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ABSTRACT

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MEASUREMENT OF CHILDREN'S PREFERENCES FOR THE PLAY ENVIRONMENT

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Abstract

A measurement technique employing photographs and comparative judgement scaling is evaluated for internal consistency and behavioral validity, with positive results. Using the validated technique, the hypothesis is tested that adult designers are insensitive to children's preferences, and the hypothesis is found to be true. The measurements thus obtained also contain useful information about the substance of what children prefer, and this is discussed briefly.

Acknowledgements

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Introduction

The preferences of children are rarely considered in the environmental design process, even when the product is intended specifically for them. One of the reasons for this is that it is difficult to gather meaningful information from children. They have short attention spans and their skills are not well developed. Another reason is that economic, political, and planning processes are not organized to allow direct participation of children in representing their own interests. If these interests are represented at all, it is through adult "advocates" who are understandably preoccupied with their own perceptions of the children's health, safety and morals. More often, however, the child is simply ignored as a user of the urban environment. Thus, children tend to be discriminated against in the environmental planning and design process because they lack capability and opportunity to express themselves effectively.

The situation is aptly described by Dattner in his discussion of children and the design of urban facilities that affect them. He defines a spectrum of users of urban facilities in terms of the extent to which the users are affected. He places children in the most and administrators in the least affected category.

> Although they (the children) are the most deeply affected groups of users, they are presently the least able to influence the design of their environment. Not only are children seldom consulted about these matters, but their needs are almost completely forgotten when the facilities are being designed. The important decisions are made by another group at the other end of our spectrum of users. (1)

It will contribute to the remedy of this problem if methods can be developed which reliably and accurately measure the preferences of children. Like any other environment, the playground should be planned and designed with many factors in mind. Accessibility (2), cost, maintenance, safety and separation from adults should all be considered. (3) (4) Also im-

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portant are the constructive functions of the play experience in a child's physical, emotional and social development. More basically, however, it is the potential satisfaction of children as users of play facilities which should be of primary importance in the planning and design process. Their use of a place intended for play is by their own free choice. If a playground or a piece of equipment is not competitively attractive to them, children will not use it, and it must be regarded as a failure. Even if a relatively unexciting play environment is used because it is the best of alternatives, a fundamental responsibility remains to maximize the users perceived satisfaction, subject to the constraints imposed by health, safety, morals and economics.

The subject of this paper is the measurement of children's preferences in the context of playground design. The purpose is to describe briefly the procedures and results of a research project that has concerned itself with three basic objectives: 1) to evaluate a simple and inexpensive methodology for gathering information directly from children concerning their preferences, 2) to test the hypothesis that adult designers and administrators are insensitive to the preferences of children, and 3) to gather new information about what is attractive to children and to suggest some design guidelines.

Validation of Methodology

The first purpose of this paper is to summerize the results of a study aimed at testing the reliability and validity of a measurement technique. Briefly this technique is to use photographs as stimuli in an interview that asks children directly for their preferences. The method of paired comparison is appealing for use with children because of its simplicity. This procedure is well developed in theory and yields interval scales. (5) (6) The respondent is required only to select the most desirable of two alternatives. However, as the number of alternatives increases, the number of pairs that must be examined grows combinatorially. Thus, fatigue becomes a serious problem.

The method of rank order is similar in theory and result to paired comparison but requires the respondent to make more complex decisions. In its simplest form, the method asks the respondent to pick the most desirable of several alternatives, rather than of only two. However, for a given number of alternatives, the number of operations is generally reduced. If the increased complexity of rank order does not detract significantly from reliability and validity of the measurements, it is to be preferred over paired comparison because of its ability to handle larger numbers of alternatives.

Before such methods are used to measure the preferences of children, three major questions must be answered:

1) Can children make meaningful choices between and among photographs so as to yield reliable and internally consistent average preference scales?

2) Does the method of rank order produce results that are in agreement with the simpler method of paired comparison?

3) Can the scales thus derived be used to predict the actual average desirability of play equipment in real playground situations?

The first two questions have been studied in general in the psychometric literature, but to our knowledge, use of the methods with children has not been explored. The third question, behavioral validity of using photographs in conjuction with these scaling and measurement methods is a perennially raised but never answered question.

