

Research on Sustainable Design of Preschool Children's Furniture Based on Developmental Psychology

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Abstract

This paper puts forward a new idea concerning sustainable design of preschool children's furniture, which is based on children's developmental psychology, preschool educational theories and environmental psychology. By excavating the needs of preschool children's physical, cognitive and psychosocial development, the goal and value of sustainable design of children's furniture are re-examined. A target function system of kindergarten furniture is constructed to help the professional communication between designers and preschool educators. This paper analyzes the functional mechanism of preschool children's furniture, and three ways of realizing approaches are concluded.

Key words: sustainable design; psychology of design; furniture Design; developmental psychology

Introduction

Realizing a sustainable society, which pays attention to the future impacts of our activities, to sustain the finite resources available to meet the needs of future generations [1], is one of the most challenging problems that humanity faces [2]. Although sustainable development is difficult to define because it is highly contextualized [3], the field of early childhood education has definitely received increased attention for this purpose in recent decades.

Preschool children (defined herein as 3 to 6 years old) are in a critical stage of development of their intelligence and personality, during which they have undergone tremendous changes in their physiology, psychology, and intelligence. Furniture has close relations with the development of preschool children's body, intelligence, emotion and personality in long-term use, having significant influences on their physical and mental development. So, it is necessary to find basis and criteria for sustainable design of preschool children's furniture from the perspective of psychology.

Previous studies on design of children's furniture involve a variety of psychological concepts or perspectives, such as cognition, motion, memory, individuality, education, motor skills, game behavior and etc.. As a matter of fact, the above concepts and perspectives could be included in the theoretical system of developmental psychology. Progress and research results of developmental (children) psychology have found out scientific basis for interpretation of the significance of exclusive products for children. It is necessary for us to re-evaluate the significance of the existence of preschool children's furniture, as well as their roles, functions and the

requirements they are given in children's growth environment.

The objectives of this research are listed as follows:

(1) Put forward a new functional explanation of furniture which could lead to a design strategy of promoting sustainable development of preschool children through furniture design.

(2) Reveal the cause and effect relations between target functions and external forms of design by analyzing the working mechanism of the target function of furniture; provide analysis tools related with children's psychology for designers who might not understand specificities of preschool children.

Statement of Problem: Actual Perplexity of Preschool Children's Furniture Design

A. Practical Problems of Preschool Furniture Design

In order to understand the functional cognition of kindergartens on children's furniture, this study investigated 7 kindergartens of Huli District, Xiamen City. Semi-structured interviews were carried out with principals of those kindergartens. The survey showed that the major existing problems for kindergartens to select and design children's furniture were: (1) Lacking of professional consultant and design team about children's furniture design; (2) It's hardly to find professional communication approaches and tools for preschool educators and furniture designers to use; (3) Furniture (environment) designers lack of necessary knowledge and experience about laws of children's development and they know little of the details of various of preschool educational activities, so it is hard for them to orient their design's objectives clearly or to capture design contact point effectively.

Due to the problems mentioned above, it is difficult for furniture designers and demanders to communicate efficiently on a professional level, and the design depends still mainly on the designers' personal inspirations and talents.

B. General Design Ideas under Common Functional Cognition

In common sense, functions of children's furniture usually mean to provide "sitting, lying, or supporting and storing" functions to the children, which are usually the most fundamental physical efficiencies, as shown in Table 1[4].

In common functional cognition, the design ideas that have currently received more attention could be summarized into the following aspects: (1) Improvement of man-machine relationships: focus on size differences, involving issues related to children's safety, health and comfort; (2) Design philosophy of "growing" and "transforming": realizing functional changes and diversities via structural changes, which is to adapt to functional changes caused by increasing ages of

the children; (3) Perspective of "emotional" design: concerning children's special "aesthetic" psychology, which lays emphasis on the figures and colors that the children favor; or adopting properly popular cartoon images to meet the children's interests; or emphasizing the delights of the images and using process.

TABLE I
 TRADITIONAL FUNCTIONS OF FURNITURE

Functional category	Specific function
Body supporting	Sitting, Resting, Sleeping
Activities	Eating, Playing, Reading, Typing, Working, Writing,
Containing Items	Displaying, Organizing, Storing
Define Space	Enclosing Space, Partitioning Space

Psychological Theoretical Basis and Guiding Significance of Preschool Furniture Design

A. Guiding Significance of Developmental Psychology for Preschool Children's Furniture Design

The idea of systematic development is becoming the core of the theoretical changes of children's developmental psychology in the past ten years [5]. Theories about "development", on one hand, aim to explain children's development and changes with the time as well as the continuity of such developmental changes; on the other hand, it also puts forward systematic requirements, which mainly refers to the relationship between biological systems, psychological systems and social systems. Its systematicness also requires that the preschool children's physical, cognitive, psychosocial development rules, education laws and specific physical environment should be considered as a holistic system. Therefore, to study the design issues of preschool children's furniture, it is necessary to extract theoretical basis that guides the design from these three psychological theory modules, namely, developmental psychology, preschool education and environmental psychology.

