Introduction

As visually impaired children are now being integrated into mainstream education, more teachers are finding themselves in the position of having to address issues of graphic literacy (‘graphicacy’) with these children. This article aims to help these teachers by providing a basic introduction to ‘tactile’ graphics, that is diagrams, charts, maps, graphs and so on, that can be felt as well as seen. In our article in PSR 64 we argued that graphic literacy is now expected of any educated adult and that primary school science teachers are in a unique position to lay good foundations for the development of this important communication skill.

Catering for the individual child

Sight problems vary enormously and, by taking a little time to establish the nature of the sight problems of the child in your class, you will be able to play to his or her strengths. While some children have no sight at all, some can perceive the direction of light, and some have partial sight. You are unlikely to encounter a totally blind child in a mainstream primary school, but you may have a partially sighted child in your class. The child may be able to see large objects but not text or, conversely, to see small areas of text but nothing distant. Similarly, he or she may have tunnel vision or the opposite - some peripheral vision but loss of central vision.

Teaching materials need to cater for these variations. Some partially sighted children may benefit from having things enlarged on a photocopier, while others may find that worse. Most will benefit from high contrast between lines and background, and from the use of strong colours. Many will also find it helpful to supplement their limited sight by using touch, although some may feel there is a stigma attached to this.

A child’s sight history is also relevant. Previous visual experience affects what can be comprehended through touch. The child’s understanding of distance, scale and depictions of 3D will be affected by whether they have ever encountered and understood such concepts visually, even at a very young age.

Production of tactile graphics

You may be able to obtain suitable tactile graphics from the RNIB, NCTD (see end) or from a special school near you, or you may need to make your own. It is worth knowing the pro’s and con’s of the three main production methods: swell paper, thermoform, and German film:

Swell paper. This is a special paper coated with invisible capsules containing alcohol. A black image is drawn or photocopied onto the paper which is then heated in a special
developer machine. The black areas absorb heat faster than the surrounding white areas, boiling the alcohol and bursting the capsules. The black areas ‘swell’ permanently and can be felt in relief against the flat white background. Many education authorities have a developer machine as a central resource or you can send flat masters to the RNIB’s Raised Diagram Copying Service. The principal advantage of the method is its speed, although one must guard against the temptation to photocopy and raise diagrams which are not really suited to the tactile medium. The other advantage is the high contrast between the black and white (colour can be added with felt pens or crayons). The principle disadvantage of the method is the lack of variation in height.

Photo shows a swell paper line graph (courtesy of MSU, University of Sussex)

**Thermoform.** This method involves heating a thin sheet of cream-coloured plastic and vacuum-forming it over a raised shape, using a special machine. When the sheet is removed it retains the shape permanently in relief. Relief mouldings of small objects can be made (e.g. keys) but more often the method is used to produce multiple copies of master graphics made with materials such as cardboard, string and wire. The principle advantage of thermoform is that it allows heights up to 2 cm, which helps make the graphic clearer. The principal disadvantages are that producing the masters is time-consuming, the plastic is a uniform colour and does not take felt pens effectively, and the specialist machine is found only in establishments like special schools.

**German film.** This is semi-transparent plastic sheet which can be drawn on using an ordinary biro. The pen leaves not just an ink trace but also a raised line. The main
advantage of this method is that it can be used interactively to create a graphic which children can feel at different stages of production. They can also make their own graphics. The main disadvantages of the method are that there is little variation in line height, and graphics quickly become tatty as the film is flimsy.

Choosing which graphics to 'translate'

It is advisable to adopt a very selective approach in choosing which graphics to 'translate' into tactile form, as the production and use of tactile graphics takes effort on the part of the teacher and the child. Try the following three-step procedure:

1. **Eliminate non-essential graphics.**
   Be critical of the purpose of any graphic. Is it just there to break up the text or does it convey an essential point?

2. **Substitute essential graphics where possible.**
   Keep a scrap box of empty containers, bits of wire, plastic lids, etc., so you can provide visually impaired children with a 'hands-on' explanation of concepts conveyed graphically to sighted children. (A blind child, confused by a raised
line diagram of a coiled spring, understood straightaway when handed a coiled piece of wire.)

3. **Redesign the remaining graphics if necessary.**
   Do not get too disheartened at this prospect: the simpler the better is a good rule of thumb. A few quick squiggles will often produce a much more effective raised graphic than the original!

### Translating visual graphics into tactile form

When considering the design of tactile graphics it is important to remember that touch does not allow such fine discrimination of detail as vision. Tactile information is also often harder to make sense of (e.g. it can be difficult to distinguish between a foreground object and its background). Some rules of thumb for good design are:

- **Focus on the essential point of the graphic:** 'less is more' really is the case here.
- **Do not copy and raise photographs:** substitute with text or a diagram.
- **Avoid line drawings where possible:** e.g. in the classic food chain diagram showing drawings of the animals, use a word label instead.
- **Use filled shapes rather than outlines** (e.g. for maps) - otherwise it can be hard to know whether you are feeling ‘inside’ or ‘outside’.
- **Avoid label lines:** these can get confused with the diagram itself. Put labels on the relevant part, or use a key.
- **Keep lines at least 2 mm apart.**

You can get some idea of the clarity of a tactile graphic by trying it out on someone who has not seen it, but remember that a visually impaired child may be confused by different aspects from a fully-sighted child.

### Using tactile graphics in the classroom

A good tactile graphic is an excellent start but a child will still need to be supported in its use. The following seven-step procedure should help:

1. Check that the child is seated square to the table to ensure consistent spatial orientation.
2. Anchor the graphic to the table to prevent misunderstanding due to orientation changes.
3. Ask the child to ‘sweep’ the graphic with both hands to get an overall idea of the graphic's size and complexity.
4. Briefly explain the purpose of the graphic.

5. Draw attention to any overall organisation (e.g. a circular shape as in the water cycle).

6. Direct attention to specific parts, explaining each in turn, and how it relates to other parts.

7. Allow the child to feel for themselves - they will find this more informative than having their fingers guided all the time.

Conclusion

We hope this brief introduction will give you the confidence to have a go if you find yourself with a child in your class who might benefit from tactile graphics. If you want to know more, a very readable, classroom-oriented book is *Tactile Graphics in Education*.

Sources of further information

- RNIB Customer Services (Raised Diagram Copying Service), P. O. Box 173, Peterborough PE2 6WS (Tel: 0345 023 1534)


- Authors: [http://www.lifesci.sussex.ac.uk/reginald-phillips/index.htm](http://www.lifesci.sussex.ac.uk/reginald-phillips/index.htm)

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Linda Sheppard and Frances Aldrich are research psychologists at the University of Sussex, specialising respectively in the study of memory, particularly how actions during learning affect subsequent recall, and how design of materials affects learning.