With the cooperation of officials of Lincolnwood School in Evanston, Illinois, the following operations were performed:

1. The six pieces of equipment in the Lincolnwood playground were photographed individually in color, and the photographs were each enlarged to 5" by 7" on individual cards.

2. Forty-five eight-year old children rated the desirability of each photograph using the methods of paired comparison and rank order in two independent tests. This was done twice. The first time was in October, 1970, and the second time was in January, 1971.

3. Using the law of comparative judgment, an interval scale of average desirability was constructed for the six photographs from each of the four data sets. These scales are shown in Figure 1 (next page).

4. Each of the four preference scales was tested statistically for internal consistency. This was done by using scale parameters, (mean and dispersion) to generate a synthetic data set which was then compared statistically with the original data.

5. The four scales were compared between methods and over time for ordinal and interval consistency.

6. During the summer of 1970 a time lapse movie camera was concealed in the school building overlooking the same playground, and the actual play behavior of children using the six facilities was recorded. A total sample of 2000 usable frames was obtained with time separation of from one to three minutes between adjacent frames.

7. Using carefully designed techniques, a sample of 550 frames was used to calculate the probability of use for each of the six pieces of equipment.

8. The four preference scales obtained from the photo interviews were used to predict

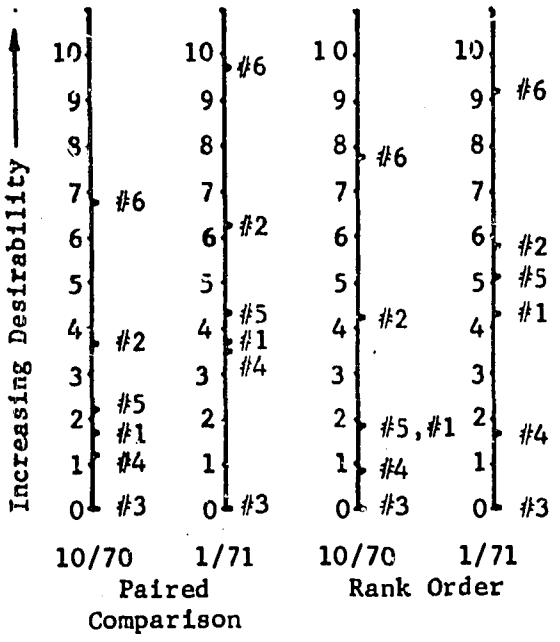

FIGURE 1

Children's Preference Scales

Derived From Interview Responses to Photographs By the Law of Comparative Judgement

(The scales have interval properties but not ratio properties. The origin is arbitrary.)

KEY:

#6 = Swings	=	First Choice
#2 = Slides	=	Second Choice
#5 = Hor. Ladder	=	Third Choice
#1 = Monkey Bars	=	Fourth Choice
#4 = Seesaws	=	Fifth Choice
#3 = Hilo Bars	=	Sixth Choice

synthetic probabilities of use for each of the six pieces of equipment.

9. Predicted probabilities were compared with observed probabilities to test the hypothesis that the two methods yield the same results. Strong correspondence between the predicted and observed probabilities would be evidence that the measurements derived from the photo interview are meaningful indicators of preference.

The details of each of these operations are explained elsewhere. (7) (8) (9)

Results of the Validation Study

The four scales calculated from the photo interview by the law of comparative judgment are shown graphically in Figure 1. Tests for internal consistency show that each scale is a valid and stable measurement of a preference process. Thus, it can be concluded that children are capable of responding meaningfully to the photographs, using the methods of paired comparison and rank order. Figures 2 and 3 show graphical and statistical comparison of the scales between methods and over time. The correlations are extremely high, which demonstrates that the two methods are reliable in the aggregate and yield stable and identical results. Thus, children are capable of using rank order methods as well as paired comparison methods. The scales are ordinally identical over time and across method. Statistical comparison of the interval properties of the scales shows that the observed differences can reasonably be attributed to chance. (10) This demonstrates that the scales have reliable interval meaning, also.

