

**Multimodal design: the semiotic resources
of children's graphic representation**

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ABSTRACT

In asking how children's graphic representation can be understood as multimodal design, I argue that meaning-making is a complex process of semiotic interweaving. My definition of graphic representation for this thesis embraces the full range of marks made on any graphic surface. Multimodal design is the socioculturally shaped process of transformation where existing semiotic (meaning-making) resources are chosen, shaped and combined according to the individual's interest and his or her perception of the particular representational or communicational need. I propose that graphic representation might be thought about as multimodal compounds (co-present writing and image) and multimodal composites (an integration of the modes that make up the self-contained entities of writing and image).

I explore how texts can be understood multimodally by examining what the semiotic resources of children's graphic representation are, how they carry meaning and how they interrelate. Through in-depth analysis of writing and drawing both discretely and appearing together in the same graphic text, I analyse paper-based and electronic texts produced at home and school for different purposes. I take my interpretations of the signs children have made and my theorization always to be hypotheses.

Language-as-writing and drawing-as-image offer potentialities for different ways of making meaning but common and particularized semiotic modes such as presentation, layout and punctuation operate across graphic representation. These modes work together in a semiotic partnership. I suggest that semiotic principles across modes of communication including and going beyond the graphic might include criteriality, connectivity and salience. This implies the notion of a multimodal disposition. The multimodality of children's graphic representational design has implications for pedagogy, curriculum policy, professional development and the research community.

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CHAPTER 1

INTRODUCTION

A need to reconceptualize graphic representation

Not all features of children's graphic representation are attended to with equal seriousness by teachers, researchers, politicians, parents, and perhaps by children themselves. I use the term 'graphic representation' inclusively to refer to any marks made on a graphic surface irrespective of what they are. Western educational, political and academic discourse which privileges the written word has persisted throughout the twentieth century. This has held back any urgent need to think deeply about children's graphic representation beyond the linguistic. It is not that other features of graphic texts do not exist, nor that they pass by unrecognized, but rather that this discourse values language as the primary source of information and communication. Inherent in such a position is that other means of representation are less significant and, whilst interesting, are not worthy of equal consideration. This distracts attention from other meaningful features of text. Interpretation beyond or without the authentication of words I have found makes people nervous. Meanings made in drawing and the visuality of writing are subject to some caution, if not suspicion, and are not invested with the same level of trust. Yet in my study of children's texts, I discovered that if signs (the smallest unit of analysis in which form and meaning are combined in a single entity such as a word or a drawing) are disregarded because they lie beyond that which is conventionally valued the 'fullness' of the communicator's meaning is overlooked. This demands a rethinking of how graphic representation is conceptualized.

Great store is put by the written word in literate societies and competent writing affords access to power (Halliday, 1989, p.78). Privileged by daily literacy lessons and end of key stage testing as well as within subjects across the curriculum, competent writing is essential to educational success. Whereas reading and writing

are explicitly taught, other means of graphic representation are learned more or less informally as children engage with their everyday graphic world. The view that drawing is merely an illustrative embellishment that accompanies the 'real' work of writing has persisted in education (Gardner, 1980, p.149, p.152; Kenner, 2000b, p.69; Millard and Marsh, 2001, p.55). In contrast with frequent judgments about the sufficiency of their written work, children receive little formative feedback on their drawing (Christensen and James, 2000, p.168). Furthermore, until recently, image-based expressions of ideas and perspectives have played a relatively minor role in qualitative research (Prosser, 1998, p.97). Drawing as a means of representing phenomena in these domains is infinitely surpassed by language as writing and speech. Furthermore, little attention is given to other features of text such as how writing and drawing are presented and set out within the graphic surface. Yet these give clues that are vital to understanding sign-making.

