

5-1989

# The Influence of Perceptual Styles on the Accuracy With Which Subjects Correctly Locate States on the United States Map

Linda Sander

*Southern Illinois University Carbondale*

Follow this and additional works at: [http://opensiuc.lib.siu.edu/uhp\\_theses](http://opensiuc.lib.siu.edu/uhp_theses)

---

## Recommended Citation

Sander, Linda, "The Influence of Perceptual Styles on the Accuracy With Which Subjects Correctly Locate States on the United States Map" (1989). *Honors Theses*. Paper 269.

This Dissertation/Thesis is brought to you for free and open access by the University Honors Program at OpenSIUC. It has been accepted for inclusion in Honors Theses by an authorized administrator of OpenSIUC. For more information, please contact [opensiuc@lib.siu.edu](mailto:opensiuc@lib.siu.edu).

The influence of perceptual styles on the accuracy with which subjects  
correctly locate states on the United States map

by

Linda Sander

Southern Illinois University - Carbondale

## Abstract

Using 93 Southern Illinois University students I demonstrated that the perceptual style which a student uses in his learning process has an affect on the accuracy with which he/she locates states on a United States map. Two perceptual styles were looked at: Global and analytic. The influence of other factors, such as sex, country of grade school education, and emotional involvement with states, were also taken into consideration. A significant relationship was found between the variables of perceptual style and number of states missed on the United States map. State preferences was also an issue examined in this study, and the results were consistent with previous studies.

The way people perceive their environment varies from one individual to another. It is a reflection of their surroundings and other aspects of themselves as well. Studies have indicated that people view other parts of the country outside their own in many different ways (Gould & White, 1974). Spatial awareness of the environment is affected by a filtering process we use when environmental stimuli becomes too overwhelming for us to pay attention to all aspects. Our personal experiences and values help us to select which stimuli we will allow to become processed in our brains (Knox, 1987). This gives us a distorted version of reality. Although one person is likely to have a different response to the same environmental stimuli another is being exposed to, large groups of people may share a common image of certain things because of similarities in culture, prejudices, and experiences.

Daniel Wallingford illustrated in his humorous drawings the distorted view of the country which individuals tend to maintain. As New Yorkers and Bostonians draw the United States, their images become increasingly distorted as they move westward on the map (Gould & White, 1974).

We derive a mental map of our immediate environment through our personal experiences, feelings, and prejudices (Knox, 1987). Information about our environment is gained relative to our activity space. An individual's activity space is the movements he/she takes to and from various activity locations daily. We tend to perceive our particular

activity space more accurately than areas we are unfamiliar with. In fact, when rating preferences of where they would most like to live, students prefer their own hometown and the immediate area surrounding it (Gould & White, 1974).

Human behavior is affected less by the way the environment actually is, than how it is perceived. What we see through our own eyes may not be what is actually there, but it is what we believe to be there and we act upon these beliefs. According to Gould and White (1974), Colorado has become the state which most people are moving to because of its images of an open and exciting life and a beautiful landscape.

Furthermore, Colorado was ranked number one in residential preferences by students at Frostburg State College in Maryland. The images students have of the state form the feelings they have toward it (Plutchik, 1984). Interestingly, Colorado was misidentified on a map by many of these same students (Duckson, 1988). This is an example of how cartographic maps and mental maps may differ.

Preferences and images of states and regions tend to be similar across the country. Students in California, Minnesota, and Pennsylvania were remarkably similar in their mental maps of the country. Despite being thousands of miles apart from each other, these three groups were almost unanimous in their perception of geographic space.

All of the students ranked their own local area as that which they

would most prefer to reside in. The second major peak of preference was over the Western part of the country, especially Colorado. Few of the students ranked the Southern states as places they would choose to reside in (Gould & White, 1974).

Students in Alabama continued the trend by indicating a local dome of desirability over their own state. As with the previous students mentioned, California and Colorado were ranked high. However, the Alabama students differed slightly from the others in that they ranked the Southern states each separately, whereas, the other students grouped these states into one large region. This can be attributed to the more extensive travel that people from Alabama would do throughout the South than people in other sections of the country. Travel experience is a factor which will be taken into account in my study as an element of emotional involvement with particular areas of the nation.