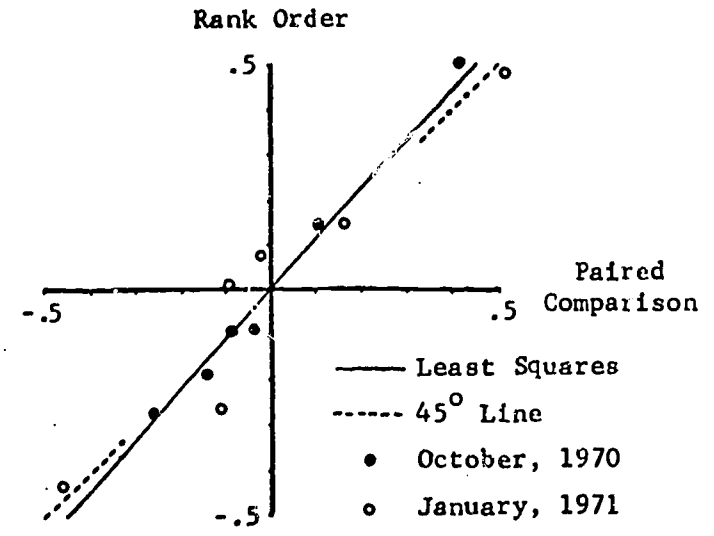

FIGURE 2

Consistency of Scales Between Methods

$R = 0.969$, $R^2 = 0.939$

(PC) = -0.0075 + 0.906(RO)

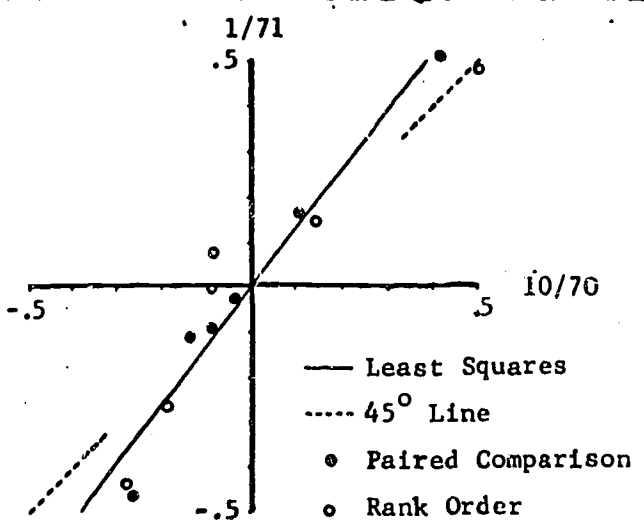

FIGURE 3

Consistency of Scales Over Time

$R = 0.952$, $R^2 = 0.905$

(10/70) = 0.00072 + 0.770(1/71)

Figure 4 shows the relationship between the observed probabilities and the probabilities predicted from the four preference scales. Here the correlation is much too high to have occurred by chance alone. The two independent data sets have fifty-seven percent of their variance in common. This allows us to conclude 1) that the interview preference scales are significantly related to actual behavior, but 2) that some differences exist between the photo to preference process and the behavior observation process. The correlation is sufficiently strong, however, to justify cautious use of photo preference scales as indicators of "true" preference. Note that the extremes correspond perfectly. The disagreement is caused by the pieces of equipment in the middle preference range that are very close together on the interview preference scales.

