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ABSTRACT

Time-lapse photography was used to record the gross play activity of preschool children, rated according to three measures of equipment use and three measures of movement. The definition and derivation of these measures was outlined, and five hypotheses were presented and tested concerning the variability and interrelation of the measures. Analysis of the data suggests that factors influencing play are so complex that present attempts at predicting group activity trends may be premature. Further work is needed in the definition and isolation of stimulus parameters of the physical environment so that the interpretation of play behavior is simplified and made more relevant for the individual child. It is suggested that individual trends must be investigated before a complete understanding of group play patterns can be achieved. (Author/NH)

GROSS ACTIVITY OF CHILDREN AT PLAY[1]

(Internal Report)

Lance Wuellner

Wuellner, Witt and Korb (1970) assessed the present status of a semi-automated photographic system for recording movement and equipment use patterns of human subjects interacting in the physical environment. However, both movement measures and equipment use measures per se received only limited definition and discussion in terms of their differential effect on sampling rate. The present paper will consider the definition and derivation of some of these measures of gross activity, as well as their variability over time, and their interrelation.

Six measures of gross activity were obtained from data collected by Wuellner (1969) on preschool children by means of the time-lapse photographic system, using 10-second intervals. Four groups of children were each filmed a total of 10 15-minute sessions in an indoor play area.

Equipment use measures consisted of the following:

1. Total Number of Exposures on Equipment
2. Total Number of Visits
3. Average Visit Length

Movement measures consisted of the following:

1. Average Distance Moved
2. Number of Intervals Moving
3. Velocity

Table 1 summarizes the definition and derivation of these equipment use measures and movement measures.

The following hypotheses were derived concerning the variability and interrelation of these measures:

1. Each measure will show a consistent trend over sessions for all groups
2. Each measure will show a constant trend over sessions.
3. Equipment use measures will be positively interrelated.
4. Movement measures will be positively interrelated.
5. Equipment use measures and movement measures will be negatively interrelated.

Analyses performed on each measure per group showed that, for each measure, significant differences[2] occurred across sessions in three out of four groups. This led to the rejection of Hypothesis 1.

Further analyses were carried out to determine the particular sessions which produced significant differences. Results indicated no consistent patterns or trends, leading to the rejection of Hypothesis 2. For any measure, significant differences could be caused by only two sessions, with one very high and one very low value; or by as many as 15 session pairs, with each pair being significantly different. Additional inspection of graphs of each measure indicated a wide divergence of trends across the four groups.

A correlation matrix (Table 2) computed for each group was obtained to investigate the interrelation between the six gross activity measures. The strength and stability of any relationship were considered. A high or strong correlation, positive or negative, would be an indication of redundancy in the measures, that either one of the two measures would

give sufficient information about the other, and that one measure could therefore be deleted. A stable relationship would provide consistent results over all groups. In such a case, all correlations would be significant in one direction, justifying deletion of one measure as redundant and indicating that the other measure could perhaps be reliably used on any similar preschool population. In Table 2 the significant correlations have been circled. Correlations close to significance have been circled with a dashed line.

Considering equipment use measures, Total Number of Exposures on Equipment bore no significant relationship to Total Number of Visits. This result was not surprising. Suppose two children each spend 70 exposures on equipment. However, one child spends all 70 exposures on the same piece of equipment while the other child alternates between two pieces of equipment at each exposure. Both children would be scored 70 exposures on equipment, but the first child would be scored one visit while the second child would be scored 70 visits.

Average Visit Length showed a moderate negative correlation with Total Number of Visits in three out of four groups. In this case Total Number of Exposures on Equipment is an interacting factor. One child could have 10 visits of one exposure apiece while another child could have 10 visits of 9 exposures apiece. Total Number of Exposures on Equipment would be 10 for the first child and 90 for the second child. Due to such possible interaction on the part of the equipment use measures, Hypothesis 3 has been rejected.

Considering movement measures, Average Distance Moved has a strong stable correlation with Number of Intervals Moving and with Velocity.

It is therefore recommended to delete Average Distance Moved as a movement measure of gross activity since it seems to produce superfluous and oversimplified information. Distance-moved data will thus be based upon instances of actual movement. While the data does not completely support Hypothesis 4, the presence of significant correlations does not warrant its rejection.

No strong nor stable relationships were found to exist between equipment use measures and movement measures. However, some interesting correlational trends were indicated, enough to keep from totally rejecting Hypothesis 5. According to Table 2, as Average Distance Moved and Number of Intervals Moving increased, Total Number of Exposures on Equipment and Average Visit Length decreased. In general, it seems that the more a child moved the less time he spent on equipment, and vice versa.

However, there seems to be a complex interrelation between the movement measures and the equipment use measures which could vary considerably from child to child. Figure 1 illustrates such a possibility in a 14-exposure play session for two children. Child A, a skillful climber, moves a great deal on each piece of equipment; while Child B, awkward and lacking confidence, remains in one spot looking on.

Equipment use measures for each child are identical, with 14 Total Number of Exposures on Equipment, 3 Total Number of Visits and an Average Visit Length of 4.67 exposures. However, Child A has moved 130 feet with 13 intervals moving, and Child B has moved 20 feet with 2 intervals moving. Thus, no strong nor stable relationships should be expected between equipment use measures and

movement measures because, as Figure 1 shows, considerable movement may occur while remaining on a single piece of equipment.