The same study was conducted in North Dakota with students from the University of North Dakota. It was the only example in the study in which there was no clear local dome of desirability over the state. Aside from this, however, it conforms to the other maps.

According to Gould and White there is no direct correlation between preferences and accuracy in locating states on a map. However, it is possible that preferences, another sign of emotional involvement with a state, will have an indirect effect on accuracy scores.

Geographical ignorance is a strong example of the educational illiteracy which is plaguing the country. Many people feel that literacy only seems to be declining because of the rising expectations for education over the years. However, a longitudinal study conducted at Frostburg State College in Maryland provides evidence supporting the idea that today's undergraduate students are more geographically ignorant than the students of 20 years ago. Students of the 1980's seem to have a lower level of spatial awareness than the students of the 1960's (Duckson, 1988). This same study, however, indicates through its findings that neither group did very well on a test in which the subjects were required to identify states on a United States map. Residential preferences were also noted by each student, and as in the Gould and White finding, there was no correlation between these two factors.

Other studies which have looked at geographical ignorance have produced some interesting results. A significant gender difference was discovered in a study by Beatty and Tröster (1987). Through five experiments it was consistently found that males scored significantly higher on geographical knowledge tests than did the females. This finding builds on the studies which have earlier indicated that males outperform females on certain visuospatial tasks (Linn & Peterson, 1985), and on measures of accuracy of route walking and map reading (Harris, 1981). In one of the experiments conducted by Beatty and Tröster, efforts were made

to determine if confounding variables may be affecting the gender differences. It was found that the influences of age, education, and the number of regions in which the students had lived had no effect on the gender differences.

Although the gender differences of the 1987 study were consistent across samples taken from thirty different colleges throughout the United States, the magnitude of the gender differences was small. Very few of the students showed superior performance on the map tests.

A recent survey conducted by the National Geographic Society was designed to test the geographical knowledge of American adults as compared to foreign respondents. The Americans had more difficulty than foreign respondents in identifying areas which have been of major importance in the news, such as the Persian Gulf and South Africa. The Americans' geographical ignorance was not only evident in the identification of foreign countries, but many of the respondents could not correctly place many of the 48 contiguous states. With regard to ethnicity, Swedish adults ranked highest in accuracy among all groups. A possible explanation for this is the fact that students in Sweden are required to study geography, quite intensely, at the secondary level. The United States, on the other hand, has eliminated the study of geography in all but two states. Most schools only incorporate it into social studies classes.

Previously, spatial ignorance was studied by Gould and White (1974)



with students in North Dakota. The students had trouble locating all the states except those with distinctive shapes like California, Texas, and Florida, and their own state of North Dakota. There was an especially high peak of ignorance over the Eastern seaboard.

Burris conducted a study in 1970 in which Illinois students showed the same results as the students in North Dakota. Also revealed in the same 1970 study was the fact that Pennsylvania students had difficulty in identifying states in the upper midwest, the south, and the mountain states. This is an example of the tendency for geographic ignorance to rise as distance increases from the state the subject resides in.

Many factors may account for our geographical ignorance. Education is one, but more importantly is the effect our perceptual styles, which we use to learn information, has on our memory of that information. This study looked at the extent to which perceptual styles affect an individual's ability to locate states on a United States map. The assumption was made that all the subjects were taught the locations of the states at least once in their lives.

Perceptual styles are processes that are at all stages of information processing (Witkin, Moore, Goodenough, & Cox, 1977). They affect the way in which we attend to and perceive certain environmental cues and the way we cognitively organize that information (Shapiro, 1965). This organizing and structuring is an important part of learning (Bjorklund,

1985; Svensson, 1984).

Most individuals spend their time processing information in one of two modes of operation (Shapiro, 1965). Psychologists have applied a number of descriptive terms to these. The terms global and holist can be used interchangeably, as can the terms analytic and serialist.

People who possess the holistic style of learning work in a deductive manner and prefer global relations of topics (Pask & Scott, 1972; Pask, 1988). This type of individual is described as being emotional, intuitive, and creative. The holist is ruled mainly by the right brain; whereas serialists are ruled by the left brain. The serialist tends to use step-by-step connections and inductive, focused thinking. He/she is logical and tends to memorize facts when learning a new subject. The serialist is not inclined to move to another topic he/she needs to learn until there is absolute certainty that the topic being studied has been learned. The holist takes a different approach to learning. Rather than learn each new topic separately and completely, the holist brings them together and incorporates them into total understanding of the main topic.

