Tactile Turtle

Explorations in space with visually impaired children and a floor turtle.

Penny Gay

Peripatetic Support Teacher Cornwall Advisory Service for Visually Impaired Children.

Introduction

Thoughts about using a floor turtle to help visually impaired children learn about space first crept into my mind during a visit to a mainstream infant classroom, where a turtle was being happily pivoted and propelled around the floor. The teacher apologetically explained that an integrated child who had very little sight was excluded from these exciting explorations in space because "she just cannot see the turtle and doesn't understand what's going on".

Yet finding out about space is an essential part of the curriculum for visually impaired children. Whilst, through movement, they may learn where objects are in relation to themselves in a ribbon-like fashion, children who have little or no sight find it difficult to form global spatial images where objects have an existence of their own in relation to each other (Tooze, 1977).

In his book, **Mindstorms**, Papert (1980) claims that turtle activities provide a familiar and manageable context for young children to explore, extend and refine their spatial knowledge. He particularly emphasises the 'syntonic' nature of learning through using a floor turtle — that is, learning related to a child's sense and knowledge of his own body. Visually impaired children, deprived of visual clues, must develop body image, spatial awareness and orientation skills through movement of their own bodies. If this movement is to be meaningful to them, it must be linked to a spatial language. So — could a floor turtle help visually impaired children to find out about space? The challenge lay in making the normally visible activities of a computer-controlled cybernetic animal meaningful also to children with little or no sight.

Turtles and LOGO

A floor turtle (so-called because of its shape) can be moved around the floor by entering commands into a computer. It can be instructed to move forwards and backwards for precise distances and to turn exact numbers of degrees right or left. The two versions of the floor turtle generally used in schools are the Jessop (or Edinburgh) Turtle and the Valiant Turtle.

The Jessop Turtle

The Jessop Turtle is dome-shaped, with a base circumference of about thirty-six inches, so that it is slightly bigger than a large dinner plate. Inside its transparent plastic cover is a motor on wheels and in the centre is a retractable tube which can hold a pen. At the command PEN DOWN, the pen is lowered and leaves a trace as the turtle moves.

The Valiant Turtle

The Valiant Turtle is smaller and more angular than the Jessop Turtle, with a faceted 'shell' and stiff plastic head and legs. However, although it is tactually interesting, a blind child would find it confusing.

All turtles will operate successfully on most surfaces — but they do not like slippery floors or carpets. They can be picked up and taken from place to place; they can knock things down and push objects along; they can be manoeuvred around obstacles and propelled up and down gentle slopes; and they will draw shapes on paper by tracing the route taken.

Before introducing the floor turtle to visually impaired children there had to be adaptations to the equipment itself — the turtle and the computer. I had decided to use a Jessop Turtle: although it was visually indistinct, it was large and simple in shape; it seemed natural and comfortable to rest palms and fingers lightly on its smooth dome and because of its round base it was possible to judge the turns as being part of a circular movement — much as you judge the rotation of your body in facing movements. To make more of a visual impact for children with partial sight, the turtle was covered in a white silky material which would reflect some light. I hoped that, even to children with limited vision, the turtle might at least appear as a white glowing shape with visible movement. A black base board (1 yard square), edged with a white strip, gave maximum contrast and provided clearly defined boundaries. Coloured ribbons were sewn on the turtle's cover — green down the front, red on the right, lemon (yellow) on the left and blue at the back. The choice of which colour for which direction was based on the idea that green might be associated with 'go' or 'forward', whilst red and right, lemon and left and blue and back had the same initial letters. The turtle also had two large eyes and a tail.

Whilst these adaptations were aimed to give maximum visibility, I still needed to make the turtle more meaningful to children who simply could not see. For them I sewed buttons down the strips of coloured ribbon; the buttons matched the ribbons in colour, so that they did not blur the image for the partially sighted children, but each line of buttons could be identified by touch: the green buttons had ridges and grooves across the whole surface, the red buttons were toggle-shaped, the yellow buttons were round and smooth and the blue buttons had one groove across the middle. Blind children, of course, would also be able to feel the eyes and tail of the turtle.

