# A STUDY OF MIDDLE SCHOOL STUDENTS' DEPICTIONS OF ROUTES BASED ON VERBAL DESCRIPTIONS AND CUES

Farhat Ara, Ritesh Khunyakari and Chitra Natarajan

Homi Bhabha Centre for Science Education, TIFR, Mumbai, India

*Maps are important in Geography education as well as in everyday experiences of navigating through unfamiliar environments. Indian school education pays some attention to map reading, but little attention to map making that places greater demand on visualization skills. The study reported here attempted to probe the strategies used by middle school students (Class 8, age 13 to 14 years) to translate textual descriptions of routes with turns and landmark location into route maps.*

*Three tasks were administered to 96 students split randomly into two groups (Group A - 47; Group B - 49). In Tasks I and II students had to draw route maps based on given route descriptions. Groups A and B got different versions of Task I: for one group symbols for landmarks were included alongside the words, and the other group's version had no symbols. In Task III students were asked to depict the route from their school to a nearby Bus Depot.*

*Students found it difficult to draw route maps based on verbal descriptions. Their productions showed that most students were not aware of the conventions used in route maps. Students invented symbols and attempted to make them realistic. Most students committed errors in making turns and locating landmarks. This indicated that map making skills among school students needs to be addressed in school education for better understanding in geography as well as better visualization in everyday situations.*

## INTRODUCTION

Our everyday activities involve visuo-spatial thinking in several ways: while recalling the food we ate, reading about descriptions of things, thinking about the people working in our office, navigating from one place to another, or while helping people find their way by giving them route directions.

## MAPS, ROUTES AND THE INDIAN SCHOOL CONTEXT

Navigation is an important aspect of human development. How did early humans communicate with their fellow beings about the location and direction of a food site or possible shelter? At some phase of human development, maps, whether on cave paintings or parchment paper, began to serve as practical guides for location and navigation. As human ventured out to explore the world, way beyond their origin, cartographic maps began to be used, which incorporated more lands and landmarks. Maps, as we know them, make use of objects and space metaphorically to represent elements and relations among them (Tversky, 2001).

Map reading and map making involve different skills. Making a route map involves active visualisation of concrete objects like routes, landmarks and also engages the map-maker in visualising him/herself on the map, a kind of internal perspective. On the other hand, though map reading involves visualisation, the individual reading a map often adopts an external perspective on

the map, seen when the reader orients the map to suit their location. Tversky (2005) reported that when a scene is conveyed by a narrative where the participants are addressed as 'you' and placed them in an environment surrounded by objects then they adopt an internal perspective by constructing a mental spatial framework consisting of extensions of three axes of the body, head/feet, front/back, and left/right, and attaching the objects to themselves. However, when the scene is conveyed by a diagram, participants spontaneously adopts an external perspective on the environment.

The maps in the Indian school contexts, which are limited to the subject of geography, focus on map reading skills, while overlooking the importance of map-making. In geography textbooks of the Maharashtra State Board, the concept of directions is introduced in Class 3 (8 year olds). Map reading, its uses and the concept of sign, symbols and even scale necessary in a map, are all introduced in Class 5. The level of complexity in maps is progressively increased as students go to higher classes. (Maharashtra State Bureau of Text Book Production and Curriculum Research, 2002)

In contrast to map reading, sketching of maps by students based on verbal descriptions or other cues ("Show how I can go from the school to your home") indicate to teachers students' varying images of the route or location. Thus, it becomes a window to students' visuo-spatial thinking.

## Objectives

This paper reports a study carried out on school students' maps based on given verbal descriptions or cues. The descriptions included both locations (landmarks) and navigation. Representations made by students in response to a verbal route description give clues to students' spontaneous use of symbols, icons, etc. for depicting landmarks and streets. They also indicate students' skill in the use of absolute and relative directions and orientations.

The study attempted to probe the strategies used by students to translate textual description of routes and landmarks to representations as maps. It also probed the effect of briefly exposing students to symbols on the nature of route maps made by them.

## METHODOLOGY

A sample of students, who participated in the study were given prior instructions regarding the nature of tasks. Three different tasks were given one after another to the students. All the tasks required students to draw routes based on verbal description or cues. The responses, which were in the form of maps drawn by students, were analysed in terms of different elements outlined in the next section.

Students were given instructions to use paper and pen only for all the tasks. Students were also assured that the tasks were not any kind of drawing ability tests and that they would not be given any grades for these.

## Sample

The sample for the study came from the Atomic Energy Central School No.1 located in the vicinity

of the researchers' institution in Mumbai. It consisted of 96 students from Class 8 (average 13 to14 years), with nearly equal number of boys (49) and girls (47). The students' home languages were all different, while the medium of instruction in school was English. Students' willingness to participate in the study, their proximity to researchers' institution and the researchers' rapport with the school management influenced the selection of the school and sample among the Class 8 students. On request, the 96 students divided themselves into two nearly equal groups, Group A (49, Boys-29, Girls-20) and Group B (47, Boys-20, Girls-27).

## Tasks

Three tasks were administered one after another over about 1.5 hours to each of the two groups. The first task was different for Groups A and B, while the remaining two were identical tasks for the two groups.

*Task 1:* Groups A and B had to draw a route map from a given route description based in an urban context, which included five landmarks (school, hospital, bus stop, church and ice cream shop), three streets and three turns and navigating through them to reach from one locale to another. The description given to Group B was a purely verbal one. For Group A the same verbal description was used with the addition of symbols (both iconic and abstract) for the landmarks alongside the words used to describe them. However, both the groups were given specific instructions to use symbols for landmarks in their drawings.

