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AUTHOR Ward, Shawn L.; And Others
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ABSTRACT

Although it has been suggested that women are less likely than men to use cardinality in dealing with environmental space, there has been no direct empirical assessment of this claim. If women are less likely than men to use cardinality, it is not clear whether women lack the competence to use a coordinate system of reference or simply prefer another style of direction giving. To examine these issues, male (N=88) and female (N=88) college students' use of cardinal directions was compared when they gave directions spontaneously, and also after they were given instructions to use cardinality. Their use of cardinal directions was also compared when a map was perceptually present and when it had to be memorized. Subjects were assigned to one of three conditions (perception, memory, memory prompted), were shown two maps, and were asked to give directions from one location on the maps to another to an unseen third party. Transcripts of subjects' direction-giving were scored for cardinality, relational terms, mention of landmarks, mention of mileage, and omission and commission errors. The results indicated that when the use of cardinality was not requested, males in both the memory and perception (before prompting) conditions used more cardinal directions and mileage indicators than females and committed fewer omission and commission errors. More cardinal directions were given by both sexes after prompting to use cardinality. These data provide empricial support for the view that males are more likely than females to use cardinality in their direction-giving. (NRB)

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SEX DIFFERENCES IN DIRECTION GIVING: A STUDY OF PREFERENCE AND COMPETENCE

Shawn L. Ward, Nora Newcombe, and Willis F. Overton

Temple University

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Sex Differences in Direction Giving: A Study of Preference and Competence.

Sex differences in spatial ability have been of special interest to psychologists since Maccoby and Jacklin's (1974) identification of them as one of only four "well-established" sex differences in psychological functioning. Most studies of sex differences in the spatial domain use psychometric tests of spatial ability, but sex differences have also been noted on tasks involving memory for large-scale space (Harris, 1981; Newcombe, 1982). Harris (1981) discusses sex difference in the understanding of geographic coordinates, that is, north, south, east, and west, and presents anecdotal evidence that women do not perform as well as men on tasks of reading maps or giving directions, especially when these tasks involve the use of cardinal directions.

Although it has been said that women are less likely than men to use cardinality in dealing with environmental space, there has been no direct empirical assessment of this claim. Bahrick (1983) found no sex differences among college students or alumni in their ability to order campus landmarks and town streets in terms of cardinal directions. However his scoring

procedure gave credit for various erroneous responses leaving the null finding confounded.

If women are less likely than men to use cardinality it is not clear if this is due to a lack of competence to use a coordinate system of reference, or if it is due to a stylistic preference. Thus, the present study was designed to examine, not only the existence of a sex difference, but also its meaning. Men's and women's use of cardinal directions were compared when given spontaneously, and also after the experimenter gave instructions to use them.
If women lacked competence to use cardinality, they would differ from men in either case. On the other hand, if a lower frequency of use of cardinality by females appeared in spontaneous but not directed conditions, this would suggest a stylistic difference between the sexes.

We also compared men's and women's use of cardinal directions when a map was perceptually present and when it had to be memorized. Sex differences are more likely in conditions where tasks are more difficult, so sex differences might appear in memory but not in perception conditions (Newcombe, 1982). On the other hand, if sex differences appeared when maps are perceptually available as well as after they are memorized, this would indicate a fairly general, and perhaps more

functionally important, sex difference.

Despite the fact that memory and reasoning about space have been given much attention in the past decade (Liben, Patterson, Newcombe, 1981; Pick & Acredolo, 1983), little is known about the components of direction-giving. When providing directions various devices can be utilized to orient someone, cardinality being only one possibility. A speaker may give the listener landmarks, for example, "drive until you reach city hall." They could also use directional terms related to the body position of the listener, such as "go left or right." Providing the mileage that would be travelled may be yet another feature of the directions given. While the typical set of directions probable consists of a combination of these devices, it is not known in what proportions.