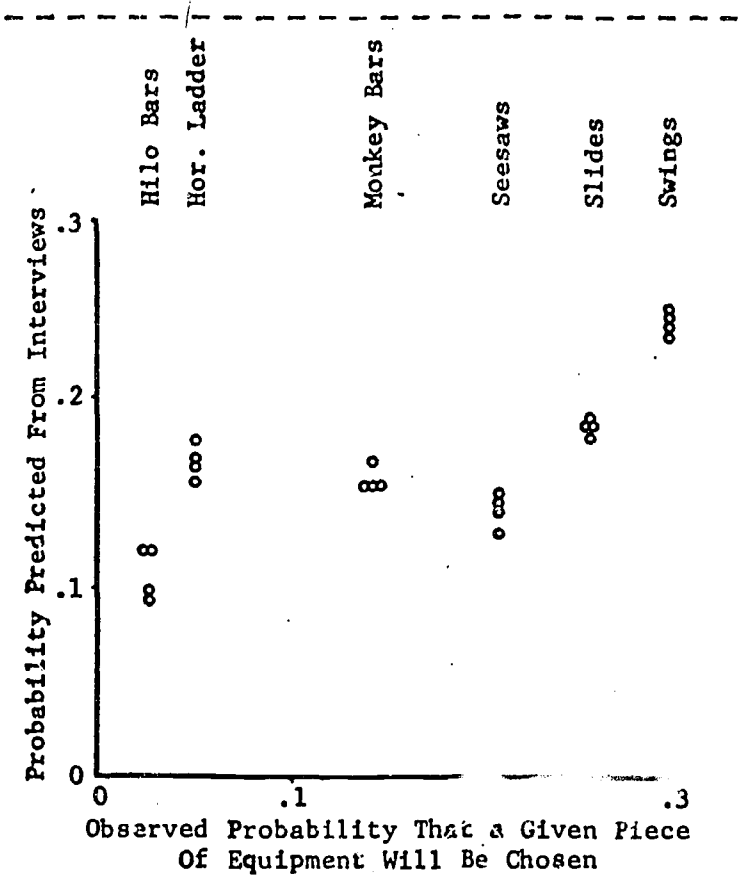

FIGURE 4

Agreement Between Interview Results And Behavioral Observation

$R = 0.757$, $R^2 = 0.573$

An important observation about the relationship in Figure 4 is that the behavioral observations discriminate more strongly among alternatives than do the interview preference scales. This suggests the possibility that the interview preference process is less sensitive to differences in the desirability of alternatives than actual behavior. This would be expected, because the child is not forced to accept the actual consequences of his decision when choosing among photographs.

Sensitivity of Designers to Children's Preferences

It was suggested in the introduction that the design process is not responsive to children's preferences. This was the justification for exploring measurement techniques. The second purpose of this paper is to summarize the results of a study that tests this hypothesis using the methods described above. This test was accomplished by 1) measuring children's preferences for sets of carefully selected photographs, 2) measuring what adult designers believe are children's preferences for the same photographs, and 3) comparing the results quantitatively and qualitatively.

In order to get a wide coverage, five sets of photographs were used. These were carefully designed to display, respectively,

1. Variations in the play environment
2. Variations of activity or play equipment
3. Slide design variation
4. Climbing apparatus design, and
5. Effects of user crowding.

Each of the first four was a set of fifteen photographs, while the last was a set of five. The larger sets were used with rank order measurement, and the last was used with paired comparison. The complete results are reported elsewhere. (11) (12) Detailed analysis of the results of the five comparisons is the subject of another paper currently being prepared. (13) Because of the need for brevity, only one of the studies, slide design variation, is discussed here, and the report is confined to a brief description of the study and a summary of the quantitative results.

Slide Design Variation: An Example

Space does not allow inclusion of the photos. The fifteen pictures were selected to cover a wide range of variation in the design of slides. They include examples of thematic, innovative, imaginative, functionally exciting and traditional or plain designs. There was no attempt to isolate specific attributes of design in an explanatory sense other than to identify types or categories and to include a wide range of alternatives that are fairly representative of available designs. These photographs were used to measure the preferences of two hundred eight-year old children, uniformly stratified by sex, ethnicity (black or white, only) and place of residence (Evanston vs. Chicago, only). Thus the sample consisted of twenty-five children in each of eight categories.

For purposes of comparison, fifty adults were interviewed using the same photographs. They were people in the business of designing and delivering playgrounds and play equipment. The sample consisted of twenty-five senior landscape architecture students from Purdue University and twenty-five professionals from the Chicago Park District. These people were asked to play the role of eight-year old children and select the photographs the way they believed children would. They were not asked to give their own preferences. Rather, they were asked to give what they believed to be children's preferences.

Figure 5 compares the preferences of male children with those of female children. The correlation of 0.96 is extremely high and shows that the two independently derived scales are essentially the same. Figure 6 is a similar comparison between blacks and whites. The correlation here is also 0.96, but the numerical identity is purely coincidental. The high correlation shows that the two ethnic groups have remarkably similar preferences for the slide design variations.

