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Beyond ‘Draw One and Make it’ – Developing Better Strategies for the Use of Drawing for Design in Key Stages 1 and 2

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Autobiographical note

Gill Hope has been teaching young children since 1973. Since 1986 she has worked at Halfway Houses Primary School, Sheppey, Kent, a three-form entry first school (ages 4–9 years). Gill currently teaches Year 1 children as well as being Design and Technology Curriculum Co-ordinator for the whole school.

Gill’s interest in researching children’s design drawings began whilst she was studying for her M.A. degree with the Open University, when she conducted two small-scale studies. In January 1998 she joined Goldsmiths College, University of London as a research student. Since 1996 she has collected examples of design drawings from over 400 children across several years of their time at Halfway School.

Abstract

There appears to be a mis-match between how real designers use drawing and how design drawing is used by young children in school. Real designers use drawing as an interactive design tool. Many researchers have reported on the inability of young children to see the connection between what they draw and what they are going to make.

From my own observations of teaching 5–9 year olds, it became clear that by age of eight, many children were using their drawings to develop ideas. My key question became ‘Why?’ What is it that an 8-year-old understands about the process of modelling by drawing that a 6-year-old does not?

This paper summarises my observations and thoughts so far and draws on the insights of those who research communication through language as well as those who research design. My proposition is the centrality of analogy in modelling for design.

Key words: (to follow)

Hands on or plan ahead

There are two ways of approaching making something: ‘design-as-you-go’ and ‘design-before-you-start’. Design-as-you-go is more characteristic of young children, artists and craftspersons – using the making as the design medium. Design-before-you-start is the preferred National Curriculum model and typifies industrial enterprise.

Roberts (1992) stresses the importance of seeing modelling in design as “modelling for” *not* “modelling of”. This is an important distinction. Design drawing is ‘modelling for’ – it is a tool to support thinking about future action. To treat drawing as ‘modelling of’ is to place closure on the process.

Pye (1964) comments wryly:

“It must be emphasised that design, of every kind, is a matter of trial and error ... We have to make the things we have designed before we can find out whether our assumptions are right or wrong ... Research is very often a euphemism for trying the wrong ways first.”

But Constable (1994) observed that “more often than not” children are asked to “draw me one then make it” but that they do not see this drawing as “an essential vehicle for channelling thoughts” which appears to be more of a hindrance to the real task of making. It is this interaction between drawing and thinking which professional adult designers find so easy which is so hard-won for the child.

Harrison (1978) quotes the phrase “Letting the tool do the job” from the industrial hand-craft heritage which could equally be applied to the use of drawing which can become a tool and a springboard for future designing. Once the mental image is put on paper, the material image begins to do the job, as each objectification becomes the springboard for the next thought.

In 1996 I began collecting and analysing the drawings done during design and technology lessons which I have conducted in the three-form entry first school (ages 4–9) where I teach. I have examples of work by nearly 400 children, and for about half of them the work spans at least three years of their school life. Sometimes the same task was given to every class in the school, sometimes to a single year group and some were a series of lessons with one class. Other teachers have occasionally given me whole-class sets of drawings when they were especially pleased with them.

It became apparent that the younger children were not using the drawings to develop design ideas. They did a drawing and then made an object, but there was little connection between the two. To what extent could young children use drawing as a tool for thought, not just to show the teacher 'I want to make one of these', but interactively, as a modelling tool to develop their ideas, which is genuinely useful to them? If it were possible to identify the cognitive skills or processes which underlie using drawing as a design tool, perhaps we could enable children to do so more effectively and with greater understanding at an earlier age.

Interactive drawing

Adams (1974) considered that:

“Visualisation, as expressed through the use of drawings, is almost essential in designing physical things well ... and in design it is not until one backs it up with the visual mode that he can see whether he is fooling himself or not.”

Arnheim (1995) says that by making a sketch, the designer provides the mental image with an optical image, which loses the disadvantages of the mental image which is quickly forgotten, but retains the advantage in that it is still fluid:

“Although the sketch stands for a passing stage of the design process, it starts that process and makes the designer examine at leisure what has been done and in what direction future work must proceed.”

However, both Adams and Arnheim are discussing the practice of design professionals, not small children. My observations suggest that amongst young children, drawing ahead of task can appropriately support idea generation but not detailed construction techniques, which Scrivener (1998) terms an “idea sketch”, the first freehand externalisations a designer produces.