Some direction-giving devices are supplementary to each other while others are redundant with each other. The direction-giver chooses which devices to include. The directions, "turn left when you reach city hall", are an example of two different features of directions that are both necessary for correct route following. The choice to incorporate redundancy might also be made. For example, use of a landmark and of mileage are not both necessary and the direction-giver may choose

between "turn left at city hall" or "turn left after three miles" or the direction-giver could also say "after three miles, turn left at city hall." Similarly, the use of cardinality and of relational directions are not both necessary since "turn left", "turn north", and "turn left, that is, north" all include the same necessary information about orientation.

Therefore the specific aims of this study were twofold. First, there has been no direct empirical assessment of sex differences in direction-giving. This study examined for the existence and meaning of any such sex differences. Second, since little is known about the components of direction-giving the present research collected descriptive data about how people of both sexes give directions.

One hundred and seventy-six college students, half female and half male participated.

Two maps, Map A and Map B, were constructed for this experiment. Each map was presented in black and white with the points of origin and destination designated in color. In Map A there were five possible routes between origin and destination points; Map B had nine possible routes. Both maps provided a legend for scaled mileage and for cardinal directions.

All subjects were tested individually and

instructed that they would be providing directions to an unseen third party for travel by car from a particular location on a map to another location on that same map. All responses were tape recorded. At the completion of the direction-giving task each subject was asked if he or she had a driver's license and if so, for how long. The imaginary third party to whom subjects gave directions was female for half of the subjects and male for the other half. The order of presentation of maps A and B along with points of origin and destination were counterbalanced.

Subjects were assigned to one of three conditions: Perception; Memory; and Memory Prompted. For the perception condition the subject was allowed three minutes to study one of the two maps. The subject then gave directions with the map still visible. The subject was then allowed three minutes to study the second map and again asked to provide directions. After completion of the second set of directions the experimenter explained the concept of cardinality, and its relation to direction giving. Subjects were asked to repeat their directions as before but to include cardinal directions wherever appropriate. The presentation of the maps was repeated as before.

The subjects in the memory condition were allowed

a five minute period to study each map and were told prior to this study period that their directions would be given from memory. At the end of this study time period, the map was taken from view and directions were recorded. This procedure was repeated for the second map.

The memory prompted subjects followed the same procedure as the memory condition except for being alerted to the concept of cardinality and its relation to direction giving prior to the task. The subjects in this condition gave their directions from memory and were asked to use cardinality wherever appropriate for two trials.

Transcripts of each subject's responses were scored using the following six categories: (a) For Cardinality, a score of 1 point was counted each time a subject mentioned north, south, east, or west; (b) For Relational terms, 1 point was assigned each time any turn was explicitly identified as left or right by the subject; (c) Subjects were given 1 point for each mention of a landmark, that is, road name, traffic light, building, or any intersection described by road names; (d) Each time a subject mentioned the mileage between two locations on a map 1 point was scored. Transcripts were also scored for the two types of errors. (e) For omission errors 1 point was recorded each

time a subject omitted an essential part of the directions; and (f) Commission errors were scored 1 point each time a subject provided erroneous information such as direction to turn left when, in fact, the turn should be a right.

A comparison of direction-giving from memory with that with a map perceptually available, for each of the six dependent measures, is presented in Table 1. Males used more cardinal directions and mileage indicators than females while committing fewer omission and commission errors. That is, without requesting the use of cardinality, males in both the memory and perception (before prompting) conditions provided more cardinal directions than females along with more indicators of the mileage to be travelled. The main effect of condition was significant for the relational, landmark, and omission error variables. For both the relational and landmark variables, subjects' scores were higher with a map perceptually available than in the memory condition. There was a significant sex by condition interaction for both the omission and commission error variables. Females made more omission and commission errors than males in the memory, but not the perception, condition.