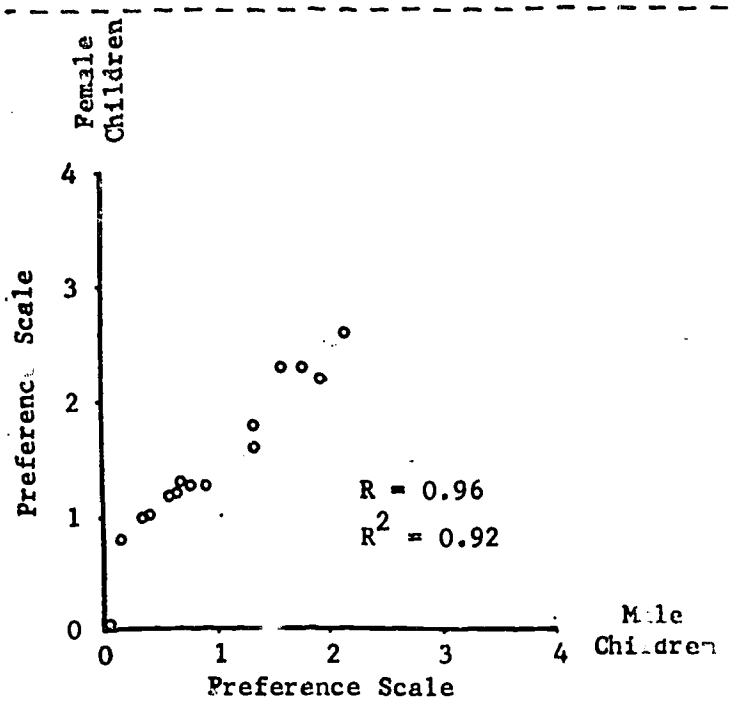

FIGURE 5

Comparison of Preference Scales Constructed For Male and Female Children

SLIDE DESIGN VARIATION

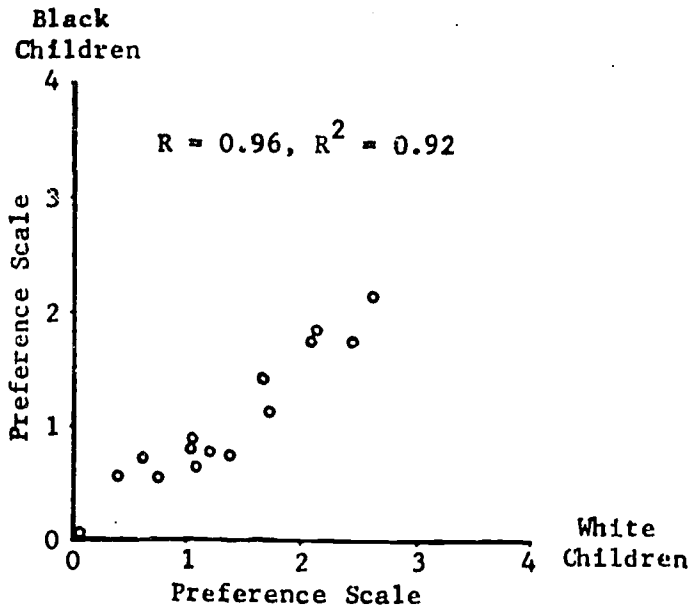

FIGURE 6

Comparison Between Preference Scales Constructed For Black Children and White Children

SLIDE DESIGN VARIATION

In Figure 7 the correlation between children's preferences and the beliefs of adult designers is only 0.56. This means that the two scales have only 31% of their variance in common whereas the communality in both the sex and the ethnicity comparisons was 92%. Using a normal test of reliability for the correlation coefficient shows that the probability of obtaining an adult/child correlation as large as 0.56 from an uncorrelated population with a sample size of 15 is only 0.03. This suggests that the two scales are positively correlated. However, a 95% confidence interval lies between 0.06 and 0.84. The adult/child correlation is thus statistically as well as numerically lower than the child/child correlations across sex and ethnicity. This supports the hypothesis that the designers are relatively insensitive to children's preferences, at least in the case of slide design variation. The hypothesis is also supported in the case of variations in the play environment, activity variation, and climbing design variation. (14) This leads us to conclude that the systematic measurement of children's preferences is an essential step in design if the facilities are to be attractive and satisfying to the children. The design challenge is to create alternatives that are both attractive and functional (i.e., safe, constructive, economical, etc.).