Observations of young children drawing for design

Assumptions have been made, however, that the practices of design professionals were of educational application, and frequently the age of the children is unspecified.

Dunn (1990), for example:

“Graphic representations, in the forms of drawings, graphs and charts, are used to convey the design technology process and its results. The child grapples with the difficulty of transferring an idea to a two-dimensional format. Sketching freezes elusive ideas and provides a format for mental rehearsal as the child mulls over possibilities ... Just as a designer or engineer works with multiple drafts, so the child ... the project will evolve, possibly through several drafts ... a final two-dimensional rendering will capture the resulting changes in the original design.”

Stables (1992) observed Year 1 children completely ignoring their drawings of a “home for a spider” once they began making them. Anning (1993) described two 6-year-olds who thought they were giving their drawing to the hamster as a present – they did not understand the drawing to be a sketch of something they would make. Garvey and Quinlan (1997) observed that Year 2 children regarded their design drawings as “wrong” if the teacher suggested improvements.

My own observations confirm these. Children at this age see a drawing as a product – a final outcome. Their agenda for the use of drawing is mastering the genre of conveying three-dimensional objects in a two-dimensional medium whilst also creating pictorial balance on the paper and aesthetic pleasure in the colours and lines. They use each iteration of the current theme – be it dinosaurs or clothes – as a design tool, but it is the perfecting of the drawing which is the aim.

Constable (1994) discusses the requirements of design drawing as needing to be a simple line drawing, probably annotated, with views from different angles and smaller detailed parts drawn separately. Her comments that few choose to use the techniques even though they can do them, is to me the most apposite. In my observations few children, even at the end of Key Stage 1, can satisfy these requirements, except in a very structured task, such as that shown in Figure 1.

This was a mental manipulation task conducted with two classes (60 children) from each of Years 1–4. The children were shown a cardboard box and told to imagine they were going to make it into a car and draw side, top, front and back views, indicating what other materials they would need and to show where they would cut into the box by using a scissors symbol. The example shown is by a Year 2 child.

Figure 2 is the same child’s attempt at designing and making a suitcase for a toy panda (another whole school task). Her

'design' is typical of Year 2 children. There are two attempts because she wanted to get the drawing right (I had given them black biro's so they could not erase anything) but the three-dimensional mock-up does not resemble the 'design'. She simply drew a different shaped suitcase on the thicker paper and cut it out.

Design as internal process

Is their drawing ability too rudimentary, insufficiently developed, to record what they want to make, particularly when combined with their lack of fluency in the medium in which they are going to make the final product? Or is it a lack of awareness of the potential uses of drawing? Is the problem due to the children not having realised the symbolic nature of drawing? The problem is not whether they can do the drawing but whether they can model in one medium (the drawing) and then make a product in a different medium which matches, in its essential characteristics, the drawn model.

Manual skills apart, there appears to be a mental block on the idea of using a drawing as a blueprint for making which is not satisfactorily bridged until around the age of eight. Before this age most children see a drawing as a product, a picture. It has no bearing on the making task for which they have been told that it is the plan. By Year 4 the drawing can support thinking about what to make.

Figure 3 shows a Year 4 child's development of a 'Surprise Box' – the inside of the box was to be linked in some way to the decoration on the outside but in a surprising way. The initial idea was a handbag with mice and insects inside. The word 'mouse' made her think of a laptop carry-case, but what would go inside? Still on insects, she thought of 'worm in an apple' and partway through writing the word 'water' she broke off to think 'drain'. At this point I noticed that she was sitting staring into space and sat down next to her. She drew picture 4 (*see Figure 3*) as we talked – she was linking insects to bugs – computer bugs. We discussed what else had a double meaning – apple/Apple (mac), mouse, chips. She thought for only a few moments after I moved on and confidently drew her final design – a plate of chips with a bug sitting on top and mice attacking from all sides. She made it from a shoe box. It was a computer on the outside with a plate of chips, bug and mouse on the inside.

Younger children frequently do not understand that there can be a connection between what they can draw and what they can make with some other material – they see no analogy between the drawing and the future product. They will conform to the teacher's instructions – make a drawing, make a model – but the drawing does not inform their making unless they are constantly supervised and kept on task.