Generally people do not choose to be either analytic or global. Perceptual styles are mainly unconscious approaches to problems and situations. While being analytic in one situation might result in a more successful outcome, using a holistic perspective might be more relevant for another situation. The ability to alternate strategies is desirable.

It was hypothesized that in a task, such as locating states on a map, the analytic person would score higher in overall accuracy than the global person. However, the factor of emotional involvement must be taken into consideration. Following the definition of a holist it would be reasonable to assume that since a holist uses emotions in the learning process, he/she will more accurately locate states which that subject has feelings toward or a connection with. This emotional involvement is operationalized as travel experience, all states the subject has resided in, and all states the subject has family or friends in.

## Methodology

### Subjects

The subjects used in this study were males and females enrolled in three different classes at Southern Illinois University - Carbondale. The first group of students were from an introductory psychology class and were participating in the research for extra credit. The second group was a Criminal Justice class and the third group was an upper level psychology class. The size of the entire sample was 93 subjects.

### Materials and Procedures

The subject was first asked to answer questions on a perceptual styles test to determine if he/she uses a global or analytic approach to learning. The test questions were selected from the Inventory of Learning Processes, a test developed by Cynthia T. Fitzgerald in 1985. The subject was to answer true on all the statements which most accurately applied to that subject in terms of learning in general, rather than taking into account a specific course/class or subject area. If a particular statement did not apply to the subject, it was to be marked false. Seven of the questions pertained to a holist process and ten of the questions dealt with serialist processing. The subject was not made aware of whether a particular statement was holist or serialist.

When the subject had completed the perceptual styles test he/she was

then asked to answer more questions on a second survey. Here the subject was asked age, sex, year in school, ethnicity, and country in which grade school education had been received. As well as being asked to answer these demographic questions, the subject also needed to indicate what states he/she had ever resided in, visited, traveled through, or has friends or relatives in. The last two questions on the survey asked the subject to indicate five states which were considered most preferable to live in and five states that would be least preferable to live in.

The final task of the subject was to indicate the names of all the 48 contiguous United States on a map provided by the examiner. A written explanation of the study was given to each subject at the completion of the test.

#### Data Analysis

First, the perceptual styles test was analyzed and each subject was classified into either a holist category or a serialist category. Because there were only nine serialists in the entire sample, the subjects were reclassified as either more holist or less holist. Each subject's serialist score was subtracted from the holist score to derive a new score. All of these scores were rank ordered and divided at the median. Those subjects receiving a difference score of 25 or less were classified as less holist and those receiving a score above 25 were considered highly holistic.

Next, the number of incorrectly identified states was recorded for each subject. From this information, a comparison was made between the means of the accuracy scores of the less holist group and those of the more holist group. Chi square was used to determine if the two variables were independent of one another or if there was a significant interaction (Wright, 1976). The variable of states was divided into two categories: Less than or equal to 18 states incorrectly identified and greater than 18 states incorrectly identified. This split was determined by rank ordering the number of states missed by each subject and determining the median.

To determine if there was a significant difference in the scores on the map test between males and females chi square was again used. Furthermore, the mean number of states missed by females was compared to the mean number of states missed by males.

Also compared were the missed state scores of students who received their grade school education in the United States with those who were educated outside the United States. Only two students fit into this category; and therefore, this variable was not analyzed statistically.

Another important factor was the emotional involvement each subject had with states in the country. Emotional involvement is operationalized as all states the subject has ever resided in, visited, traveled through, or has family and friends in. Using chi square, a relationship was anticipated between the number of states the subjects correctly identified, the number

of states the subjects indicated having emotional involvement with, and perceptual style.

Using the last two questions on the second survey regarding residential preferences, the 48 contiguous states were ranked from most to least preferred and the results were compared with other studies to determine the reliability of this study. The states were also ranked in order of most often accurately located to least often accurately located.

