29: RELATING RESEARCH TO PRACTICE

DESIGNING TO REINFORCE THE MENTAL IMAGE, AN INFANT LEARNING ENVIRONMENT

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Abstract

The reasoning and design for an actual physical setting organized to have a deliberate reinforcing effect on the mental development of infants is presented as a demonstration of the possibilities of design based on knowledge of cognitive development and to illustrate the theoretical potential of a lingustically conceived model of cognitive development keyed to classes of visual form.

Introduction

If architects are to design so as to confirm or transform the cognitive representations by which people know the environment it is necessary that they understand how these representations are acquired and how the environment might be designed to more directly conform to and influence such representations. This knowledge implies a theoretical comprehension, a mental schematization, of cognitive development and function extending to a linguistic conception of the environment itself.

It is the purpose of this brief paper to sketch the process of mental development in children as evidenced in the psychological literature, (particularly that of Piaget) (1) to present the design of an environment intended to complement and foster this development, (2) and to put forward a normative model for environmental information that is based on cognitive development and function and which seems to have linguistic utility as a framework for relating the physical and cognitive worlds.

Background

There is a great deal of information, most of it only now coming into focus, regarding the process of mental development by which the infant builds the cognitive foundations for the environmental images of later life. (3) Werner, Piaget and Bruner have established that mental development builds from direct sensorimotor activity in concrete physical settings to the symbolic coding and cognitive manipulation of abstract thought. Werner has recognized three successive levels of development and termed them sensorimotor, perceptual and contemplative (4) while Bruner has noted that children pass successively through three modes of representing the environment which he calls enactive (images recalled as actions) the iconic (images recalled in terms of their formal and physical properties) and the symbolic (images recalled through labels, cues and associations) (5).

Cognitive Development

Piaget has provided a much more detailed description of this ontogenetic progression. He tells us that mental development begins with functional reflex actions such as sucking, touching, etc., in which the child mentally accomodates a single action, a group of sensations as an isolated event. During the first months of life, as long as assimilations (of experience into the mind) remain central to the organic activity of the subject the universe presents neither permanent objects, nor objective space nor time interconnecting such events as such, nor causality external to the personal actions. (6) The child lives in a world of his own fragmented actions which constitute his means of exploring his world and of apprehending the percepts which it presents. His original "purposeful mobility" (7) is organically motivated yet responsive to sensory stimuli. This sensorimotor activity soon becomes schematized as a process having continuity as the child acquires the ability to follow or rediscover by means of coherent movements the perceptual images associated with his direct sense experience.

With the subsequent coordination of sight and movement growing from this ability he then learns to coordinate the different previously constituted practical spaces into a single system and to form objective groups in the

field of perception. The infant then becomes able to intercoordinate these groups and acquires the ability to conceptualize the world beyond the field of immediate perception to a limited degree. He remains limited in that conceptualization is tied to the immediate objects of his perception and extends causally from them.

In the final stage of this initial sensorimotor period for the "acquisition of perceptual invariants" reciprocal relations are established among and between bodies in motion and at rest and the child is able to direct his search to combine schemata mentally without having to directly perceive them. With this he acquires his sense of himself as an object and as an actor in the world. As Piaget says the basic organization of reality has occured" to the extent that the self is freed from itself by finding itself and so assigns itself a place as a thing among things an event among events." The infants sensorimotor intelligence has elaborated his understanding of the world sufficiently to make sensorimotor language and representation possible (and) the universe is at once substantial and spatial causal and temporal." He has entered the realm of symbolic communication and abstract thought. (8)

The Design Program

This description of mental development in which each stage is integrated in succeeding stages has provided the program for the design of an infant learning environment. In the environment the new born infant is provided with a crib-place containing well-formed and particular sensations each in its own location and each possessing a distinct and related activity pattern or movement to attract and hold attention. In this particular design these stimulus elements have the following distinctive forms: small soft holes with bottoms that pulse in and out; a curving line of varying amplitude, a vertical flat surface subject to rotation, horizontal surfaces or areas having distinct tactile qualities or a bead-bar having groupable rather than intermixed colors, a vertical element composed of elements designed to be lifted, and a particular opening or portal at which an adult normally appears to attend or remove the child. It will become apparent that these stimulus elements are not arbitrary but prefigure at the level of initial perceptions the forms which in the larger infant learning environment contain the child.