Fast-moving advances in distribution and communication technologies are perhaps beginning to force the issue. The intersection between the capabilities of electronic resources and social and cultural shaping of those capabilities is changing what can be done graphically and what texts are. Digital photography, graphics programs and print technology enable writing and image to be brought together and presented in ways that were not possible 20 years ago, and that are now expected in children's books and magazines. Non-fiction texts published over the past decade or so tend to use the double-page spread as an organizing principle; colour pictures dominate, paragraphs can be read in any order and cohesion is achieved by thematic grouping of items (Moss, 2001, p.108). A consequence is that the dynamics between writing and image are changed. Words no longer inevitably dictate the layout of the page, nor do they necessarily take on the greater share of the communicational load. Writing and image are able to do different and contrasting work. Web pages, especially those frequented and made by children, are not necessarily writing accompanied by image, but rather the opposite – images accompanied by words. Computer resources enable people to communicate and publish in ways that have not been possible before. In composing electronic texts, still and moving words and images can be brought together and manipulated with ease. This implies a shift in what graphic

representation is for the current generation of children. That the primacy of language is challenged, even displaced, with the arrival of 'new' technologies is becoming a popular assertion (see, for example, Bolter, 1998, pp.7-9; Snyder, 2001, p.41). For me, it is not necessarily that image and visuality entirely dislodge the linguistic but that there is a shift in the balance and interrelationships between them, and how they are attended to. As words become recognized as one means of communication amongst others, and not always the principal means, this new 'communicational landscape' signals the need for a more expanded understanding of graphic representation.

In the educational domain the written word (and drawing to a lesser extent) holds power. If not disvalued, some signs are perhaps more transparent than others, because transparent overlooked, because overlooked not made analytically explicit, and as a result little understood. Consequently, much is known about some aspects of children's graphic representation and much less is known about others. By no means does my study advocate a supplanting of the linguistic in favour of image. My views, too, are shaped by dominant discourse. Indeed, in the graphic representational world as it has evolved to (currently) be written language is and will continue to be of the utmost importance. Competence and confidence in reading and writing are essential features of being and becoming literate citizens and are fundamental to everyday working and social lives. Yet other features of text are significant for meaning. I do not propose disproportionate attendance to image or graphic visuality. Nevertheless, I am interested in the full range of representational resources that appear in children's graphic texts. For me, all signs 'count' irrespective of what they are. I endeavour to notice multiple ways in which signs have been made and combined, and to attend to the diversity of what the text holds, its 'semiotic range' (Street, 1998, p.16). Identifying and describing resources beyond the linguistic – and even the pictorial – entails suspending the view that some semiotic (meaning-making) resources are ancillary or even unimportant, and attending to the variety of means through which children represent meaning.

The signs of text and the questions they raise

Children's graphic representation abounds with signs – but what are those signs? If graphic representation is more than language (and image), then what else makes up what it is? A 17-word email initiated, composed and sent quite independently by a 6-year-old child was nothing particularly out of the ordinary. Yet it proved intriguing and, in conjunction with other texts, began to raise challenging questions around what graphic representation might be. Linguistic analysis of Kathleen's message using Halliday's (1994) functional grammar opened up ways of understanding her wording. Yet this was not enough. There was more there waiting to be seen, analysed and understood. Kathleen made just one punctuation mark in her initial message, a full stop. At a time prior to automatic capitalization in email, she wrote entirely in lower case with the exception of two occurrences of 'I'. Children are expected to use capital letters for proper names and at the beginning of each new sentence, never mind at the start of a piece of writing. What could this mean? Was this inadequacy, a failed attempt at 'proper' writing? Alternatively, was it a flagrant dismissal of the rules of school-like writing in this home context? If so, why had she felt it apt to ignore what she knew to be 'correct' English usage? Was this quite meaningless or intensely meaningful?

Also perplexing was Kathleen's consistent spacing between some words whilst there were irregularities between others. Why she had done this and what it might mean? Considered in relation to her wording, about which more is known than spacing, possible explanations began to emerge. In presenting my work, some academics rejoined that the action of pressing the space bar is routinized, automatized and subconscious and therefore devoid of meaning. This is possible. If not meaningless, some signs could carry a less intense meaning than others. This would imply layers of signification. However, this raises two key issues. Firstly, who makes the decision about what is meaningful and what is not? Secondly, how are those signs considered to be of lesser significance to be interpreted? My thesis is based on the belief that all signs are meaningful because they are transformations. The individual takes existing culturally available semiotic resources and remakes them according to what is

perceived as needed. No signs can be discounted. It appears to me unreasonable to accept as meaningful only those signs that can be easily explained and to disregard others as meaningless. Thus it was that Kathleen's email began to raise fundamental questions around what counts as meaning.