A comparison of spontaneous with prompted use of

cardinal direction for each of the six dependent variables from the perception condition, shown in Table 2, yielded a main effect of sex of subject only for cardinality. Males presented more cardinal directions than females. The main effect of instruction was significant for the cardinality, relational terms, landmark, and omission error variables. More cardinal directions were given by both sexes after prompting the use of cardinality. Although the use of cardinality increased tremendously, the number of relational terms, landmarks and errors decreased after prompting to use cardinal directions.

Table 3 presents a comparison of spontaneous and prompted use of cardinal directions under memory conditions revealing a sex difference for the relational terms and mileage variables. For both measures males used more of these variables in their directions than females. A comparison of conditions was significant for cardinality, relational terms, and commission errors. The memory prompted subjects's scores were higher on cardinality and commission errors than the memory condition. The subjects from the memory condition used more relational terms than those in the memory prompted condition.

Correlations between the dependent measures yielded a negative relationship between the cardinality

and relational term variables in each of the three conditions, with significance in only the memory and perceptual (before prompting) conditions. Correlations of driving experience with each of the six dependent measures for the whole sample resulted in a significant positive relationship between driving and relational terms.

The data from this study provides empirical support that males are more likely than females to use cardinality in their direction-giving. In addition, males are more likely to indicate mileage. These sex differences appeared when subjects had maps perceptually available, as well as when the maps were committed to memory.

Given our theoretical framework, the nonsignificant sex by condition interactions for both the perception and the memory conditions would seem to indicate that men and women differ in their competence to use cardinality. Several aspects of the data, however, argue against a strong competence interpretation and may instead support a sex difference in the preference of select features of direction-giving. Although females did not equal males in use of cardinal directions after instruction, both females and males massively increased their use of cardinal

direction in response to prompting. This was not accompanied by a significant rise in errors, except for males in the memory analysis. Thus it appears that females have the competence to use cardinality in direction-giving, but may have a stylistic preference not to. Further support for a stylistic preference in selection of features in direction-giving is reflected in the negative correlations between cardinality and relational terms in each condition.

The question arises of why might men prefer to use cardinal directions more than women. Driving experience as measured in this study, while greater for men, did not consistently correlate with any of the direction-giving variables. It is possible with a more refined measure of the amount of driving, and of driving in unfamiliar areas or areas with complex layouts, driving experience might then disclose associations. Another possible reason for the sex differences in direction-giving might be due to a sex difference in taking geography courses, using a compass, sailing, orienteering, or similar activities in which cardinality is needed. Some recent research has found these activities to be perceived as masculine in sex-typing by undergraduates and have higher male than female participation rates (Newcombe, Bandura, & Taylor, 1983).