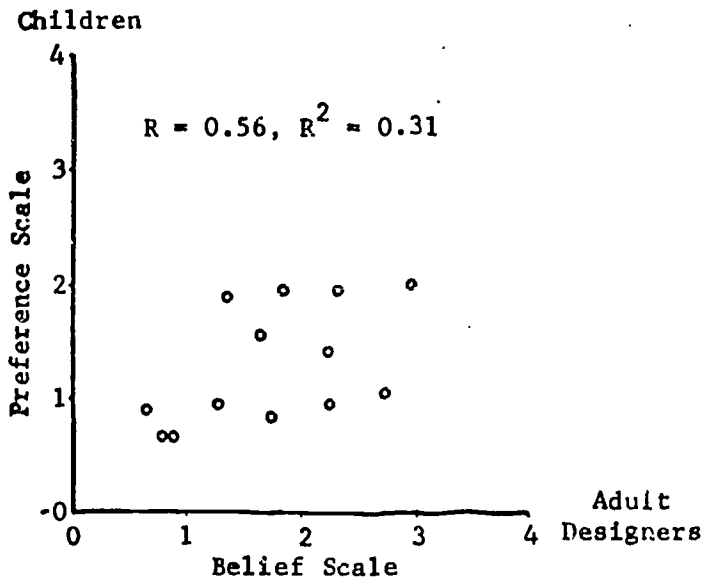

FIGURE 7

Comparison of Children's Preferences and Adult Designers' Beliefs About Children's Preferences

SLIDE DESIGN VARIATION

Conclusions about Children's Preferences

In the process of validating methodology and testing designer sensitivity, considerable information was gleaned about what children prefer. For example, in the pilot study it was established conclusively that of the six traditional designs studied, swings and slides are considerably more attractive to children than horizontal ladders, monkey bars, seesaws or horizontal bars. It was further established that horizontal bars are considerably less attractive than any of the other five facilities. These results were obtained consistently from four independent interviews and were verified thru unobstrusive behavioral observation. We now are in a position to ask 1) whether innovative, thematic or colorful design variations might affect attractiveness, 2) how children react to a wider variation of alternative facilities, 3) how variations in the play environment affect preferences, and 4) what are the effects of crowding? The comparative and substantive results of these studies are described only briefly here, in qualitative terms.

Comparative Findings

In general it was found that there are sex differences in play preference that are greater for blacks and for central-city residents than for whites or suburban residents. That sex differences are greater among blacks than among whites with regard to such things as self-esteem has been reported by Yarrow, Campbell and Yarrow and by Stewart. (15) (16) A recent study of the recreation preferences and experiences of high-school students by Peterson, Hansaen and Bishop also reports greater sex differences for blacks than for whites. (17) The central-city differences also have reinforcement. Kohn found that working class boys and girls have toy preferences much closer to traditional sex-typed choices than do middle class children. (18) However, the actual qualitative differences are difficult to interpret in design terms and probably have more relevance sociologically or psychologically.

Qualitative Findings-Play Environment

The children differentiate strongly between contrived and uncontrived play environments. By contrived environment, we mean that it has been designed for the purpose of play, whereas an uncontrived environment is one that might be used for play but is not intended for that purpose. These two types of environment cannot be scaled on the same continuum, which suggests that they are not equivalent and perform different functions in the minds of the children. It was found that construction sites, junkyards and vacant lots comprised one scale continuum whereas the contrived playgrounds offering conventional facilities had to be scaled on another continuum. This suggests that "adventure playgrounds" may be complements to, rather than substitutes for, playgrounds primarily designed for physical activity. (19)

In general the children preferred thematic and colorful environments, that were clearly recognizable as places to play, with an appearance of openness and an abundance of attractive vegetation. A striking difference between adults and children occurred in the case of an innovative and stylized play area without any of the conventional equipment, but obviously the recipient of careful and tasteful architectural design. This was rated very high (2nd) by the adults, but mediocre (7th) by the children. Adults and children agreed that stark, enclosed, barren, hard, cluttered or colorless areas are the least desirable.

Activity Variation

Again, colorful, innovative and thematic designs were preferred over those which are drab or traditional. In fact, the children seemed more concerned with design treatment than with the apparent activity. A traditional sandbox was the least preferred of the fifteen alternatives while an innovative sandbox was near the top of the list (fourth). The innovative sandbox added things to climb on, under and thru, however, and therefore offered much more than an opportunity to dig in the sand. The seven most preferred activities were, in order of average desirability, 1) thematic and

colorful rocket ship slide, 2) geodesic dome climber, 3) traditional merry-go-round, 4) innovative sandbox, including things to climb on, under and thru, 5) innovative seesaw (4 way with springs and animals), 6) innovative swings (St. Louis-type supporting arches), and 7) innovative wading pond, including smooth rocks and stone seals. The eight least preferred activities were, in order, 1) traditional slide, 2) traditional wading pond with sprinkler, 3) traditional seesaw, 4) traditional monkey bars, 5) traditional swings, 6) innovative Lincoln logs for building, 7) cable slide and 8) traditional sandbox.