The signs of children's written texts are multiple. They include the linguistic but they also go beyond. The ways in which textual items are presented and arranged within the graphic space are significant. The problem is that these features are so embedded for proficient readers that they become virtually transparent and are read almost subconsciously. Actually, these semiotic resources are neither mere accompaniments to language nor are they mechanistic compliance with convention. They can be highly significant in enabling particular ways of meaning not possible or not so readily represented linguistically. To disregard their contribution to representation is to neglect clues vital to the sign-maker's meanings. This 6-year-old's message just over one line long, along with other written texts, challenges traditional assumptions about what writing is. If linguistic analysis is not enough to understand the 'fullness' of what a text holds, then what other features of writing are there, what is their function and how are they weighted in the representational load?

Image-based mind mapping produced by 9- and 10-year-olds proved to be a rich source for exploring how they made meaning through drawing. Surprise after surprise emerged as I explored how the children had composed their drawings and the variations in the diagrammatic structures of their maps. Yet, amongst educationalists I met with some apprehension about whether children's drawings could be considered reliable sources of information, or at least as reliable as spoken or written words. On the other hand, the related written accounts which were produced around one week later proved something of a disappointment for the purposes of the evaluation. For me, this was intriguing. Why were the children's drawings (disvalued by some) such a captivating source of interest for me? Why was their writing of an apparently different order from their drawing? As I studied the mind maps and the subsequent written accounts, the different capacities of writing and drawing emerged as a key theme. What did one appear to be doing that the other could not? In other words, how

did their functionalities differ? As I studied the interrelationships between drawing and writing here and in other texts, it struck me that not only is difference important but also similarity. I therefore began to hypothesize that, as writing and drawing are both graphic, they must also share certain features. If so, what might they be?

Understanding the signs of graphic representation

What are the means by which these multiple signs can be identified, described and understood? A semiotic approach (the study of signs) provides the analytical tools to undertake a systematic examination of the 'fullness' of children's texts. Semiotics includes but is not restricted to the study of linguistic signs. In embracing all instantiations of sign-making, it goes beyond words (see, for example, Barthes, 2000). Nevertheless, semiotics in itself does not provide theoretical explanations that can help towards understanding the interrelationships within and between the resources of writing and drawing.

Multimodality provides a way forward. It challenges the assumption of linguistic monism. Multimodality refers to the co-presence of multiple modes. Modes are culturally regularized groupings of semiotic resources. A multimodal approach seeks to understand the different modes that make up representation / communication and how they interrelate. It aims to identify, describe and explain the different specializations of modes and how they can perform different and complementary functions.

The notion of multiple semiotic resources brought together to make meaning cannot be separated from a theory which provides explanations of how meaning is made. Where do the signs of children's graphic representation come from and how are they made? Adopting a sociocultural perspective, I take the view that meaning-making is a culturally and historically shaped social process (Heath, 1983; Street, 1984; Gee, 1992; Vygotsky, 1978; Wertsch, 1998; Barton and Hamilton, 2000). Traditional theories of representation construct graphic communicators as users of existing, culturally developed codes and rules that are learned and applied. Whilst recognizing

that shared mediational resources are fundamental to mutual understandings between communicators, the codified reproduction of signs does not fit with the evidence. A shared social mind accounts for similarities in how children represent meaning but how might variations be explained? Why are there sometimes slight and sometimes considerable differences in children's responses to the same task?

In their science curriculum work 6-year-old children undertook an experiment with a variety of materials to discover which did or did not reflect light. On the basis of their findings they completed a worksheet which entailed drawing one of the reflective materials and writing a sentence from the board. Seemingly, the tight constraints of this graphic activity inhibited the potential for individual thinking. There was a 'sameness' in what the children did. Yet examination of the completed worksheets reveals variations that imply subtle inflections of meaning. This might be construed as individual creativity but this begs the question as to where creativity begins and ends. If it flows in differing degrees, the implication is that there is a moment when it ceases and codified reproduction takes over. This seems to me unsatisfactory. If meaning is being made, creativity must be present in some sense. A theory of representation must be able to offer ways of understanding the creative processes of meaning-making.

