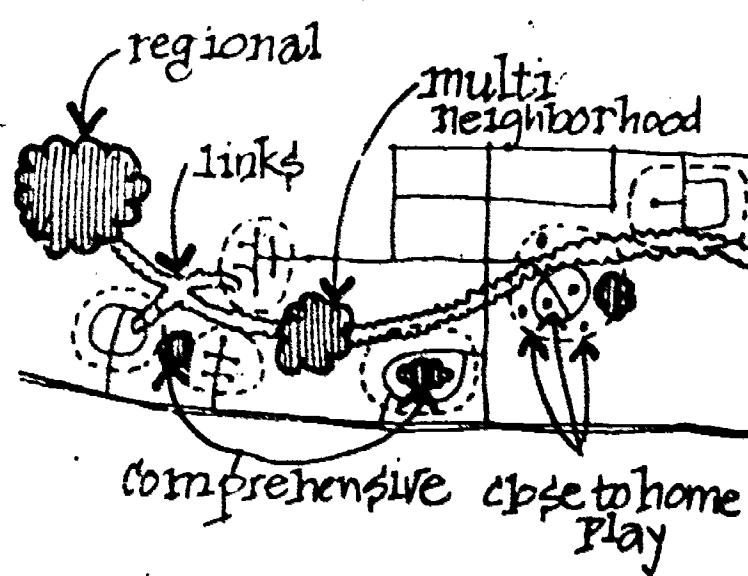
Pattern. Policies should be promulgated which provide for an advocate for play and for qualified play leaders in every residential community. (Cohen et al., 1979; Child Play Patterns 102 & 106)

OUTDOOR PLAY ENVIRONMENTS: PLANNING RECOMMENDATIONS

The Tiered Park System

Issue. Children will play anywhere and everywhere; they need a wide variety of play and recreation opportunities.

Pattern. Every district should work toward implementation of a tiered park system, which should be hierarchically organized to include a regional park, smaller neighborhood parks, comprehensive playgrounds, and links completing the network of play. (Cohen et al., 1979; Child Play Patterns 200-209)



OUTDOOR PLAY ENVIRONMENTS: ARCHITECTURAL AND LANDSCAPE DESIGN RECOMMENDATIONS

Ambiguity, Loose Parts, and Clear Accomplishment Points

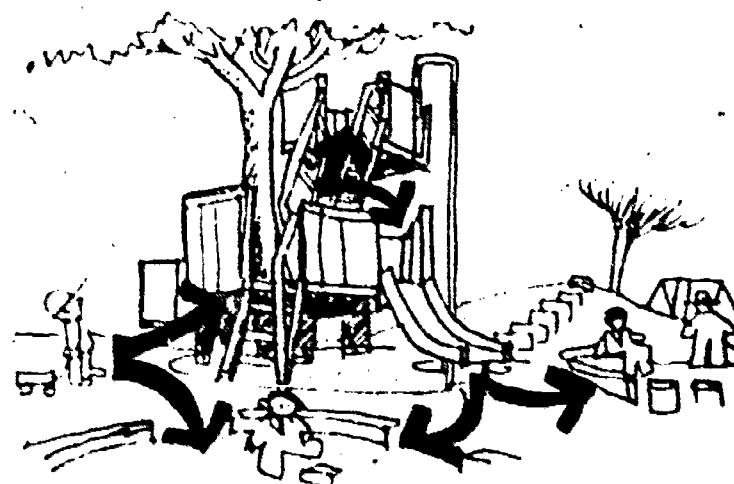
Issue. The quality of all play spaces can be enhanced by good design that responds to children's developmental needs and to the role of the physical environment in development.

Pattern. Provide ambiguity in settings and objects to stimulate fantasy play; provide loose parts for creative and intellectual play; and provide clear accomplishment points to reinforce the development of self concept. (Cohen et al., 1979; Child Play Patterns 700-722)

The Organization of Variety

Issue: The overall success of a play area is inversely related to the degree of haphazard juxtaposition of different pieces of play equipment. Children's attention span is less on traditional, manufactured play equipment than in other types of play environments like creative playgrounds and adventure playgrounds. The predominant activity on conventional play equipment is motor or physical play.