LOGO

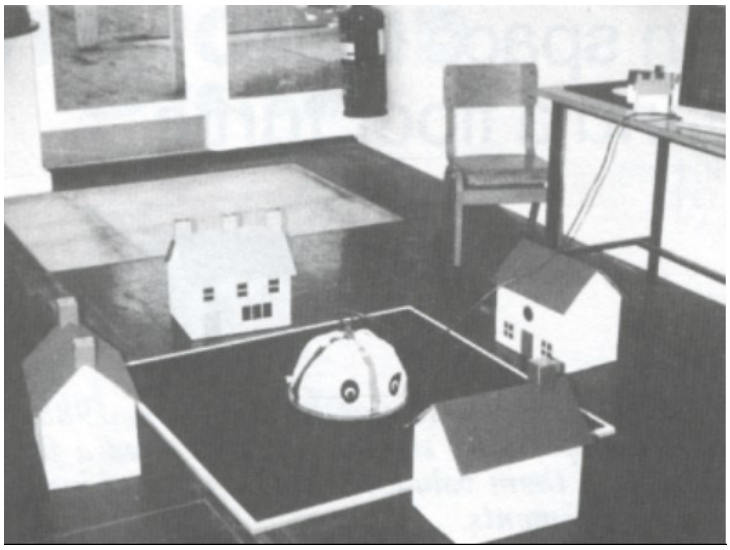
LOGO is the computer language normally used to control turtles. However, a full LOGO programme demands knowledge of the whole QWERTY keyboard. A programme being used with young children in many schools is DART — a subset of LOGO. It does not offer all the features of a full LOGO but, with any BBC computer, it can be used to operate a floor turtle. For the initial activities which I had in mind it seemed ideal, since my main concern was that visually impaired children should have easy access to the command keyboard. DART 2 was the programme required to operate the Jessop Turtle.

By using a DART 2 programme, the essential keys on the computer were the function keys at the top of the keyboard, the number keys in the next row down and the RETURN key. Strips of card, clearly printed or brailled, fixed above the function keys and below the number keys made them easily accessible to partially sighted or blind children. A tactile triangle on the number strip led the fingers down to the RETURN key.

Activities

The early activities had two main aims:

1. To give experience of using the concepts of left and right
    1. From the child's own point of view
    2. Using another person's reference system (in this case the turtle's)
2. To give experience of facing movements — 1/4, 1/2, 3/4 and full turns
    1. To make children aware of the change in the position of objects in relation to themselves as they turn, and thus
    2. To promote awareness of the position of objects in relation to each other.



To give purpose to and understanding of facing movements and positional concepts, four model houses were placed around the edge of the base board, one house in the centre of each side of the square. One house had a green roof and no chimneys, the next, going clockwise, had a red roof and one chimney, the third a blue roof and two chimneys and the fourth a yellow roof and three chimneys. Thus, when the turtle faced the house with a green roof, its ribbons matched the roofs of the houses in colour. Children with some sight could identify the houses by the colour of the roofs, whilst blind children could identify them by the number of chimneys.

There were also four small houses — replicas of the larger models — and these were used firstly with a doll, who stood firmly in the inverted top of a mustard jar and could be rotated to face the different houses, and secondly with a round cardboard disc which represented the turtle.

The doll was used to simulate the moves the children had practised with their own bodies. By turning the doll, the children were able to think in a more objective way about facing movements and were required to use the doll's reference system. For instance, if the doll was facing them, the children would have to put themselves mentally in the doll's position and realise that their left was, in fact, the doll's right. This skill was needed if the children were to control the turtle's movements correctly.

The disc, attached to a square card with a butterfly fastener, had one button at each quarter of its circumference to match each line of buttons sewn on the turtle's cover. It, too, could be pivoted to face the small houses and was used to familiarize blind children with the feel of the buttons and the process of rotating a circular object through 90, 180, 270 and 360 degrees to right and left.