B. Guiding Significance of Preschool Educational Theories for Preschool Children's Furniture Design

Basically, the Montessori Method, Reggio Emilia Approach, High/Scope and Developmentally Appropriate Practice (DAP) have reflected the situation of the development of preschool education in the past century, both in theory and practice. By comparing these educational ideas, it could be found they have high consistency in many aspects. Highlights of the common characteristics on furniture design are concluded as follows:

(1) Children's development is an interconnected system. To analyze specific influences of furniture on children's development, it is necessary to match children's different development fields with relevant activities, transforming the abstract "development" problems into basis that could be judged intuitively.

(2) Modern early childhood education emphasizes promoting children's development by environment creation, during which furniture plays significant roles.

(3) Considering the special psychology of preschool children, furniture design should take into account the tendency of children's possible game behaviors in the process of interacting

with furniture when using it. Moreover, Game behavior is also an essential way to promote children's development.

C. Guiding Significance of Environmental Psychology for Preschool Children's Furniture Design

Egon Brunswik, the notable eco-psychologist argued that correct psychology must be a science studying the relations between the organism and the environment, instead of a science derived from organism, whose prime target is to study how the organism shall keep pace with the environment it is in [6]. As a crucial factor of environment, furniture affects children's emotions and their ability to establish relations and plays significant roles in their study and development: (1) Furniture constitutes the essential part of the physical environment of kindergarten, which involve with security and health, teaching organization, play and activity as well as situation creation and cultural transmission; (2) Furniture could provide specific support to children's life, study and playing.

To sum up, developmental psychology of children, preschool education and environmental psychology, which are relatively independent and also closely related, constitute the basis of the psychological theory of this study.

Sustainable Furniture Functional Design Centered on Promoting Children's Development

A. Feasibility and Necessity of Constructing a Functional System Centered on "Promoting Children's Development"

(1) The field of children's development is clearly defined; and relevant specific contents of all the fields are abundant and distinct and it is systematic; therefore, it is possible to form the framework of "functional system".

(2) No matter preschool education theories or environmental requirements, in fact, all aim at how to adapt or promote the development of children. So, this problem has formed the logical starting point of phenomenological analysis.

(3) It is helpful for designers who do not engage in early childhood education to understand children's behavioral and psychological characteristics, to know of the philosophy and operational details of preschool education.

B. Construction of Furniture Functional System

To construct a functional system to promote children's development based on a full understanding of preschool education and environmental requirements could provide new ways and methods for construction of design strategies, design methods and procedures, as well as design evaluations of children's furniture.

Process of construction: With the core of "promoting children's development", this functional system consists of four levels: ① Level 1: basic fields of children's development to be promoted; ② Level 2: specific elements of children's development to be promoted; ③ Level 3: development of the children's abilities to be promoted; ④ Description of children's activities related with various functions, which are listed into four rows in the functional system table from left to right.

(1) Level 1: Field of development. According to the classification method of children's "development" fields put forward by Diane E. Papalia, it is divided into three categories,

i.e., physical development, cognitive development and psychosocial development [7], as shown in Table 2.

TABLE 2
 FIELD & CONTENT OF CHILDREN'S DEVELOPMENT

Field	Contents of development
Physical Development	Development of body and brain, development and health of sensorimotor abilities and sports skills, as well as influences in other aspects.
Cognitive Development	Including learning, memory, language, thoughts, moral reasoning and creativity.
Psychosocial Development	Including changes and stability of personality, emotions and social relations. Changes in this aspect could also affect cognitive and physiological development.

(2) Level 2: Developmental elements. Specific developmental elements are determined by subdividing the contents of these three basic modules, the process of which refers mainly the classification framework of the learning

indexes of curriculum designed by American Head Start Program, which is a national action plan implemented by Office of Economic Opportunity, aiming at preschool children and their families [8]. It is necessary to note that, considering correlations with furniture, this study eliminated all development elements of ① language development, ② literacy ③ learning method in the table of children performance of Head Start Education [9]. (3) Level 3: Development of capacity. Subdivide the development elements further according to activity contents that are easily understood by common people. (4) Specific description: Literature research on theoretical works of preschool education is conducted; and the content of activities mentioned above are described in notes in the form of "phenomenon-describing" to help designers match the target functions to their according levels effectively and correctly.

Results of construction: According to the thoughts and steps mentioned above, localization analysis table of objective functions of furniture for preschool children is finally obtained as shown in Table 3.