## Results

The mean number of states incorrectly identified was 18.86. (Figure 1 & 2) The map was divided into four regions which had been specified in previous studies: West, Midwest, South, and East. The West, which consisted of 11 states had a mean number missed of 3.93. The Midwest consisted of 13 states and had a mean number missed of 3.58. Eleven states made up the southern region and the average number of states missed was 3.44. The East, with 13 states, had a mean number missed of 7.98.

Forty percent of the males in the sample incorrectly identified more than 18 states as compared to a larger percentage of females (54.72). Table 1 illustrates the frequencies and percentages for the interaction between gender and number of states missed. The interaction was not found to be significant; chi square=1.432 (df=1), significance=.2315.

There were slight differences between the three classes tested. The Introduction to Psychology students missed an average of 24.2 states. The average for females was 25.6; males missed an average of 19. The upper level psychology class missed an average of 16.8. The female average was 16.5 and the male average was 15.7. The criminal justice class had the lowest average number of states missed, which was 15.8. The females were well above the average with 24.1 and the males were below the average with 13.8. Overall, females missed an average of 22.06 and males missed 16.16.



Table 2 illustrates the relationship between perceptual style and number of states missed. Twenty-seven subjects who were classified as more holist missed less than or equal to 18 states on the map as compared to 17 of the less holist students. The mean number missed by students who were more holist was 15.95 as compared to the less holist average of 22.45. The relationship was found to be significant; chi square=4.545 (df=1), significance=.0330. The correlation between level of holistic learning style and number of states missed was  $-.21$ .

Tables 3a and 3b illustrate the interaction among three variables: Perceptual style, number of states missed, and number of states subjects have some form of emotional involvement with. For those students mentioning 12 states or less, 63.83% missed more than 18 states. Out of the 47 subjects in the sample, 30 were less holistic and 17 were highly holistic. Twenty-one of the less holist subjects missed more than 18 states as compared to 9 of the more holist subjects. Using chi square, the interaction was not found to be significant; chi square=1.368 (df=1), significance=.2422.

Table 3b consists of the sample of subjects who indicated having some form of emotional involvement with more than 12 states in the country. In this sample, 27 of the subjects were less holist and 14 were more holist; resulting in a total of 41 subjects. 70.37% of the more holist subjects missed 18 states or less as compared to 57.14% of the less holist subjects who missed that same number of states. Again, no significance was found; chi

square=.717 (df=1), significance=.3970.

(Table 5) New Hampshire and Vermont were missed 79 times each by the test subjects, making them the most missed states. Delaware was missed by 73 of the subjects, Maryland by 69, and New Jersey by 65. Illinois and Texas were both correctly identified by every subject in the sample. California and Florida were each missed by one subject, and Missouri was missed by nine of the students.

Only two of the 93 subjects received their grade school education outside the United States. Both of the students missed 41 states, which is well above the average number of states missed for all the subjects.

(Table 4) California was preferred by 46 out of the 88 subjects responding to the question of state preferences. Illinois was preferred by 44, Florida by 34, New York by 27, and Colorado by 25 subjects. New York was the least preferred state by 20 of the subjects. California and Idaho were both least preferred by 18 subjects; and Alabama, Florida, North Dakota, and Texas were all indicated as the least preferred state to live in by 17 of the subjects.

## Discussion

As in previous studies, the students tested in this study were shown to lacking in geography knowledge. Only one student in the entire sample of 93 correctly identified all 48 contiguous states. The average number of states missed was 18.86, which is over one-third of the states. When looking at the regions separately, the East showed a significantly higher number of missed states than the other regions. This may be attributed to its distance from the Illinois students. Past studies have shown that as distance increases from the state the subject resides in, the less accurate his score will be when locating states on the map. Students had great difficulty identifying all the states except those with distinctive shapes, such as California, Florida, Texas, and Illinois (the town they reside in). All the other states presumably look alike to the subjects. All five of the states missed the most number of times were in the East. This finding is consistent with past studies (Gould and White, 1974).

Slight gender differences were found in the number of states missed, although the difference was not significant. In all three classes and overall, the males did better than the females. However, neither males nor females displayed superior performance on the map test. These results are consistent with those of Beatty and Tröster (1987).

The average number of states missed by the Introduction to Psychology students was well above the averages of the other two classes. It is

possible that there is a connection between year in school or age and number of states incorrectly identified on the map. This would be an interesting question to consider in further studies.