Pattern. Provision should be made for the overall organization of play spaces in accordance with sound, behaviorally-based site organization principles like continuity and branching, controlled access, looped circulation; and separated but linked zones. Within this matrix, provision should be made for a variety of play opportunities and types of play spaces. (Cohen et al., 1979; Child Play Patterns 505-511, 600-614; for handicapped children see also Moore, Cohen, Oertel, & van Ryzin, 1979)



DESIGN APPLICATIONS

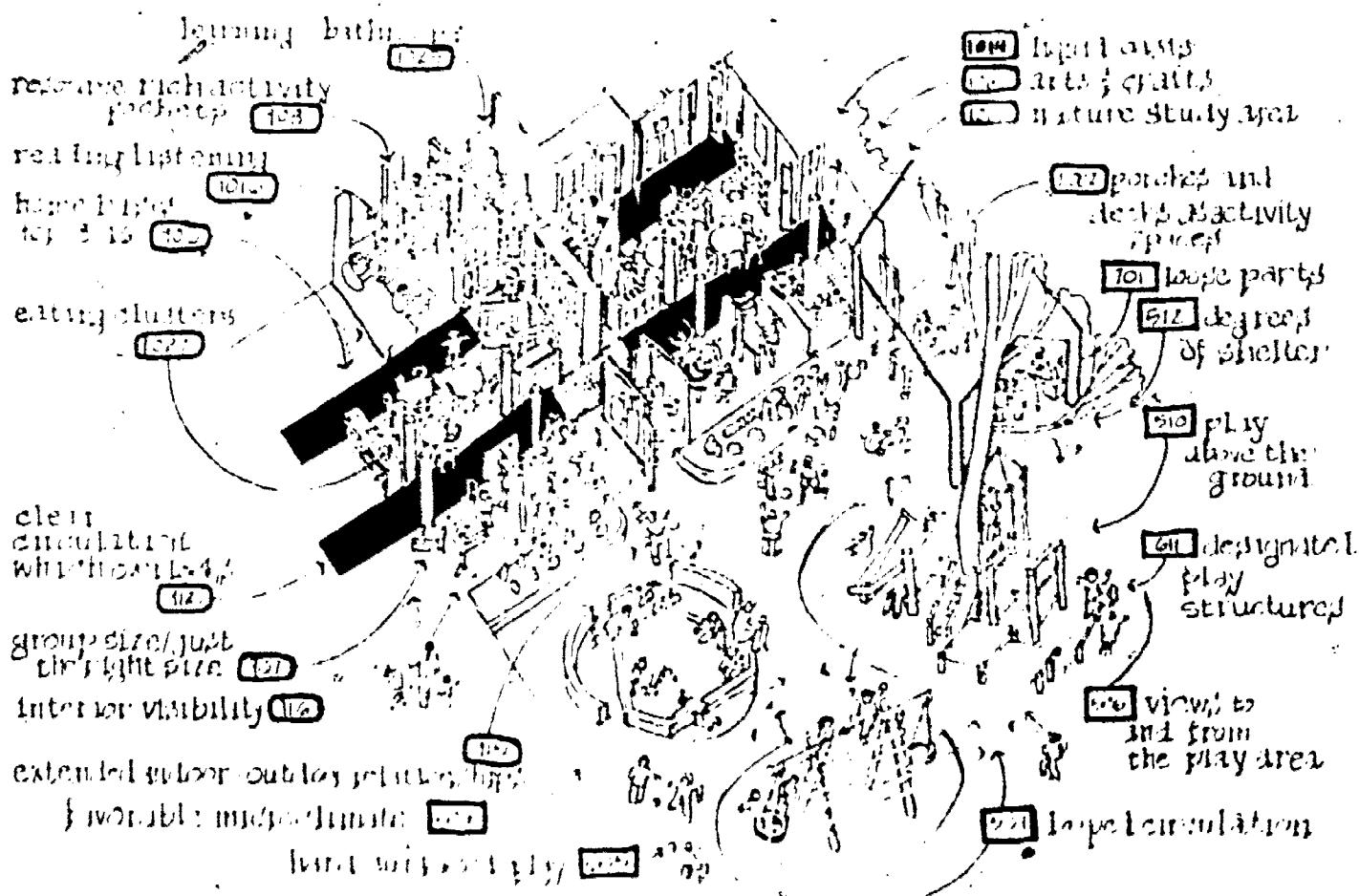
The final phase of the project included the demonstration of selected design applications. Patterns and related criteria for both contexts--child care and play environments--were put to use in developing concept alternatives for different facilities. Those ranged from comprehensive play areas to small play lots, and from child care centers for 242 children (campus plan concept) to one for 6 children (family home care).