The underlying skills

Nevertheless, the predisposition towards the use of analogy and symbolism emerges early in life. Young children's play revolves around using one object to represent another. In my Year 1 classroom we made the role play area into 'Treasure Island'. How gleefully the provision of buckets and spades to dig in the 'sand' was greeted. How embarrassed anyone over the age of six would have been to be seen publicly digging into a piece of canvas, filling a bucket with imaginary sand and then turning it out (complete with patting the base) onto a beige curtain. But the children knew what to do; they knew what game to play; they argued whose turn it was and how many sand-pies each child had made before relinquishing the bucket and spade. They came to me in tears when "Laura's already had a go."

Given a stack of scrap paper, the children request sellotape and stapler and make fans, baskets, mats, puppets, and books in which to write lists of who's coming to their birthday party and then roam around collecting names. One boy brought in a 'ghost' he had made with his childminder. It was a piece of tissue paper, draped over a second piece rolled into a ball, tied round with a piece of thread to make a neck and dangled from another length of thread attached to the top of the head. By 10 o'clock half the class had one and were playing with them and conducting conversations through them.

In their playing and their making young children use their perceptions of the similarities between things, the analogies which they perceive all around them, sometimes by serendipity, sometimes by intent, using and combining them playfully and creatively to design a self-propelling, shared world. In this, they are acting in exactly the same way as adult designers.

Models and analogies

I want to suggest that the primary intellectual pathway is in perceiving similarity – between two objects, between a present object or situation and a previously encountered one, or any number of more complex constructs, including the designer's attempt to capture the possible future in the present by exploiting stored mental images.

Gentner (1982) sees models as "structure mappings" from one domain to another but struggles to find a suitable ordinary word which neither has other connotations nor leads into theoretical arguments over semantics, thereby distracting from the real issues:

“There is no good term for ‘non-literal similarity comparison’. The term ‘metaphor’ conveys an artistic or expressive non-literal comparison of a certain form; the term ‘model’ conveys an explanatory-predictive non-literal comparison, often mathematically stated.”

This seems to be parallel to Veale’s (1999) “conceptual scaffolding” which he describes as

“an architectural guide, or blueprint, for the assembly process, but may not constitute an element in the final edifice. That is to say, conceptual scaffolding possesses a transient existence to serve as a temporary representational purpose.”

Tourangeau in Miall (1982) speaks of “creating a parallel system” which also seems to describe the process. It is the ability to think completely in one system and come to logical conclusions about the parallel target system; to think in it, manipulate it, make parallels and juxtapositions and jump back and forth from one to the other. But I suspect that Wittgenstein would be critical of the use of complicating terminology where common words would do. Perhaps his “seeing as” is the simplest and best of all.

Gentner opts for analogy. Lakoff and Johnson (1980) for metaphor (but they can get away with it – they’re discussing language). In Miall’s (1982) tribute to Richards’ work on metaphor, he refers to Richards term: the “interanimation of words” – making metaphor not just a matter of verbal displacement, but “a borrowing between and intercourse of *thoughts*, a transaction between contexts.” It is this liberation into a genuinely cognitive approach, says Miall, which allows Richards to recognise the disparity in metaphor, and to suggest a view of the power of metaphor beyond the limits of words, as such, to sensory images.

Lakoff and Johnson (1980) believe that all human thought is based on metaphor, although I prefer to use ‘analogy’, since that widens the field beyond language into other modes of thought and expression. Seeing the similarities and patterns in things enables us to make the leap from one area of knowledge to another or from one symbol system to another. Analogical fluency allows us to construct in one symbol system a pattern for construction in another: to draw what we will make.

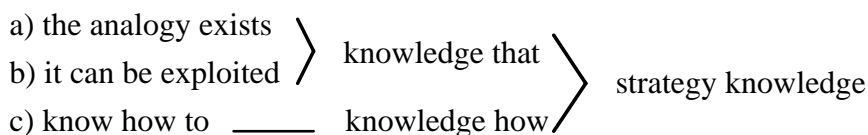
Gentner discusses scientific “explanatory analogies” and compares them to “expressive analogies”. I want to propose that design drawing functions as an exploratory analogy.

Knowing how + knowing that = strategy knowledge

Ryle (1949) divided knowledge into “knowing how” (skills) and “knowing that” (facts). However, factual information about appropriate processes affects the “knowing how” to approach a task. There seem to be inseparably woven threads combining “knowing how” and “knowing that” in the developing mind. One cannot say which comes first, how they might be separated or how they interact.