A definite relationship was found between perceptual style and number of states missed. More holist people tend to learn work in a deductive manner and prefer global relations of topics (Pask & Scott, 1972; Pask, 1988). Less holist people, those who may also be described as serialist, learn in a more inductive, logical way. Students who were classified as more holist had an overall better average than students who were less holist. The average number of states missed by the more holist people was 15.95 and the less holist people missed an average of 22.45.

The number of states a subject had some form of emotional involvement with was also taken into consideration when comparing the missed state scores of the two perceptual styles groups. After rank ordering the number of states been to or visited for each subject, a median of 12 was determined. It was found that the majority of students mentioning 12 states or less were in the less holistic category (Table 3a). When looking at the sample of students who had mentioned more than 12 states, the more holistic people were clearly in the majority, as shown in table 3b. It is not known whether this is a significant observation. Further studies would have to be done to determine if there is a causal relationship between the variables of perceptual style and number of states a subject has been in

contact with.

In comparing the scores of the two groups in the 12 states or less sample, it was found that the less holist subjects missed more than 18 states more often than the more holist people. In other words, the less holist people did not do as well as the people classified as more holist. The second sample of students, those who had a connection with more than 12 states, also showed interesting results. Whereas the less holist subjects' scores were split down the middle, over 70% of the more holist subjects missed only 18 or less states. A question that should be researched more thoroughly is why so few of the subjects displayed a serialist learning style. Perhaps the dividing line between holist and serialist is not as clear as was previously believed. The study seems to imply that most of the subjects possess characteristics of both learning styles. As discussed earlier, having a mix of the two styles and using them flexibly is most desirable. In order to determine more accurately what type of perceptual style each subject uses, a more extensive test would have to have been administered.

Putting all the results together, it seems that the hypothesis of this study was partly correct regarding the interaction between perceptual style, number of states been to or involved in some way with, and number of states incorrectly identified on the United States map. It was found that overall, more holist people do better on a geography test than less holist

people. This does not support the hypothesis that people who learn in a more inductive manner remember information learned in the past better than people who learn in a less focused manner. However, the hypothesis was correct in that the scores of the more holist people did improve as the number of states they had emotional involvement with increased. The scores of the less holist people were not improved by this variable.

Also observed in this study were the states students noted as where they would most prefer to live and least prefer to live. The most preferred state was California. The reason students pick this state may be because of the mental images it creates. The West is seen as warm and sunny; an improvement to many of the students who had to take this test in the middle of winter. Illinois was the second most preferred state, which supports past studies that have shown people tend to prefer their hometown. Florida, another state which conjures up images of warmth and sunshine, was the third most preferred state to live in. New York and Colorado were also mentioned several times by students as states that would be preferable to reside in. Ironically, New York and California were not only indicated as states students would most prefer to live in, but they were also at the top of the list of states least preferred by students. A possible explanation for this phenomenon is that these states are more visible to students than many of the other states in the country. New York is often portrayed by the media and in movies as exciting and

glamorous; the place to go to achieve dreams. This eastern state is also infamous for its crime and fast paced life. California is also depicted by television as a place people can go to start their lives. However, California also has its drawbacks, such as air pollution and rapidly growing population; issues highly publicized to the rest of the country.

This study raises several questions about the connections among the variables of perceptual style, number of states a subject has a connection with, and number of states incorrectly identified on the United States map. Finally, this study is consistent with previous research which has indicated that there is a plague of geographic illiteracy in this country. Educational institutions have a responsibility to heed these studies and increase geographic learning.