Whilst a particular representational instantiation might signify individual choice and shaping of semiotic resources according to a specific perceived need, a sociocultural approach insists that meaning-making resources are the 'common property' of a cultural group. In a social semiotic approach, these apparently divergent perspectives are entirely compatible. Social semiotics provides a basis for understanding sign-makers as socially positioned yet having agency. The worksheet completers' choice of colour and drawing composition were culturally and situationally constrained, yet their pieces of work were freshly created in response to the scientific task. Kathleen chose particular words and put them together in a particular order, and she made decisions about the 'look' of her writing. This was both new and not-new. Her composition was newly made as a means of sharing her good news with her uncle, yet her words and spellings were not at all novel. Representation implies some sort of

complex relationship between the original, innovative and creative and the routine, commonplace and ordinary. The individual makes choices from existing cultural resources not as codified reproduction but in a process of transformation (Kress, 1997). I explore these ideas more fully in Chapter 2 (pp.34-36).

In seeing children's graphic composition as situated within and shaped by sociocultural discourses and processes yet individual and agentive in response to a particular representational event, the notion of design emerges as a key theoretical principle. This approach contests the notion that representation is replicating use of systems of rule-governed code. It suggests that representation / communication is a complex interweaving of semiotic resources brought together in a socially located creative process of meaning-making. Multimodal design entails the choice, shaping and combination of semiotic resources from a range of possibilities as deemed apt to the particular representational need, and always located in historically situated social and cultural practices.

My research question

The overall aim of my study is to open up discussion on how graphic representation might be reconceptualized. My research question is: *how can children's graphic representation be understood as multimodal design?* This idea crystallized as a consequence of my engagement with and reflection on children's graphic texts in conjunction with reading. My fascination with how children write and draw was not new. What was new was an endeavour to understand their graphic representation as multimodal design. Studies on the multimodal processes of meaning-making are beginning to emerge (see, for example, Kress et al., 2001; Lancaster, 2001; Franks, 2003; Kenner, 2003). Whilst semiotic methods for the analysis of images have been developed (Kress and van Leeuwen, 1996) and the relationships between words and (still and moving) images have begun to be explored (see, for example, Kress et al., 2001; Jewitt, 2003; Kress, 2003), to my knowledge there has been no systematic study of the semiotic resources that make up writing and drawing discretely and when they appear together. Multimodal design is a way of accounting for the multiplicity of

signs that are co-present in children's graphic representation. It recognizes that sign-makers negotiate a whole range of semiotic resources as they compose written and drawn texts and it offers a means by which the complexities of graphic sign-making can be understood. My study seeks to identify the range of semiotic resources that constitute graphic representation and how children combine them to orchestrate meaning.

In order to investigate my research question, I ask three questions of graphic representation:

- *What are the semiotic resources?*
- *How do they carry meaning?*
- *How do they interrelate?*

Firstly, I ask *what the semiotic resources of graphic representation are*. Seemingly straightforward, this question proves remarkably complex. It demands definition of the term 'semiotic resources', hypotheses concerning what the semiotic resources of writing and drawing might be and consideration of whether they can be thought of as modes. The very different representational resources of writing and drawing have resulted in long-standing academic traditions of each being dealt with separately, the former mainly by linguists or educationalists interested in language and literacy, and the latter largely by developmental psychologists. Of course, this is highly apt for modes of representation that are so different. Yet, until recently, rarely have they been seriously considered in relation to one another as inter-functional (rather than merely co-present) graphic resources. This fragmentation, along with the privileging of the language of writing, has inhibited thinking about writing and drawing as sharing the characteristic of being graphic. That both writing and image are forms of graphic representation would suggest that there are semiotic resources that they share. If so, the question arises whether these take the same or a different form. Little is understood about what writing and image have in common. Indeed, I believe this is a new question to ask of graphic texts.