I think the link between the two, particularly with regard to children’s knowledge about designing, is what I want to call ‘strategy knowledge’ – knowing a particular procedure will work best in the given circumstances. The procedure itself might be classed as ‘know how’ but ‘know that’ is needed to apply it. It is the development of this strategy knowledge that I find fascinating. Children can be taught certain procedures (labelled diagrams, for example) at quite a young age but do not access this procedural knowledge because they do not see its applicability to problem solving.

For drawing and designing, it is necessary to see that



Bruner (1962) refers to Weldon’s distinction between difficulties, puzzles and problems. A problem is solved or a discovery made when we impose a puzzle form on a difficulty to convert it into one with which we can deal. Discovery consists of knowing how to impose a workable “puzzle form” on various difficulties.

Knowing that by drawing it, a problem can be solved, is an imposition of a known puzzle form in Weldon’s sense. However, realising that the task is bigger or more complex than can be visualised mentally and that external support is needed, whether from a drawing, a list or whatever, involves a level of self-awareness or metacognition which young children lack.

Children are unaware of the limits of their visualisation skills. They think they have the answer and start to make something, leave it half done because it doesn't work or change it completely at a whim. By teaching children to objectify and record their mental images, visualise onto paper, we are teaching methodological efficiency for use in a whole range of contexts.

The ability to use drawing as a design tool hinges on seeing the analogy between the designing medium and the making medium, on being able to transfer seamlessly from one to the other and on being able to manipulate one symbol system to develop ideas about something to be created in another. My future research will focus on the development of analogy skills relevant to the designing process with children aged 6–8.

I am taking as my theoretical model an extrapolation of Lakoff and Johnson's model for understanding the interaction of metaphorical understandings (*Figures 4 and 5*). I have applied their schema for 'argument' to 'drawing'. It is, I believe, that as children understand how a drawing can be more than a container for their thoughts that they can take their ideas on a journey by drawing them, that they begin to use drawing, not just as a decorative or recording medium, but as a tool for thought.

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Captions

- Figure 1: Manipulation of mental image – imagine you made this box into a car. Year 2 child.
- Figure 2: Drawing a prototype for Pandy's Suitcase. Same child as Figure 1.
- Figure 3: Design for Surprise Box showing interactive use of drawing – Year 4.
- Figure 4: Lakoff and Johnson's model for metaphorical entailments.
- Figure 5: This model can be generalised to include all process/product words e.g. design, etc.

Figures

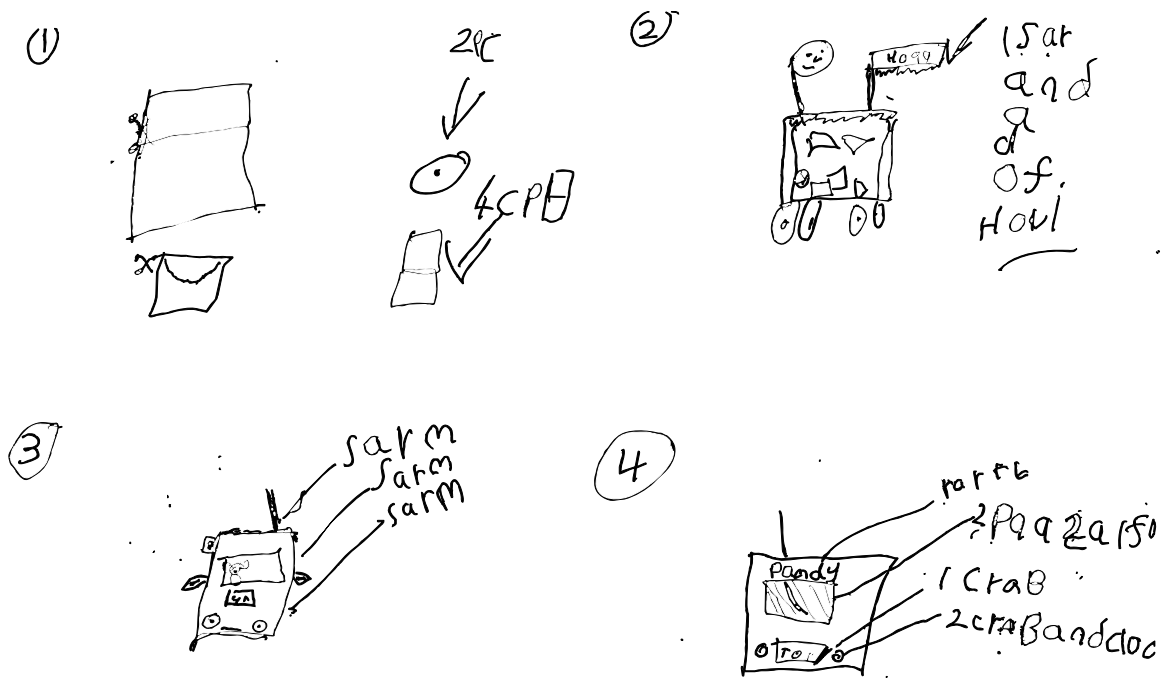
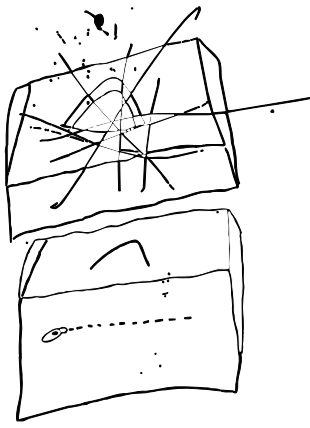