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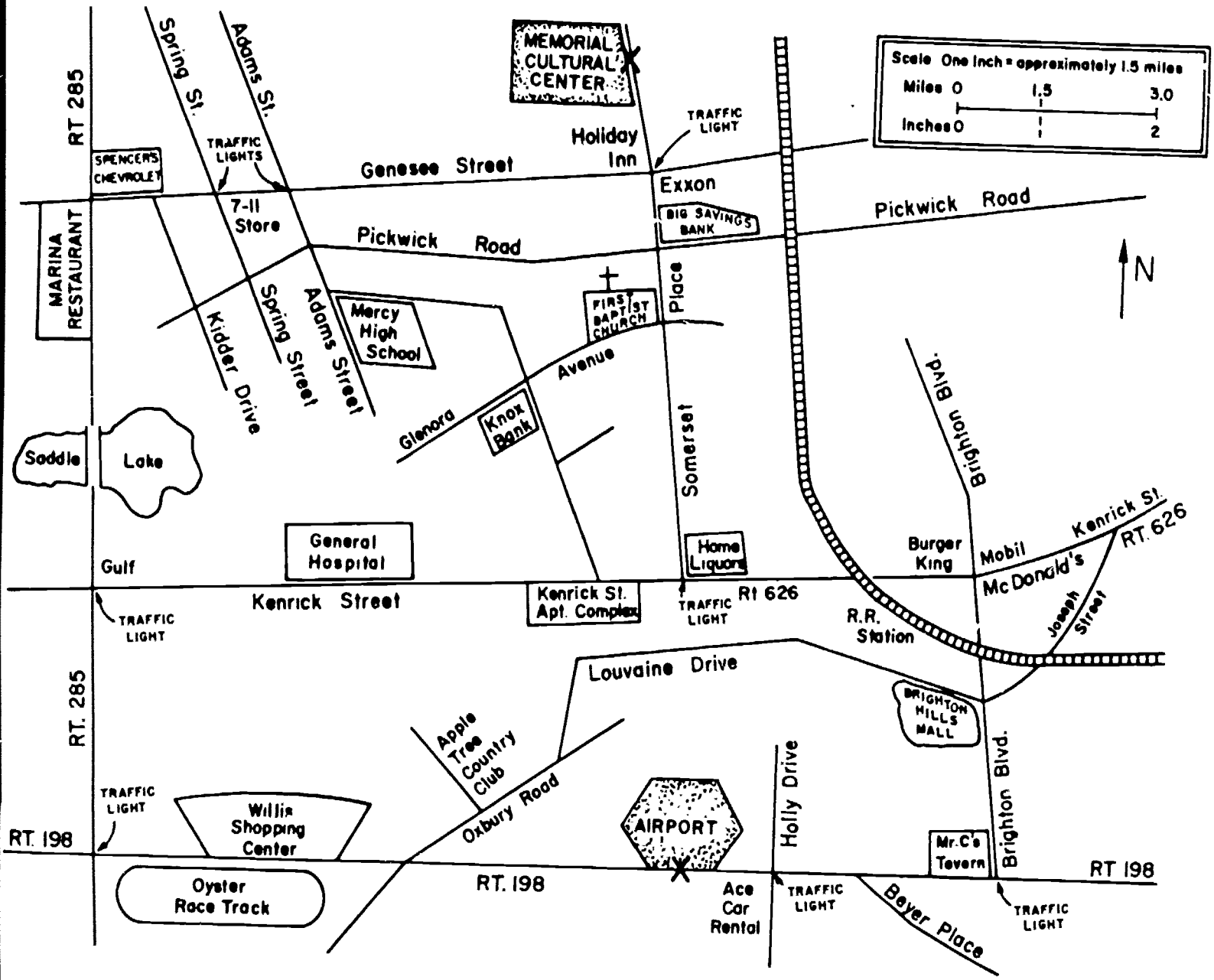
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Adams St.
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SPENCER'S CHEVROLET
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Genesee Street
Exxon
BIG SAVINGS BANK
Pickwick Road
7-11 Store
MARINA RESTAURANT
Pickwick Road
Kidder Drive
Spring Street
Adams Street
Mercy High School
FIRST BAPTIST CHURCH
Place
Avenue
Glenora
Knox Bank
Somerset
Brighton Blvd.
Saddle
Lake
General Hospital
Gulf
Home Liquors
Burger King
Mobil
Kenrick St.
RT. 626
McDonald's
Joseph Street
TRAFFIC LIGHT
Kenrick Street
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TRAFFIC LIGHT
Rt 626
R.R. Station
RT. 285
Louvaine Drive
BRIGHTON HILLS MALL
Apple Tree Country Club
Oxbury Road
Holly Drive
Brighton Blvd.
TRAFFIC LIGHT
Willis Shopping Center
AIRPORT
Mr. C's Tavern
RT. 198