Figure 1

# Mean Number of States Incorrectly Identified in Each Region

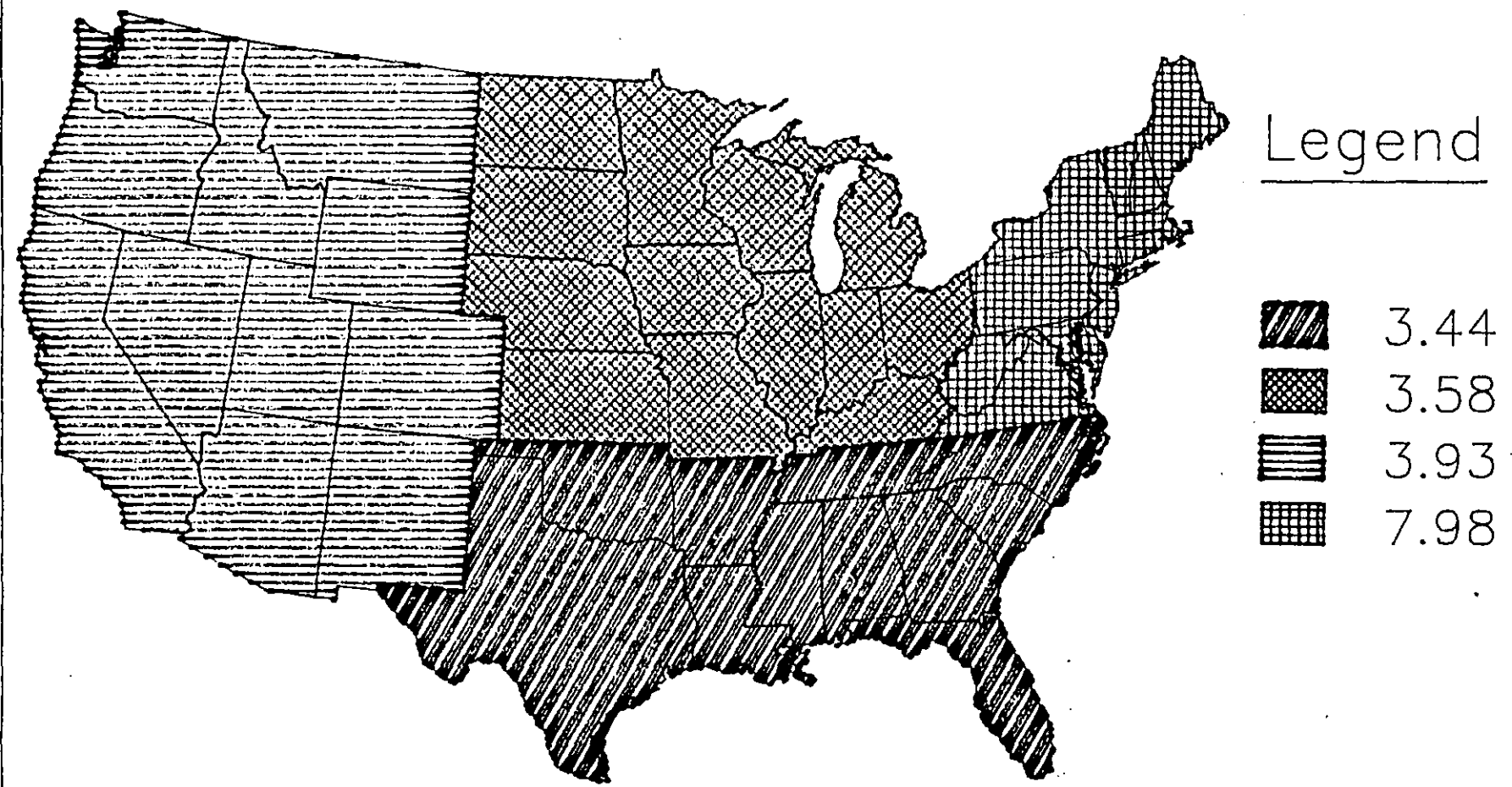




Figure 2

# Map of the Number of States Incorrectly Identified by College Students

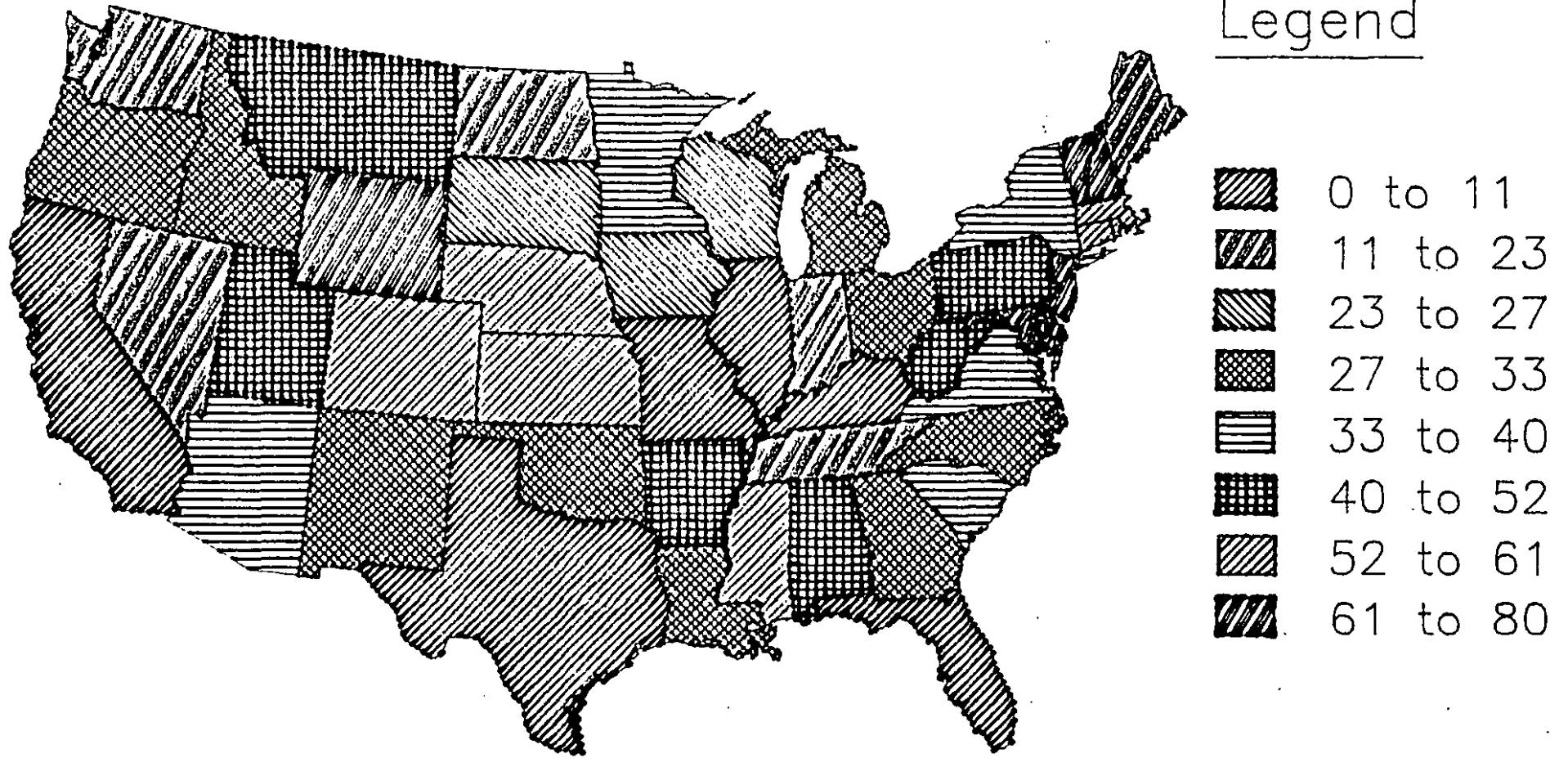


Table 1

Sex	States missed		Total
	≤18	>18	
Frequency			
Percent			
Row Pct			
Col Pct			
<hr/>			
Male	24	16	40
	25.81	17.20	43.01
	60.00	40.00	
	50.00	35.56	
<hr/>			
Female	24	29	53
	25.81	31.18	56.99
	45.28	54.72	
	50.00	64.44	
<hr/>			
Total	48	45	93
	51.61	48.39	100.00

Chi square = 1.432

df = 1

Significance = .2315

Table 2

Category	States missed		
Frequency	≤18	>18	Total
Percent			
Row Pct			
Col Pct			
More	27	17	44
Holist	30.68	19.32	50.00
	61.36	38.64	
	61.36	38.64	
Less	17	27	44
Holist	19.32	30.68	50.00
	38.64	61.36	
	38.64	61.36	
Total	44	44	88
	50.00	50.00	100.00