The results indicate that unusual activities such as Lincoln logs or the cable slide should be tested experimentally before they are used. The low preference ratings may be due to unfamiliarity and a resulting inability of the child to visualize himself in the situations. Alternatively, the activities may simply be less interesting or too demanding for the age group in question.

Slide Design Variation

In this set of photographs the thematic rocket ship slide that was most preferred in the activity variation study was eclipsed by four other designs. The most preferred slide had the appearance of a giant cage-like robot with the slides being tubes that are the robot's arms. In second place was a giant undulating slide with capacity for six riders in parallel. Third most preferred was an innovative spiral slide and fourth was a planet-like combined slide and climber. Only three traditional slide designs were included, and they were 12th, 13th, and 14th out of fifteen. Surprisingly, a natural mud slide on a small grassy hill was least preferred by the children. It was rated much higher (9th) by adult designers. In general, the children were attracted by an exciting ride (height, speed, variation), color, and imaginative design with an animated or dynamic and recognizable theme. Garishness seems to be more attractive than "tasteful" architectural designs, as though "stimulus-seeking" is an important motive. (20)

Climbing Design Variation

For this group of photos the disagreement between adults and children was greater than for any of the other groups. The correlation between the two scales was only 0.28 which has a probability of 0.31 of occurring by chance alone from a totally uncorrelated population! In general the adults discriminated much more strongly among the alternatives than the children did, but their criteria seemed to be totally different. The children again preferred colorful, innovative and imaginative designs. A common characteristic of three of the five most preferred is the fact that the child climbs on, thru, and into cavities in an object rather than on a frame or lattice that is the object. The two most preferred were of this type and were also very colorful.

Apparently the children studied are not as interested in trees as is commonly believed. Three of the fifteen photos had a tree theme. One was a tree-house in an artificial tree, a second was a climber consisting of tree-like structures and the third was a real tree. These were rated 10th, 12th, and 15th, respectively by the children. The adults rated them 3rd, 4th, and 8th! In addition to this problem with trees, the adults seemed to be so concerned with what might be called "artistic prejudice," that they were relatively insensitive to the criteria used by children. Again, the traditional designs (horizontal ladder, monkey bars and horizontal bars) were at the bottom of the children's list, and this is the only thing that the adults and children even came close to agreeing on. A challenging design problem is obviously to create climbing devices that satisfy the adult's aesthetic senses while also exciting the child's imagination and satisfying his need for stimulation.

Effects of Numbers

This test employed five photographs of a moderately innovative climbing device. The five pictures were identical with the exception of the number of children using the device. This was varied so that there were one, two, three, four and thirteen children. Unfortunately, there were also some shadow variations that may have influenced response, but the data do not allow this to be tested. The children preferred, in order from most to least, the pictures with three, four, thirteen, two and one child. In general the adults agreed. This shows that crowded and empty are both less desirable than three or four children playing, and that crowded is more desirable, on the average, than empty.

Summary and Future Directions

The research described briefly in this paper was designed primarily for 1) testing the validity of techniques for measuring children's preferences for playground alternatives, and 2) testing the hypothesis that adult designers are insensitive to children's preferences. The results demonstrate that photographs and the methods of rank order and paired comparison produce highly reliable and internally consistent interval scales of average preference for playground alternatives. Comparison with data obtained thru unobstrusive observation of actual playground behavior suggests that the artificially derived preference scales also

have considerable behavioral meaning, but the scales are apparently less sensitive than behavioral observation.

The hypothesis that adult designers are insensitive to the play preferences of children is strongly supported by the results. This suggests that the design traditions and artistic talents of the design profession may not be sufficient. The objective of playground design is to provide attractive and satisfying play opportunities that also enhance the child's "health, safety, and morals," contribute constructively to his growth and development, and are economical. Designers must add to their skills and techniques 1) an ability to measure the preferences of children, and 2) an ability to explain the preferences in terms of design variables.

