

METHODOLOGICAL INQUIRY INTO ELICITATION PROCEDURES:
COGNITIVE MAPPING AND FREE LISTING¹

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Summary.—This study investigated the effect of two methods of eliciting data concerning environmental perception among children of Guadalajara, Mexico and Newton, Massachusetts. The two tasks used to assess children's perceptions of their environment were a cognitive mapping task commonly employed in previous research and a free-listing task. Data demonstrated that task specificity has a direct effect on the kind and quality of environmental elements children use to describe their environment. It is concluded that elicitation procedures should be examined thoroughly and systematically before developmental or comparative analysis is performed on experimental data.

This work represents an attempt to investigate systematically the effect that different elicitation procedures have on the quantity and quality of data obtained in an experiment concerning environmental cognition. Previous researchers in cognitive psychology have argued that elements of certain domains remain stable despite experimental manipulation in the procedures used to obtain those elements, the inference being that the elements represent some form of analogous external representations of internal structural organization (Shepard, 1975; Henley, 1969). Other researchers have used this inferential process to investigate the development of children's spatial representations in macrosystems (Acredolo, 1977; Siegel & White, 1975; Kosslyn, *et al.*, 1974).

While these investigators have developed interesting hypotheses with regard to developmental aspects of cognitive representations of environmental systems, they have not yet reported any systematic investigation of the possible effects that varying procedures of data collection might have on children's performance. One exception is Lynch (1960), who utilized several techniques to investigate adults' perceptions of their cities. Even though Lynch introduced the idea of multiple collection techniques no attempt was made to analyze the differential effect of eliciting techniques in a systematic fashion.

Recent research on American kinship systems (Rose & Romney, 1979) has demonstrated that different procedures of data collection, in fact, retrieved two different and competing componential analyses of American kinship systems in a homogeneous population. It is possible that alternative methods of

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data collection in the domain of environmental cognition might yield qualitatively and quantitatively different results. This hypothesis was tested by obtaining information on children's perceptions of their cities by two different means, a cognitive mapping task and a free-listing task.

Cognitive mapping is a data-collection technique which requires asking children to draw a sketch of their environment (city). They are told to include whatever elements they think are relevant. The children are allowed to continue the task as long as they choose. When the maps were completed the frequency for each item in the city was tabulated. These frequencies were then superimposed over an actual map of the city to produce a composite map.

Free lists were used as an additional means of gaining the children's perceptions of their city and to compare with those obtained through the use of cognitive maps. Free lists were obtained by asking the children to make a list of all the things that occur to them when they think of their city. Bousfield (1953) pioneered the research on free-list techniques as a means to study the organizational processes of memory. He suggested that this method reflects the manner in which information is structured by the individual. The frequency for each element listed was tabulated. These frequencies were then superimposed over an actual map of the area and the resulting map is referred to as a composite free-list map.

The order of task presentation was alternated within groups to control for effect of order. The tasks were administered a week apart. The cognitive maps and the free lists were used to investigate the kind and quantity of elements the children chose to describe their cities and whether differences between the children are manifested on the tasks. By comparing the tabulated frequency data and analyzing the composite maps from each task we can begin to understand which elements are influenced by task constraint.

The sample ($N = 51$) was comprised of sixth grade children (age 11 to 12 yr.) from Guadalajara, Mexico and Newton, Massachusetts. This age group was chosen to investigate the possible difference between elicitation tasks, as was noted for adults (Magaña, 1978), and was evident in children at about the mid-point in the development of their spatial skills (Norman, 1980). Two culturally distinct groups were chosen to assess whether differences in spatial representation were related to language and cultural differences or the elicitation task. The children from Newton ($n = 25$; 16 male and 9 female) were from middle-class families and attended public schools. The Mexican children ($n = 26$; 15 male and 11 female) were from upper-middle-class families and attended a private school in Guadalajara.

No significant differences on Student's t tests were observed by sex ($t = .109$, 49 df) or the order of task presentation ($t = .045$, 49 df) for the over-all group. Student's t tests were performed on the mean number of elements ob-

tained by each elicitation procedure for each group of children. On the cognitive mapping task the mean number of elements per map was 11.9 for the Newton children and 10.5 for the Guadalaran children, the difference between group means was not significant. On the free-listing task the mean number of elements was 13.3 for the Newton children and 14.9 for the Guadalaran. The differences between groups were not significant, but within both groups there were significantly more elements given on the free-listing task ($p < .01$; Guadalaran, $t = 23.89$, 22 *df*; $p < .05$, Newton, $t = 5.84$, 46 *df*) than on the cognitive mapping task.

An analysis of the elements included on both tasks yielded patterns of similarity and difference. For instance, 30 to 35% of all elements included in the cognitive maps were streets. When the map elements were compared within groups across the tasks approximately 60% of the elements on the cognitive mapping tasks were listed on the free lists (see Table 1). Streets, which comprised a large percentage of the cognitive mapping elements, were conspicu-

TABLE 1
ELEMENTS GENERATED: FREE LISTS AND COGNITIVE MAPS WITH
RELATIVE FREQUENCY (%)

Free Lists		Cognitive Maps	
Guadalaran			
Cathedral	100	Theater	100
Theater	88	Cathedral	93
Shopping Center (Del Sol)	65	Museum	87
Governor's Palace	58	Shopping Center (Del Sol)	62
Park	55	District Zapopan	43
Soccer Stadium	53	Market	37
District Zapopan	53	Rotary	37
Shopping Center (Patria)	46	District Tlaguepaque	31
Museum	34	Club Guadalaran	31
Bus Station	34	Minerva	30
Shops Downtown	30		
Shopping Center (Alcade)	30		
Market	30		
Newton			
Town Hall	68	Shopping Center	100
Cinema	59	Highland Avenue	60
Grocery	55	Friend's House	48
Fire Department	55	Town Hall	44
Police Station	50	Own House	44
McDonald's	45	Carter School	32
High School	41	Rosemary Pond	28
Carter School	36	Commons	24
Hobby Shop	36	Webster Street	24
Hospital	36	High School	20
Rosemary Pond	32	Church	20
YMCA	32	Grocery	20
Library	32		

ously absent from the free lists. The emergent pattern indicated that (1) some elements appeared as a result of the specific task, e.g., streets; (2) some elements were shared by both tasks, 60%; and (3) the free-listing task was less constraining than the cognitive-mapping task, i.e., generated significantly more elements.

These data raise questions about the position forwarded by some psychologists who have argued that the underlying cognitive structure for any given domain remains stable regardless of the method used to elicit information (Shepard, 1975; Henley, 1969). These findings support recent experimental evidence that the method of experimental elicitation may influence the cognitive structures that are utilized (Rose & Romney, 1979). The results obtained in this experiment demonstrate that two different external representations can be generated, depending on the method used. The two representations are not competing models as in Rose and Romney's work, but overlapping representations with elements in common. It is important to note that in this experiment the data were similar across cultural groups and significantly different across tasks within homogeneous groups, emphasizing that while cognitive maps and free lists produce overlapping data, they are indeed different external representations.

While cognitive maps have been shown to evoke internal representations of cognitive structures, the task has been shown to exhibit a bias when contrasted with other methods in the domain of environmental perception. It is suggested that additional elicitation procedures be employed in other domains as well so that developmental changes in cognitive structuring can be understood apart from the biases of tasks and elicitation techniques.

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