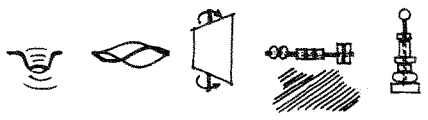

Figure 1

The fixed location of these elements is intended to reinforce the child's attempts to establish the habitual perceptual images of the second phase of mental development by confirming his expectancy of perception in a given place, and by reinforcing his prior sensations. By maximizing the differences between the sense elements and holding them to a number within the organisms capacity for short term memory (within 7 ± 2 distinctions) (9) the intent is to clarify and smooth their perception. These fixed locations in this design also reflects the empirical evidence which suggests that the child's first perceptions are schematized in terms of the movement of the body and its componant parts. (10) The design of the crib-place further acknowledges the action focussed, egocentric, and organically motivated response of the infant to individual stimuli.

The second stage of development, characterized by the continuity of recognition (constrained by the attention span and complexity of the motivating stimuli and tending toward the construction of a coherent representation integrating the images of the perceptual events of the first stage) is reinforced by scaling the nesting place to the limited sensorimotor domain of the infant, bounding it and containing the visual field to provide a stable background against which activity patterns and sense elements may be holistically perceived. This containment helps the infant to concentrate on the limited number of activity centers and locate them in space relative to himself. It also prefigures the fixed systems of reference which follow the egocentric stage in that once the child has a coherent representation of his nesting place he is in a position to transfer the center, the node, of this organization to some fixed reference object or landmark. It is important to note that this partially enclosed environment is only one of many that the infant is experiencing (car, carriage, house, etc.) but it is the one

scaled to and centered on him and easiest for him to physically explore, and thus comprehend.

As the infant mentally assimilates the organization of this partially closed environment its design encourages him to discover the objects near at hand but partially concealed by its boundary. Thus, the environment fosters the formation of the inside-outside schemata and reinforces the child in his now complementary ability to crawl and explore. The bounded domain which the "nest" represents when perceived either from the inside or the outside, helps to distinguish its object character for the child.

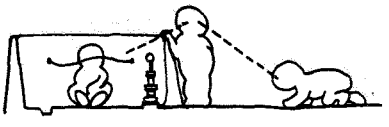

Figure 2

He is either inside the domain and identified with it or outside and therefore related to it. The domocentric or home based image which older children typically manifest as the basis of their first fixed reference system is naturally reinforced by this experience. (11)

Figure 3

The child's own nest becomes the node or place in the path or route representation which the infant subsequently develops. (12) The learning environment surrounding the node-cave of the child is composed of other distinct form-places which he can visit and learn in the manner of his original nesting place. Thus, his universe is enlarged and his sense of himself as an actor in a stable world containing other actors like himself is reinforced.

Fully locomotive, at around 18 months and possessing words and representations of objects in the world, the infant, still within the sensorimotor egocentric level of development, enters the realm of symbolic meaning and communication. This symbolic capacity is reinforced in the design of the environment by reintroducing the forms of the initial sense elements of the crib-place at a new and larger scale-that of the extended infant learning landscape itself. Indeed, the original sense elements are now revealed to be interpretations of the highly imageable classes of form which Kevin Lynch has identified in the recalled images of a significant number of residents in Boston, Los Angeles and Jersey City. (Three notably different urban environments.) He has suggested that the five classes of elements by which people form their image of these cities were: Nodes, points or intensive foci which people may come to, enter and leave; paths or channels of movement; edges or boundaries which break or contain the continuity of experience; districts, domains or areas which have a recognizable identity, character or form; and landmarks or point references which are external to the observer and are singled out for purposes of identification structuring or orientation (13).

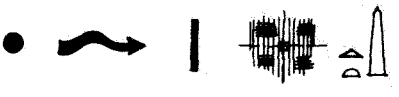

Figure 4

It is suggested that not only do these elements represent important primitive classes of a symbolic visual language or code but that the sequence of their acquisition and integration is as given above, i.e.; first the egocentered node, then the action-continuous path from the egocenter, then the edge, boundary or surface of the object acted upon, succeeded by the area or district as the conceptually bounded abstractly known sensorimotor domain, and the landmark as the fixed reference point to which this objectified image is transferred.

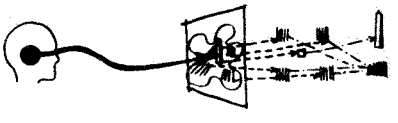

Figure 5

The design of the basic crib-place of the infant learning environment physically reflects and complements this sequence. In the larger infant learning landscape in which these places are located however, each form-place combines the character of the node, the district and and the landmark in order to complement the egocentric sensorimotor stage of the infant. Said otherwise the object character of the nesting places are the dominant features of the landscape just as the initial activity centered sense elements were the prevalent foci within the crib-place. But the larger infant learning landscape is also designed in terms of the symbolic character of the five elemental form classes to manifest the larger world; the buildings and cities into which the children will grow. A description of the learning landscape in which individual nest places are designed as form class elements will present this interpretation.