Even if gross activity measures were scored on the basis of a dichotomy such as high versus low, a highly diversified collection of scores across subjects could be obtained, making interpretation exceedingly difficult and time-consuming. The results of the present paper suggest that the factors influencing play are so complex that attempts at predicting group activity trends at the present time may be premature. Further work, such as that currently being done by Gramza and associates (Gramza & Witt, 1969; Gramza, Witt, Linford & Jeanrenaud, 1969; Gramza, 1970), and by Witt (Witt & Gramza, 1969; Witt, 1969), is needed in the definition and isolation of stimulus parameters of the physical environment so that the interpretation of play behavior is simplified and made more relevant for the individual child. It seems that individual trends must first be investigated before a complete understanding of group play patterns can be achieved.

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Footnotes

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[2]A .05 level of significance was used throughout.

Table 1

Measures of Cross Activity and Their Derivation

Equipment Use Measures	Derivation
1. Total Number of Exposures on Equipment	1. Frequency Count Min = 0; Max = 90 per session*
2. Total Number of Visits = Number of Times on Equipment over Successive Exposures	2. Frequency Count Min = 0; Max = 90 per session*
3. Average Visit Length	3. Number of Exposures on Equipment (1) Divided by Number of Visits (2) Min = 0; Max = 90 per session*
Movement Measures	**Derivation**
4. Average Distance Moved (in Each Interval)	4. a. Total Distance = $\sqrt{\sum(Xi-Xj)^2 + \sum(Yi-Yj)^2}$ b. Total Distance Divided by 89 (89 intervals)* Min = 0 Max Undetermined* In Wuellner (1969): Min = .01 yards; Max = 2.99 yards
5. Number of Intervals Moving = Number of Times Position in One Exposure Differs from Position in Previous Exposure	5. Frequency Count Min = 0; Max = 89 per session*
6. Velocity = Average Distance Moved When Moving (Based on Intervals in which movement occurs)	6. Total Distance (4a) Divided by Number of Intervals Moving (5) Min = 0; Max Undetermined* In Wuellner (1969): Min = 1.00 yards; Max = 3.74 yards

*15-minute session photographed at 10-second intervals.

Table 2 (Continued on next page)

Correlation Matrix of the Measures of Gross Activity

		Equipment Use Measures			Movement Measures		
		Total Number of Exposures on Equipment	Total Number of Visits	Average Visit Length	Average Distance Moved	Number of Intervals Moving	Velocity
Equip. Use Measures	Total Number of Exposures on Equipment						
	Total Number of Visits	.397 -.189 -.426 -.023					
	Average Visit Length	.590 .511 .480 .591	-.372 -.754 -.703 -.732				
	Group	1 2 3 4	1 2 3 4				

Table 2 (continued from previous page)

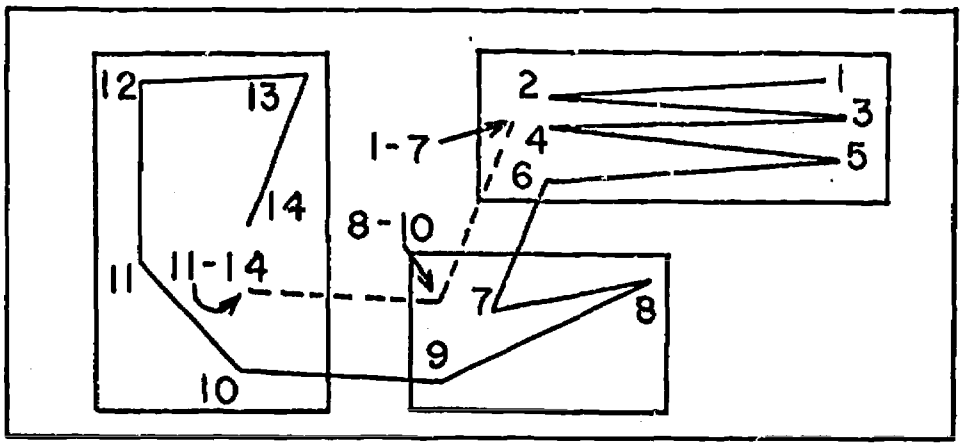
Correlation Matrix of the Measures of Gross Activity

		Equipment Use Measures			Movement Measures		
		Total Number of Exposures on Equipment	Total Number of Visits	Average Visit Length	Average Distance Moved	Number of Intervals Moving	Velocity
Movement Measures	Average Distance Moved	-.723 -.560 -.494 -.525	.017 .425 .684 .635	-.576 -.445 -.511 -.711			
	Number of Intervals Moving	-.724 -.540 -.526 -.552	.200 .475 .786 .629	-.829 -.392 -.682 -.751	.805 .741 .854 .816		
	Velocity	-.623 -.426 -.428 -.270	.050 .348 .514 .374	-.534 -.379 -.558 -.375	.810 .619 .792 .775	.648 .433 .615 .276	
	Group	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4

Groups 1 and 2: N = 10. Need r = .632*

Groups 3 and 4: N = 8. Need r = .707*

*For .05 level of significance



PLAYROOM W/ 3 PLAY AREAS

EACH SEGMENT MOVED = 10 FT

BOTH CHILDREN - 14 EXPS. ON EQUIP.

3 VISITS

4.67 EXPS. AVERAGE

VISIT LENGTH

10 FT AVE. DIST. MOVED

WHEN MOVING

CHILD A - 13 INTERVALS MOVING

(SOLID LINE) 130 FT TOTAL DIST. MOVED

CHILD B - 2 INTERVALS MOVING

(DASHED LINE) 20FT TOTAL DIST. MOVED

FIGURE 1

14-EXPOSURE DIAGRAM SHOWING POSSIBLE RELATIONSHIPS

BETWEEN GROSS ACTIVITY MEASURES