Chi square = 4.545

df = 1

Significance = .0330

Table 3a

Been to  $\leq 12$  states

Category	States missed		
Frequency	$\leq 18$	$> 18$	Total
Percent			
Row Pct			
Col Pct			
More	8	9	17
Holist	17.02	19.15	36.17
	47.06	52.94	
	47.06	30.00	
Less	9	21	30
Holist	19.15	44.68	63.83
	30.00	70.00	
	52.94	70.00	
Total	17	30	47
	36.17	63.83	100.00

Chi square = 1.368

df = 1

Significance = .2422

Table 3b

Been to >12 states

Category	States missed		
Frequency			
Percent			
Row Pct			
Col Pct	≤18	>18	Total
More	19	8	27
Holist	46.34	19.51	65.85
	70.37	29.63	
	70.37	57.14	
Less	8	6	14
Holist	19.51	14.63	34.15
	57.14	42.86	
	29.63	42.86	
Total	27	14	41
	65.85	34.15	100.00

Chi square = .717

df = 1

Significance = .3970

Table 4

States most preferred

California - 46  
Illinois - 44  
Florida - 34  
New York - 27  
Colorado - 25

States least preferred

New York - 20  
California - 18  
Idaho - 18  
Alabama - 17  
Florida - 17  
North Dakota - 17  
Texas - 17

Table 5  
Number of Students Missing Each State

<u>State</u>	<u>Times Missed</u>	<u>State</u>	<u>Times Missed</u>
Alabama	48	Nebraska	55
Arizona	33	Nevada	13
Arkansas	45	New Hampshire	79
California	1	New Jersey	65
Colorado	53	New Mexico	27
Connecticut	57	New York	35
Delaware	73	N. Carolina	32
Florida	1	N. Dakota	21
Georgia	27	Ohio	30
Idaho	29	Oklahoma	31
Illinois	0	Oregon	31
Indiana	13	Pennsylvania	40
Iowa	24	Rhode Island	60
Kansas	52	S. Carolina	33
Kentucky	10	S. Dakota	23
Louisiana	27	Tennessee	11
Maine	16	Texas	0
Maryland	69	Utah	40
Massachusetts	57	Vermont	79
Michigan	27	Virginia	33
Minnesota	39	Washington	17
Mississippi	52	W. Virginia	47
Missouri	9	Wisconsin	23
Montana	42	Wyoming	61

## References

- Beatty, W.W. & Tröster, A.I. "Gender Differences in Geographical knowledge." Sex Roles, Vol. 16, pp. 565-589, 1987.
- Burris, F. "Patterns of Ignorance of States' Names," unpublished manuscript, Dept. of Geography, Northwestern University, 1970.
- Cunningham, G. "Ten Questions That Shook the Class." Phi Delta Kappan, pp. 158-160, Oct. 1986.
- Duckson, D.W. "Patterns of Spatial Awareness." Journal of Research and Development in Education, Vol. 21, pp. 30-35, 1988.
- Gould, P. & White, R. Mental Maps. Penguin Books Ltd., England, 1974.
- Harris, L.J. "Sex-Related Variations in Spatial Skills." In L.S. Liben, A.H. Patterson, & N. Newcombe, Spatial Representation Across the Life Span: Theory and Application. Academic Press, New York, 1981.
- Knox, P. Urban Social Geography: An Introduction. Longman, Scientific and Technical, U.S., 1987.
- Linn, M.C., & Peterson, A.C. "Emergence and Characterization of Sex Differences in Spatial Ability: A Meta-Analysis." Child Development, Vol. 56, pp. 1479-1498, 1985.
- Pask, G. "Styles and Strategies of Learning." British Journal of Educational Psychology. Vol. 46, pp. 128-148, 1976.
- Pask, G. & Scott, B.C.E. "Learning Strategies and Individual Competence," International Journal of Man-Machine Studies. Vol. 4, pp. 217-253, 1972.
- Plutchik, R. "Emotions and Imagery." Journal of Mental Imagery, Vol. 8, pp. 105-112, 1984.



Schmeck, R. and Geisler-Brenstein, E. "Individual Differences that Affect the Way Students Approach Learning." Learning and Individual Differences, Vol. 1, pp. 85-124, 1989.

Scott, B.A. "The Decline of Literacy and Liberal Learning." Journal of Education, Vol. 168, pp. 105-115, 1986.

Wright, R.L.D. Understanding Statistics, Harcourt Brace Jovanovich, Inc., USA, 1976.