Measurement of preferences is useful in identifying and closing the communication gap, and this research has both demonstrated the need and provided a methodology. In specific cases the designer or administrator can test alternative designs using the methods we have described. Hopefully, our results will also stimulate research aimed at explaining what children prefer. An explanation of preference is necessary if synthesis of new alternatives is to be efficient. What is needed is a theory of the child's environmental preferences, in terms of real design variables.

Although the studies described in this paper were not designed specifically to describe or explain children's preferences for play equipment, some coincidental information was acquired. This information together with content analysis of the photographs will be used in the future to propose specific explanatory hypotheses.

Notes

(1) Dattner, R. Design for Play, Van Nostrand, New Jersey, 1970, p.33.
(2) Dee, N. and J.C. Leibman, "A Statistical Study of Attendance at Urban Playgrounds," Journal of Leisure Research, Vol. 2, No.3, 1970, pp.145-159.
(3) Dattner, R., Design for Play, Van Nostrand, New Jersey, 1970.
(4) Friedburg, M.P., Play and Interplay, MacMillan Co., New York, 1970.
(5) Guilford, J.P., Psychometric Methods, McGraw-Hill, New York, 1954.
(6) Torgerson, W.S., Theory and Method of Scaling, Wiley, New York, 1958.
(7) Bishop, R.L., "Towards the Synthesis of Environmental Design Criteria from Children's Preferences for the Visual Appearance of Urban Play Environments," Doctoral Dissertation, Dept. of Civil Engineering, The Technological Institute, Northwestern University, Evanston, Ill., August, 1971.
(8) Bishop, R.L. and G.L. Peterson, "A Synthesis of Environmental Design Recommendations from the Visual Preferences of Children," Technical Report No.2, Grant No. 5 R01 EC00301 from the U.S. Public Health Service, Dept. of Civil Engineering, The Technological Institute, Northwestern University, Evanston, Illinois, September, 1971.
(9) "The Preferences of Children as a Basis for Environmental Design: Validation of Measurement Methodology," paper in preparation by the authors, The Technological Institute, Northwestern University, Evanston, Illinois.
(10) Ibid.
(11) Bishop, op. cit.
(12) Bishop and Peterson, op. cit.
(13) "The Design of the Play Environment: Sensitivity of Adult Designers to the Preferences of Children," paper in preparation by the authors, Dept. of Civil Engineering, The Technological Institute, Northwestern University, Evanston, Illinois.
(14) Research completed as of November, 1971, indicates that the adult designers are more sensitive to the preferences of male children than they are to the preferences of female children. This tendency is acute in the case of activity variation and climbing design variation where there is no correlation at all between the beliefs of the adults and the average preferences of female blacks or Chicago females. There is also a weaker but significant tendency for the adults to be more sensitive to the preferences of white children than they are to the preferences of black children. These results are developed in more detail in (13).
(15) Yarrow, M.R., J.D. Campbell and L.J. Yarrow "Interpersonal Dynamics in Racial Integration" in E.E. Macoby, et. al., Readings in Social Psychology, Holt, Rhinehart and Winston, New York, 1958.
(16) Stewart, V.M., "Improving the Self-Esteem of Black Children Through Curriculum Manipulation," Unpublished Master's Thesis, Department of Psychology, Northwestern University, June, 1970.
(17) Peterson, G.L., J.U. Hanssen and R L. Bishop, "Toward an Explanatory Model of Outdoor Recreation Preference," paper prepared for the Symposium on Consumer Behavior and Environmental Design, American Psychological Association Meeting, Washington, D.C., September, 1971.
(18) Kohn, M.L., "Social Class and Parental Values," American Journal of Sociology, Vol. 64, 1959, pp.337-351.
(19) "Adventure Playground" are popular in Denmark, Great Britain and other European countries. These are usually large lots containing materials, "junk" and tools for children to do as they please. Supervisors

are present, but the supervision is usually kept to a minimum. In Europe they have been quite popular. They have not found much success in this country, however, due to adult objections on aesthetic and safety grounds. No photos of actual adventure playgrounds were included in this study, because none were available to us. Junkyards and construction sites were intended to be approximate substitutes.

(20) McKechnie, G., "Measuring Environmental Dispositions with the Environmental Response Inventory," EDRA TWO, Proceedings of the 2nd Annual Environmental Design Research Association Conference, edited by J. Archer and C. Eastman, Pittsburgh, Pa., October, 1970.