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Oyster Race Track
Ace Car Rental
TRAFFIC LIGHT
Beyer Place
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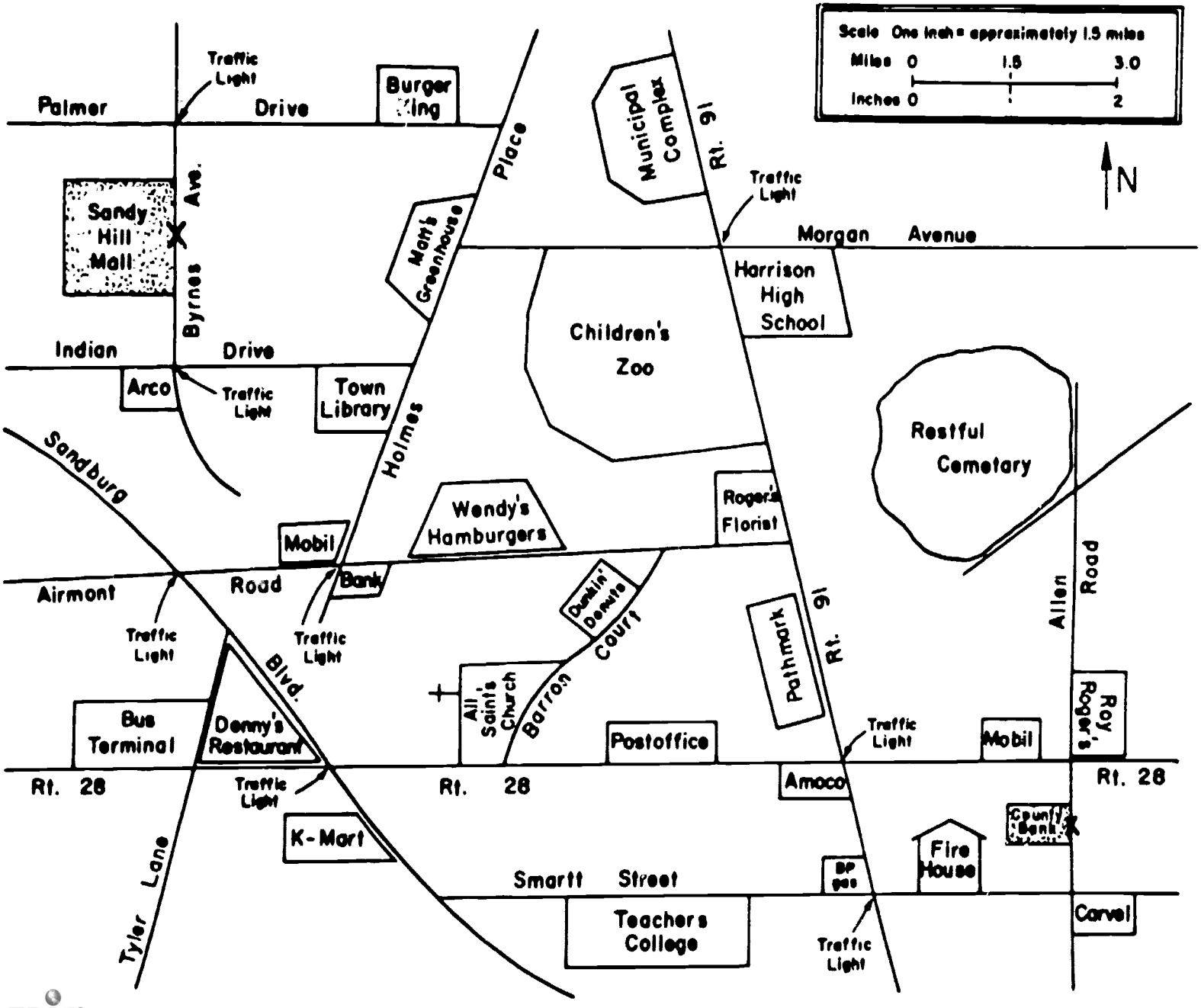
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Traffic Light
Burger King
Municipal Complex
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Place
Sandy Hill Mall
Ave.
Byrnes
Mart's Greenhouse
Morgan Avenue
Harrison High School
Children's Zoo
Indian
Drive
Arco
Town Library
Holmes
Restful Cemetary
Sandburg
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Roger's Florist
Mobil
Airmont
Road
Bank
Dunkin' Donuts
Court
Pathmark
Allen
Road
Blvd.
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Barron
Bus Terminal
Denny's Restaurant
Postoffice
Roy Rogers
Rt. 28
Amoco
Mobil
K-Mart
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Smartt Street
BP gas
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TABLE 1.