The Infant Learning Landscape

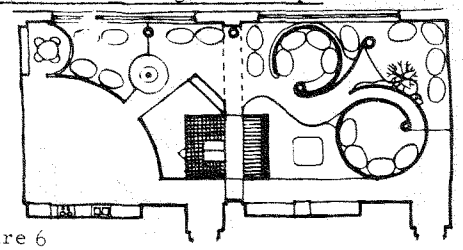

Figure 6

In the top left of the plan of the two conventional school rooms which will contain the landscape is a nature place of organic forms and textures, containing a growing tree, a rock, and water course symbolic of the countryside and recreation. Its oval crib-places range agains the corner walls and a sick bed is sheltered near at hand.

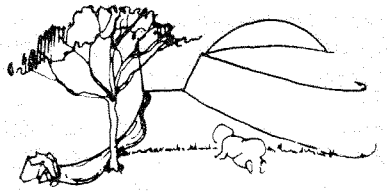

Figure 7

From this place a road rises and then falls to passthe opening to a cave-like space, a quiet domed place of mystery, social intimacy and passiveness which provides a sociopetal reinforcement, symbolic of the council chamber or sacred place.

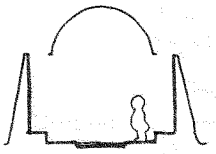

Figure 8

Opposite from the entrance to this cave-like sepulchre the road rises to a high withdrawn space giving a view of the whole (from the top of the mountain as it were). This space provides the infant with a chance to objectify and reinforce his image of the landscape as a whole. From this cluster of relatively organic forms a hard surfaced "road" symbolic of the highway and serving as the actual channel of movement for both toddlers and adults extends toward the places of great socialization and work. Its sometimes curving and eventually straight form reinforces the line of movement it represents while allowing for places along the way to entertain delay and inform the toddler.

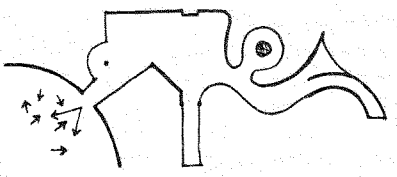

Figure 9

One turn in the road leads through a walled hard surfaced enclosure filled with man-made artefacts and toys symbolic of the work place or factory. This geometrically regular, Euclidean space is organized to present increments, intervals of movement, patterns and measures to reinforce the development of abstract, rational, coordinative thought.

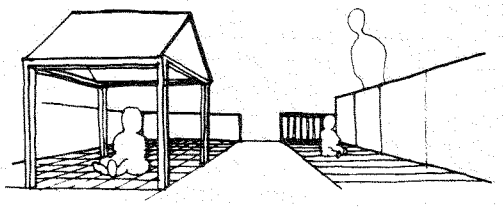

Figure 10

The other fork of the road passes a tower functioning as a totem, a landmark, marking the place of greatest socialization, the eating

area. Besides this traditional function as an orienting landmark or reference marker for a place of meeting, the tower symbolizes man's achievement vertically and individuality in a sociofugal form reinforced by the mound on which it stands.

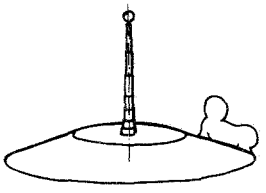

Figure 11

Individual prowess and dramatic physical achievement is reinforced by incorporating ascending musical notes culminating in a bell at the top which an enterprising infant may, with some difficulty, learn to ring. All of the spaces and forms are reinforced by appropriate sounds,textures and colors. For example the cacophonic sounds,strong colors and hard surfaces of the walled work place are differentiated from the melodic sounds, warm colors and varied textures of the nature setting. The form places are also differentiated in the way they reinforce sensorimotor skills.

Significance of the Setting

From a functional point of view each form place (except for the rectilinear walled enclosure) provides an identifiable home for three infants and a caregiver (parent figure). Each is provided with a changing station (a surrogate for the bathroom in a house). Each is sufficiently distinct in its spatial quality to allow a comprehensive range of spatial experiences to facilitate the separation of active and sleeping infants, and to allow for the study of the effects of various spatial settings on the behavior of both infant and caregiver.

Most importantly this infant learning landscape is designed as a visually integrated sensorily organized physical setting, scaled to the infant, and manifesting knowledge of his mental development. It is a physical hypothesis, an experimental setting through which to examine the effect of the environment on the mental development of infancy and to learn more about how the perceptions of infancy come to prefigure and influence those of adult life. It is not as most nurseries and day-care facilities, merely a conventional adult scaled room filled with unintegrated furnishings designed to make child care less demanding of adults and filled with miscellaneous toys designed to serve narrow and uncoordinated learning tasks.