TABLE 3
 ORIENTATION ANALYSIS TABLE OF TARGET FUNCTIONS OF FURNITURE FOR PRESCHOOL CHILDREN

Level 1 Field	Level 2 Elements	Level 3 Capacity	Description	
Physical development	Fine motor skills		Have the strength, sensibility and controlling capacity of using scissors, stapler, hammer and other tools. Hand-eye coordination when building blocks, doing puzzles, stringing beads and use scissors. Ability to use technical tools to write, draw and for artistic creation.	
	Gross motor skills		Controlling ability and balance force when walking, climbing, running and jumping. Movement coordination skills when throwing, grabbing, kicking, tapping the ball, playing slide and swing.	
	Security & health		Possible injuries to the body caused by collision, smash and scratch; Influences of light and noises on eyesight and listening.	
Cognitive development	Development of sensory capacity		Ability of identifying articles by observing, listening, feeling, tasting and smelling	
	Development of perceptual capacity		Movement perception Balance perception Time perception	
	Development of scientific cognition	Science		Activities that could arouse exploration and interests in nature as well as observation and measurement. Collect, describe and record information by drawing, tabulating. Inspiring initiative and curiosity.
		Mathematics		Figures, classification, sorting, space
	Development of artistic performance capacity	Fine Arts		Create and express feeling with in various ways with various artistic media and materials. More refined, creative drawing, painting and miniature creation. Artistic creation related with hand-made.
Music			Explore and differentiate various sounds. Simple instrument playing.	
Psychosocial development	Mental concern	Family atmosphere	Help the children get sense of belonging, controlling, independence and generosity.	
		Individuality	Children's personal articles, personal labels or changing according	

		to their interests.
Social communicative competence	Parent-child relationship	Promote communication and cooperation with their parents.
	Teacher-student relationship	Promote communication and cooperation with their teachers.
	Peer relationship	Promote communication and cooperation with their companions. To play creatively with their companions in cooperative games.
Self-management skills	Self-help ability	Help the children to do what they can do.
	Safety education	Cultivate safety consciousnesses.
	Moral education	Pro-social behavior, having love to plants and animals. Reduce influences to others' activities.

C. Working Mechanism of Target Functions of Preschool Children's Furniture

Working mechanism of target function actually refers to logical interpretation of how furniture affects children's development. It could be seen clearly how children furniture correlates with various theoretical modules, as shown in Figure 1: all function relations could be summed up as promoting the development of children. Besides, it also suggests that furniture mainly relates with children development in the following ways:

(1) As an environmental factor, furniture could affect children's development directly; it could form "playing space" to affect children's playing behavior, that is, to affect children's development indirectly; or it could form "exploratory space" to promote children's development indirectly from the perspective of education.

(2) As a kind of practical tool or "teaching aid" in some sense, furniture could affect children's development in the form of "education".

(3) As a "toy" in some sense, furniture could affect children's development indirectly by affecting children's playing behavior.

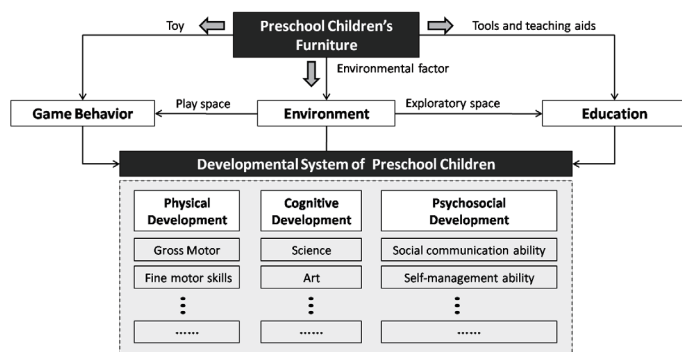


Fig. 1 Interaction of preschool children's furniture and psychological theory modules

Conclusion

Preschool children's furniture could not be regarded simply as "miniature" adult furniture is because to large extent the "functions" it undertaken have strong particularity and complexity. From the perspective of sustainable design, this study is based on the laws of physical and psychological development of preschool children, as well as the objectives and requirements of preschool education and environmental requirements, with the aim to break through conventional

functional understanding and classification methods and to re-examine the "functions" of furniture for preschool children. Through theoretical derivation, functional design ideas and design strategies with "promoting children's development" as the core is put forward definitely. Based on development fields and contents, target functional system of furniture for pre-school children is constructed, trying to set up a bridge between children development psychology and furniture design and to promote professional communication between the designer and the early childhood educator, which is favorable to manage and control the expected design objectives scientifically before the designer starts designing, so that effective design creativity could be obtained with quite new understanding and the design chances could be identified and located.

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