Asking *how semiotic resources carry meaning* requires in-depth analysis of individual signs. The signs of graphic representation are infinite because children's interests and motivations are infinite and because each new graphic text is a new design. It is through the study of highly particularized, semiotically particular signs that I examine meaning-making situated in particular social contexts. Understanding how semiotic resources carry meaning is inevitably tied up with their functionality. The issue of similarity and difference again arises. Do writing and image perform functions that are fundamentally different in essence or are there different inflections of similar functions? For example, do only words explain? If drawing can explain, how does it do this and in what ways is that different from writing? Beyond the lexis of language or the lines of drawing, I explore how other graphic resources carry meaning. What are, for example, spacing and diagrammatic structuring able to do that words and individual images cannot, or is it that they do it in a different way? Are certain semiotic resources best suited to certain ways of meaning in that they do some things well and other things less well? These are big questions and not ones to which I provide definitive 'answers'. I *begin* to explore the meanings carried by semiotic resources in a small number of children's graphic texts.

Crucial for understanding multimodal design is *how semiotic resources interrelate* in children's graphic representation. Having identified groupings of semiotic resources as modes and having asked how they make meaning discretely, a critical question is how they are combined and how they work together to co-construct meaning. This is an issue to be addressed both within writing and drawing discretely and when they appear together co-presently. How do features beyond words work with words? How does colour work with the lines of drawing? What happens when writing and image appear together in the same text? Does drawing merely illustrate, even replicate, meanings as writing takes on the dominant role, or is their interrelationship more complex than this? I argue that how modes of representation interweave as multimodal design opens up scope for rethinking how children make meaning graphically.

Original contributions

For me, this study has been an important step in being and becoming an educational researcher and an accepted member of the research community. It has also been a significant learning experience. Semiotic analysis suits the detailed way in which I like to work, multimodality has provided a way into understanding the interrelationship of modes within and between writing and drawing in children's graphic representational design, and the notion of transformation in sign-making has been theoretically illuminating. Beyond this, my study has been an opportunity to explore new ideas, to risk stepping into the unknown, to work creatively and to contribute to what is understood. I have endeavoured to do this in three interrelated ways: through empirical evidence, through methodological insights and through the development of theoretical hypotheses.

Firstly, the texts in my study expand the body of available data in this field. At a time when little research, including educational research at primary level, has been undertaken using a multimodal social semiotic approach, my empirical work offers a particular lens for understanding children's graphic representation. I examine a small but densely intricate collection of graphic texts in detail and endeavour to understand how and why children made particular signs with particular semiotic resources. Exploration of the relationship between the semiotic resources of writing and drawing in children's graphic representation I believe has not been undertaken before.

Secondly, I provide methodological insights. In my interpretation of a range of children's non-fiction texts, I apply the semiotic methods developed by Kress and van Leeuwen (1996). I also endeavour to build on them. I have taken opportunities to be creative and exploratory. For example, my suggestion that drawing 'lexis' (individual images) might be understood through 'criterial form' and 'criterial attributes' (Chapter 4) is a development of their ideas and my notion of shifts in criterial attributes builds on a theoretical tenet posited by Michael Halliday (1989, pp.55-56). I also apply Kress and van Leeuwen's analytical methods developed for image analysis to the visuality of writing.

Thirdly, I develop theory. In critically evaluating current thinking on mode and multimodality, I draw out theoretical issues that have proved problematic for my study. By suggesting possible resolutions, I offer alternative ways of conceptualizing graphic representation multimodally. Others will undoubtedly emerge in time. I also explore alternative definitions of terminology and suggest possible terms to name phenomena which arise newly from multimodal theory, such as ‘intermodal reshaping’ (Chapter 2, pp.39-40). As my theorization endeavours to ‘ferret out the unapparent import of things’ (Geertz, 1973, p.26), I suggest possible ways of thinking about semiotic resources with regard to graphic representation, in particular as common and particularized modes across graphic representation and as common semiotic principles across modes of communication. These are not intended as definitive solutions but rather offer alternative ways of thinking about graphic representational design.

Brief overview of the study

Throughout this study it is my intention that existing theory, my chosen methodology, my empirical research and the implications arising from my analysis work together as a coherent and cohesive whole. The five themes of my theoretical framework – graphic representation, sign, mode and multimodality, semiotic resources and design – are reflected in my thesis title, underpin my research questions, are integral to the analysis of my data and are essential to consequent theoretical, educational and research implications. I aim to present a lucid and reasoned account of the semiotic resources of children’s graphic representation as multimodal design.