Instead, such an infant learning landscape as is here proposed might fulfill four of the goals desirable in educational day care facilities today: it would invite the infant to extend himself toward greater confidence and competence in the exploration of his surroundings; foster development of a coherent, cognitive model of the larger world; encourage strong social relationships with adults and other children, and for staff, provide surroundings that are content rich as well as functional.

A Theoretical Framework

A linguistic conception, a theory of description, communication and analysis of the environment itself may follow from the empirically supported pattern of cognitive development which has informed this design. This conception, at the level of a form class categorization, recognizes an heirarchical structure in Lynch's five elements of imageability that is progressively more complex and abstractly integrated in a manner keyed to cognitive development.

This system of cognitive destinctions appears to have direct and important relationships to architectural theory, problem solving thought, information handling and even language itself. (14)

It may be simply characterized by the following mapping of the ontogenesis of cognitive development onto Lynch's elements.

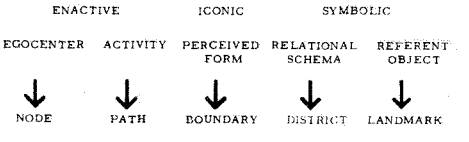

Figure 12

It will be noticed that this scheme manifests the empirically confirmed dimensions of cognitive development ; from concrete to abstract, from fused to differentiated, from egocentrism to perspectivisim, and from immediate change to functional flexibility with stability over time. (15) The mapping onto Lynch's elements implies a similar

sequence of development and integration in the use of these elements for structuring the mental images which they manifest. Experimental confirmation of these relationships would have important ranifications with regard to the cognitive organization of perceptions, as well as the theory of man-environment relations.

The scheme offers the rudiments of a theory of architecture in that it lends an operational humanistic interpretation to the archetypal elements of architecture in a manner which integrates the distinctions of classical architectural theory.

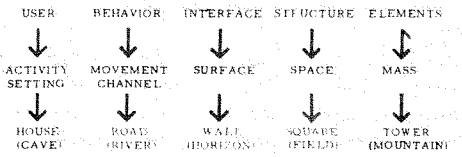

Figure 13

Norberg Schultz has described specialized constructs of space which help us orient and adopt to various aspects of the environment which can be mapped onto the proposed scheme to provide an integrated theory of spatial description keyed to cognitive development. Norberg Schultz notes:

> "We have so far distinguished between five space concepts: the pragmatic space of physical action, the perceptual space of immediate orientation, the existential space which forms man's stable image of his environment, the cognitive space of the physical world and the abstract space of pure logical relations. Pragmatic space integrates man with his natural 'organic' environment, perceptual space is essential to this identity as a person, existential space makes him belong to a social and cultural totality, cognitive space means that he is able to think about space, and logical space, finally, offers the tool to describe the others. The series shows a growing abstraction from pragmatic space at the 'lowest' level to logical space at the top, that is, a growing content of 'information'. Cybernetically, thus, the series is controlled from the top, while its vital energy rises up from the bottom." (16)

A clarification of these concepts consistent with the theory would be pragmatic, functional, existential, logical, and symbolic space.

More generally it is acknowledged that the stages of mental development manifest themselves for all of us in the working through of any process of thinking. (17) An interpretation of the proposed system according to particular roles has been explored in the organization of interdisciplinary teams in group dynamic settings, and in the study of information handling dynamics in actual problem solving with salutory effect. (18) In this interpretation of the distinctions the roles and the types of information associated with them are:

Figure 14

These information types and roles and the relationships implied by the theory have been the basis for the design of comprehensive linguistically conceived, computer oriented information systems to facilitate communication and design. (19)

Conclusion

This brief theoretical outline does no justice to the full implication of the line of reasoning it suggests. Nor does it adequately represent the facility of this comparatively developed model of cognitive development as a normative framework for integrating and structuring large quantities of both empirically validated and philosophically determined information. It has proven to be an epistemological model of real utility to the author and one which offers the advantage of a linguistic flexibility applicable to both the physical environment and the cognitive world which is the individuals prevailing reality.

This outline of a general theory has been sketched here in relationship to the design of an infant learning environment in order to suggest the notion that architects who relate their design to knowledge of cognitive psychology may find themselves involved in a universal linguistic system not founded on historic

styles, or geometric combinations but on human experience with, and understanding of, architecture. They will discover a new conceptual foundation for architecture that embraces symbolic content and meaning as well as the traditional notions of form, function and technology or mass surface and space. (20)

Notes

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