Whilst moving the doll or the disc, the children also verbally rehearsed the commands they would need to enter into the computer in order to produce the equivalent movements in the turtle. For example, they learned that **Right 90** was the command for a quarter turn to the right. Using the doll or the disc, the turns and verbal commands could be made simultaneously; when they came to operate the keyboard the children would not have simultaneous finger-tip contact with the turtle and would be required to think in a more abstract way. This abstract thinking had to be based on the concrete experience of operating the doll and the disc.

Through these preliminary activities I hoped that, before using the computer and the turtle, the children would be familiar with the position of the houses, would have experienced the rotation needed to face each of them, and would know the commands required to rotate the turtle.

Thus prepared, I carried out the following activities with a group of children at the West of England School, Exeter . Of the seven children, whose ages ranged from five to ten years, three were totally blind.

1. Standing on a square raised platform, the children used their own bodies to turn. After each facing movement (1/4, 1/2, 3/4 or full turn to right or left) questions were put to the children about the position of the houses in relation to themselves.
2. The doll and smaller houses were used to carry out facing movements. At this stage it was established that 'A turn (or right-angled turn) would be 90 degrees to the turtle. The children then translated the turns made by the doll into computer language.
3. As 2, but using the cardboard disc with buttons — which came to be called the 'mock turtle'.
4. I introduced the children to the turtle and gave them the opportunity to feel it move forwards, backwards, and turn right and left. I asked them to identify which way they felt the turtle had moved or turned, to estimate how far and to name the command that might have been entered into the computer.
5. I familiarized the children with the computer keyboard and taught them how to give commands to the turtle.

6. The children commanded the turtle to **face** the different houses by entering commands into the computer. Blind children were able to check by touch that they had given the correct command and turned the turtle accurately.
7. They commanded the turtle to face one of the houses and then move towards it — again checking by touch each time to make sure the correct command had been given.
8. More complicated routes were gradually built up from house to house, both by turning in the centre and moving forwards and by going around the edge of the board.
9. The children were asked to command the turtle to wall all around the edge of the board to make a square — this led to the use of the **repeat** and **end** keys to programme a square. Working in pairs, the children could programme the computer, then ask their partners to press the final command, whilst they put hands on the turtle to feel it moving.
10. Partially sighted children commanded the turtle to walk a route clearly marked in white chalk on the black base board. Blind children commanded the turtle to walk a tactile route (string taped on to cards to form simple route patterns). At this stage the children were beginning to link the concept of space with the concept of shape.

At no time in these activities was the pen used to draw the route taken, since this would have been meaningless to blind children and an unnecessary complication for partially sighted children at this stage. The aim was to develop spatial concepts through what Papert referred to as 'body syntonicity'.

Evaluation

The adaptations made to the turtle and the computer keyboard were successful, and in fact the children had far less difficulty in understanding and activating the turtle's movements than I had expected. Particularly rewarding was the obvious enjoyment the children got from the activities. Whether the turtle learning environment actually improves the spatial concepts of visually impaired children needs to be researched. It was not my intention in this project to prove that it does. There are clearly further uses for the turtle, particularly in teaching mathematical concepts which link position with movement in space; for instance, compass directions or concepts relating to the clock face and the position of hands in telling the time.

I am not a computer expert and I am sure there is far more to achieve than I have been able to accomplish. Use of the turtle would be even more enjoyable and meaningful to visually impaired children if the computer could be linked to a voice synthesizer which would speak out the commands as they were entered. Despite exhaustive enquiries, I am still searching for a solution to this. It would mean that the children would be more independent in their use of the turtle, since they would have auditory confirmation that they had entered commands correctly. Auditory feedback would also help to consolidate their learning.

However, even without this refinement, these early and tentative explorations in space would seem to suggest that the turtle deserves further use in this way — if only to ensure that integrated visually impaired children are able to participate in activities with their sighted peers and are involved in experiences in which spatial language and movement are linked in active learning.

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Penny Gay is a Peripatetic Support Teacher Cornwall Advisory Service for Visually Impaired Children. This article contains extracts from an unpublished dissertation from the University of Birmingham , 1988. It describes and evaluates a practical project in which blind and partially sighted children used a floor turtle to find out about space. In particular, the activities gave them valuable experience in using the concepts of right and left and in performing accurate facing movements.

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