MEAN SCORE ON SIX CATEGORIES OF DIRECTION GIVING FOR THE PERCEPTION AND MEMORY CONDITIONS

	PERCEPTION* (N = 64)		MEMORY (N = 80)	
	MALES	FEMALES	MALES	FEMALES
CARDINALITY[A]	1.68 (.15)	0.87 (.08)	1.71 (.15)	0.86 (.08)
RELATIONAL[B]	9.34 (.84)	9.50 (.85)	8.73 (.78)	7.84 (.70)
LANDMARK[C]	26.90 (.49)	26.43 (.48)	15.28 (.28)	14.78 (.27)
MILEAGE[D]	1.00 (.08)	0.68 (.05)	2.07 (.16)	0.48 (.04)
OMISSIONS	.56	.81	1.28	2.85
COMMISSIONS	.74	.84	.53	1.50

*RESULTS BEFORE PROMPTING CARDINALITY INSTRUCTIONS

[A]MAXIMUM WEIGHTED SCORE = 11.17

[B]MAXIMUM WEIGHTED SCORE = 11.17

[C]MAXIMUM WEIGHTED SCORE = 55.11

[D]MAXIMUM WEIGHTED SCORE = 13.30

VALUES WITHIN PARENTHESIS ARE PERCENTAGES OF POSSIBLE SCORES

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TABLE 2.

MEAN SCORE ON SIX CATEGORIES OF DIRECTION GIVING AS A FUNCTION OF SEX AND TREATMENT FOR PERCEPTION CONDITIONS

	BEFORE PROMPTING		AFTER PROMPTING	
	MALES	FEMALES	MALES	FEMALES
CARDINALITY[A]	1.68 (.15)	0.87 (.08)	10.93 (.98)	10.25 (.92)
RELATIONAL[B]	9.34 (.84)	9.50 (.85)	6.62 (.59)	6.50 (.58)
LANDMARK[C]	26.90 (.49)	26.43 (.48)	24.09 (.44)	23.43 (.43)
MILEAGE[D]	1.00 (.08)	0.68 (.05)	1.06 (.08)	1.09 (.08)
OMISSIONS	.56	.81	.03	.13
COMMISSIONS	.74	.84	.96	1.00

[A]MAXIMUM WEIGHTED SCORE = 11.17

[B]MAXIMUM WEIGHTED SCORE = 11.17

[C]MAXIMUM WEIGHTED SCORE = 55.11

[D]MAXIMUM WEIGHTED SCORE = 13.30

VALUES WITHIN PARENTHESIS ARE PERCENTAGES OF POSSIBLE SCORES

TABLE 3.

MEAN SCORE ON SIX CATEGORIES OF DIRECTION GIVING FOR THE MEMORY AND MEMORY PROMPTED CONDITIONS

	MEMORY (N = 80)		MEMORY PROMPTED (N = 32)	
	MALES	FEMALES	MALES	FEMALES
CARDINALITY[A]	1.71 (.15)	0.86 (.08)	7.75 (.69)	7.18 (.64)
RELATIONAL[B]	8.73 (.78)	7.84 (.70)	6.93 (.62)	5.00 (.45)
LANDMARK[C]	15.28 (.28)	14.78 (.27)	13.50 (.24)	14.81 (.27)
MILEAGE[D]	2.07 (.16)	0.48 (.04)	1.62 (.12)	1.31 (.10)
OMISSIONS	1.28	2.85	1.44	1.38
COMMISSIONS	.53	1.50	1.81	1.81

VALUES WITHIN PARENTHESIS ARE PERCENTAGES OF POSSIBLE SCORES