*Task 2:* The second task was common to both the groups. The descriptions in this task consisted of the same number of streets (3) and turns (3) as the first task but the number of landmarks were doubled (10). It described going from an urban to a rural setting. The students were required to draw a map based on the descriptions for a person who did not understand English.

*Task 3:* The third task asked the students to depict the route from their school to the Bus Depot, a route all must have traversed at some time or another. The context was expected to be familiar to all the students in the sample.

Students could carry out rough and exploratory drawings before they finalised their maps. All their work on a particular task was collected on completion of the task and before assignment of the next task.

## Analysis framework

The drawings have been analysed with respect to the following elements:

Spatial elements:

- Depiction of absolute directions: There were mentions of 2 absolute directions (East and North) given in Task 1 and Task 2. The number of students who had indicated the directions on their page was noted. The number of respondents who committed errors in location or motion at the start was noted.

- Turns: The number of turn errors committed by each student was counted. The number of turns made by each student was also noted.

- Location of landmarks relative to the orientation of motion at that location: This aspect referred to the number of errors committed by each student in locating landmarks.

- Proportions: Distances were provided in the descriptions in both the tasks. The number of students who maintained an overall proportion in their maps was counted.

Graphical elements:

- Use of symbols and icons for landmarks: Number of icons or symbols used by each respondent was counted.

- Types of symbols and icons used for the landmarks and routes: The nature of symbols and icons used by students, whether realistic or abstract, were noted.

The elements in each student's map was recorded in a code sheet, and entered in a spreadsheet for a quantitative analysis. Salient features were recorded as notes and used for a qualitative description of students' productions.

## RESULTS AND DISCUSSION

The salient features of the preliminary findings are given below.

## Spatial elements

Despite the mention of two absolute directions, East and North, in the the description in Task 1 (" come out of the East gate of the school and walk towards the North") and in Task 2 ("walk towards East"; "this road turns North"), only a few (about 8%) drew these on their page to help them orient the route. The students who had not depicted the absolute directions on their paper seemed to have problems in either locating or orienting themselves on the paper. However, it was interesting to note that those who chose to show these directions in Group A, made no errors in the absolute location and orientation of motion but the 4 students in Group B who had depicted absolute directions on paper, made errors in the orientation of motion. Though a sixth of students in Group A who had not shown absolute directions, drew the correct route in terms of absolute directions. In Group B, all the students including those who drew the absolute directions, made errors in the absolute location and orientation of motion. The number of turns made by each student was counted. Among the depicted turns, the number of correct and incorrect turns were counted. Most of the students, who made the turn errors (making a turn in the wrong direction), seemed to expect a turn after every landmark. These turn errors were perhaps due to incorrect interpretation of the phrase like, "Go *down* the street." The word "down" seemed to elicit a sense of change in direction of route, probably in the south direction. Only a fifth of all the students were able to depict the relative location of all the landmarks correctly.

## Graphical elements:

Students both used and invented symbols in their drawing of maps and routes based on given descriptions or cues. They attempted to make them as realistic as they could. In Task 1, when the symbols were provided in the description to Group A, over two thirds of the students used all five of them, while only 3 did not use any symbols for landmarks. Eight students modified the given

symbols and included realism to the iconised symbols. On the other hand, among the Group B that was not provided with symbols, less than half used symbols for all the 5 landmarks, and 4 did not use any symbols. Besides, the symbols used by Group B were more realistic and less abstract (or icons) than those of Group A that was provided symbols. A similar pattern was observed in Task 2 as well.

In Tasks 1 and 2, the symbols used for streets in both the groups varied from single and double dashed lines to single and double solid lines. The streets were shown by most students to end at the start and destination landmarks. For 7 out of the 96 students, the streets were continuous with the landmarks. Some even had their streets going through the landmarks. About a fifth of the students used arrows to indicate directions in the route.

## CONCLUSION

The present study was based on a small sample but it suggests that though Indian students have maps introduced in Class 3 (8 year olds), they are made to focus more on map reading rather than on map drawing which calls for a higher level of spatial visualisation. Even the students of Class 8 found it difficult to draw route maps from textual descriptions, which involved traversing from one locale to another. Map sketching by students can help teachers understand about the nature of visuo-spatial thinking among students, which in turn might also help the teachers know about the diverse images that the students have about their environment and their localities. A preliminary report by Chunawala and Pradhan (1993) on upper primary Indian students' attitude towards school subjects indicated that geography was among the least liked subjects. If we involve the students in activities of map making, perhaps we can motivate more students towards studying geography. Besides, the general visuo-spatial skills developed through these activities will enable students to understand the science descriptions better and equip them for design and engineering as well.

## References

Chunawala, S. and Pradhan, H.C. (1993). A study of students' attitudes to school subjects, a preliminary report. *Journal of Education and Social Change*, Volume VII, No 2 & 3

Maharashtra State Bureau of Text Book Production and Curriculum Research, Pune, (2002a). *General Geography for Class 3-5*

Ibid. (2002b), *Natural Regions, Neighbouring countries for Class 6*

Ibid. (2002c) *World Geography-Part 1 (for Class 7) & Part 2 (for Class 8)*

National Council of Educational Research and Training (NCERT), 1996. *Lands and peoples- Part 1 (for Class 6), Part 2 (for Class 7), Part 3 (for Class 8)*.

Tversky, B.(2001). Spatial schemas in depictions. In M. Gattis (Editor), *Spatial schemas and abstract thought*. Cambridge: MIT Press.

Tversky, B.(2005). Visuospatial Reasoning. In K. Holyoak & R. Morrison (Eds), *The Cambridge Handbook of Thinking and Reasoning*. Cambridge: Cambridge University Press.