The use of the patterns and criteria is an involved process. Briefly it included the following:

- the development of a facility program, which in large part was based on selected patterns in concert with local factors and considerations; patterns and criteria were selected to satisfy developmental goals and objectives as assumed for the case studies under development, and changed from case to case
 - the development of concept design alternatives, following the organization of patterns in the design guide, progressing from patterns covering general site design and development, moving on to facility organizing principles, individual space criteria, and finally to subsystems and details
 - evaluation of the design proposals; the patterns and design criteria were used to verify that the solutions included the appropriate responses to identified issues and needs

The development of alternative concept designs served two basic goals: to "field test" the applicability and usability of the patterns and related criteria; and to demonstrate to the reader of the guides the range, versatility, and richness of the solutions which can be generated from the patterns.

The following concept design illustration is one example of design application for a hypothetical indoor child care facility and adjacent outdoor play area.



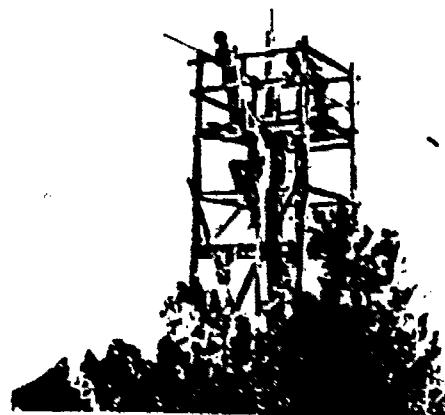
Accountability diagram: The schematic application of selected child care and play patterns

The primary patterns which influenced the location, size, orientation, and qualitative characteristics of each part of the solution are indicated. Together they not only govern the parts, but are the form givers for the building as a whole as well as shaping the site.

CONCLUSIONS

The quality of the physical environment plays an important role in the early childhood years. Previously the importance of the physical environment in child development has been overlooked. The current work is an attempt to address this issue and redress the balance. It is also an attempt to present the results of this investigation in a way that can be used by both child developmentalists and educators on the one hand, and by architects, landscape architects, planners, and policy planners on the other hand.

The two design guides described in this paper represent a humanistic approach to architecture based on an examination of children's needs and the role of the physical environment in child development and experience. They are based on the latest research in child development, environment and behavior, and architecture, and the recommendations have been revised to account for the latest and best findings. The work also incorporates ideas on child care facilities and play settings from around the world. Most of the information in these documents, while generated for specific application in family housing areas on U.S. military installations, is obviously generalizable to child care facilities and outdoor play environments for children across the entire country.



FOOTNOTES

¹ Details of the sample, the research procedure, and instruments used are contained in Cohen, Moore, & McGinty, *Case Studies of Child Play Areas and Child Support Facilities* (1978) and *Technical Appendix* (1978).

² This collection is stored and catalogued in the Children's Environments Project offices at the University of Wisconsin-Milwaukee, and is available to the public.

³ Collected in internal, interim reports--Moore, Lane, Hill, Cohen, & McGinty, *Recommendations for Child Care Centers* (1979) and Cohen, Hill, Lane, McGinty, & Moore, *Recommendations for Child Play Areas* (1979). The final design guides are in preparation and will be published and distributed by the U.S. Government Printing Office in late 1980.

⁴ This pattern is a clear example of the working hypothesis nature of patterns--and of all design concepts or principles. Where data is available, patterns are based on the latest and best empirical information about space-behavior relations in the child; where data is lacking, patterns are based on extrapolations, inferences, and experience. They are all, however, stated in a testable way, and should be tested at the first opportunity.

⁵ Complete arguments for these patterns, together with supporting data, are outlined in the referenced reports.

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