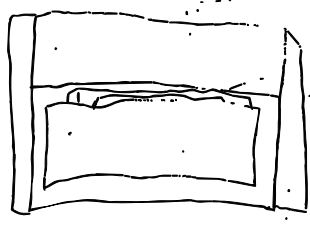
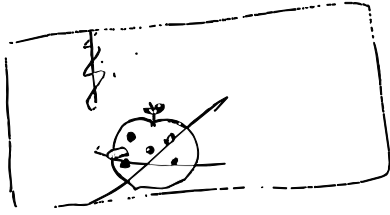
Fig.1. Manipulation of mental image - Imagine you made this box into a car. Year 2 child



Fig.2 Drawing an prototype for "Pandy's Suitcase". Same child as Fig.1.

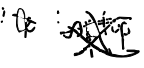


I thought I could do a handbag with a mouse and with insets inside it



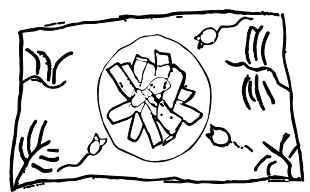
laptop with a drain inside

2.



I thought I could do a laptop and inside I could do a apple with a worm in it like mit. and some ~~the~~ wet

4.

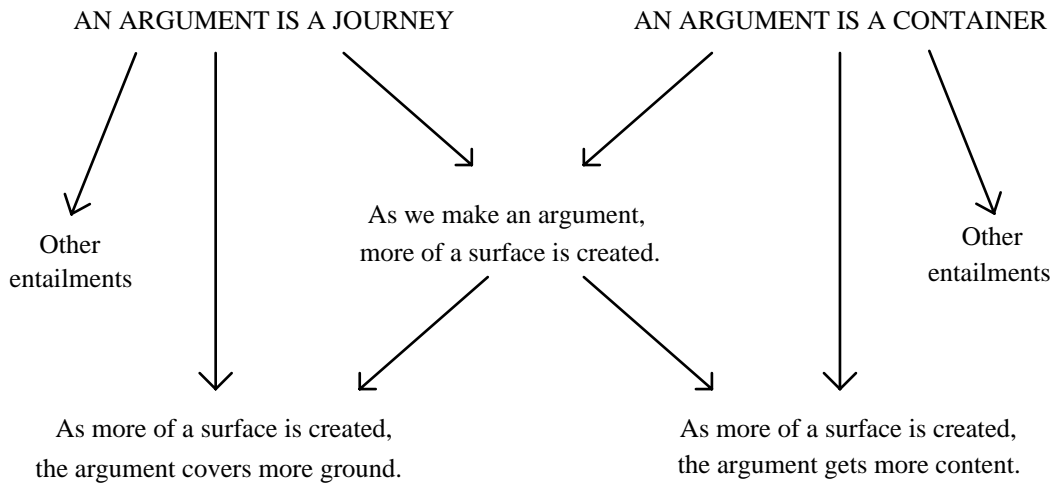


one of the tails from one of the mice will be pulled out of the hole in the box

Nikki

Fig.3 Design for "Surprise Box" showing interactive use of drawing - Year 4.

Fig.4 Lakoff & Johnson's model for metaphorical entailments



This model can be generalised to include all process/product words e.g. design, etc

Specifically (Fig.5):