In Chapter 2, I set out the theoretical framework for my study. My aims include a clear and concise identification of key ideas in existing and established theory that are relevant to my work, critical reflection on theoretical approaches and concepts, and suggestions of possible terminological and theoretical resolutions to newly emerging or problematic issues. A summary of sociocultural theories in their entirety is beyond the scope of my study and so I draw out a small number of significant themes arising

from key thinkers, particularly those in the field of literacy. I explore traditional and social semiotics and their differing notions of sign as well as more recent theorization of mode and multimodality. Where I feel that more recent ideas are not yet fully settled, I explain why and suggest possible ways forward. The notion of design emerges as a way of understanding children's graphic representation within this framing. My theoretical framework consists of an interplay between existing theories and my response to them as a consequence of my data analysis. Hence, it is a dialogue between the ideas of others and my own.

In Chapter 3, I reflect upon my methodological approach. I specify the criteria guiding my data collection, identify my dataset, give an account of how the texts were gathered, provide contextual detail and explain how I went about my analysis. My intention here is to make transparent how I approach my research. Understanding how texts have been composed is inextricably interrelated with understanding why. My methodology should be understood in relation to the social semiotic and multimodal framework set out in the previous chapter.

As semiotic interpretations, my qualitative analyses are always hypotheses. Working with the signs in the texts, the context of the representational event and the framing of particular social practices, I put forward possible or likely meanings but recognize that there are alternatives. Within a theoretical framing that considers meaning to be anything but fixed and codified, it could only be thus. Since multimodality, a theory in its infancy, is not yet settled, there can be no dogmatic statements of facts or truths about 'correct' ways of thinking about semiotic resources. My three empirical chapters take up the themes of my theoretical framing as I explore the semiotic resources of writing and drawing and endeavour to understand them as multimodal design. I extract the semiotic resources of children's graphic representation by identifying, describing and analysing in detail the richness and complexity of the signs they have made, and then to seek to understand them in relation to one another. Chapter 4 focuses on the semiotic resources of drawing, Chapter 5 on the semiotic resources of writing and Chapter 6 on the semiotic resources of writing and image together. These examples demonstrate children's sophisticated representational

capabilities and the impressive ways in which they have used the semiotic resources at their disposal to communicate effectively.

Graphic representation cannot be understood singularly. Like literacy, it does not belong primarily to the educational domain, only to be downgraded to the less pure instantiations of the home and the community. Just as literacy varies according to different social and cultural domains, graphic representational practices are multifaceted and wide-ranging. Children meet and make a whole variety of graphic texts in their everyday lives. Across these three chapters, I dip into some of the representational diversity of home, school and community, endeavouring to understand semiotic resources across different graphic practices. I explore prescribed curriculum work, texts autonomously produced in the informal settings of home and a school club, and semi-structured materials generated for research purposes, looking for traces of different and shared semiotic resources within and between children's graphic representation. These non-fiction texts span a whole spectrum of functions, genres and modal combinations. Analysis of electronic as well as paper-based texts is a way of understanding similarities and dissimilarities between texts made with different media.

In my final chapter, I endeavour to rethink the relationship between the semiotic resources of writing and drawing in a way that is consistent with my approach to sociocultural theory, social semiotics and multimodality. Whilst many questions remain unsettled, I aim to offer some ideas for reconceptualizing graphic representation. The state of the representational world is neither fixed nor definitive. In view of the shifting graphic experiences of the current generation of children chiefly as a consequence of technological developments and cultural use of technologies, I draw out implications for the educational domain and for the wider research community.

Afterword

Some studies of children's graphic representation make judgments about their 'correctness' or seek to discover developmental patterns. Whilst I am fascinated by the process of enculturation, I do not hold with the view that children's graphic texts are semiotically flawed or maturationally deficient. Rather, I am intrigued by how children go about making meaning because this is an indication of how they perceive the processes and products of sign-making. Endeavouring to understand what they have represented and how may mean suspending an adult view of what texts 'should' do and seeking to appreciate form and meaning from the child's perspective. For me, the important question is: what are children's interests, aims and priorities?

Bracketing convention, I try to understand graphic representation from the child's point of view and thereby to gain insights into their graphic creativity as multimodal design. In a study that holds a belief in the seriousness of children's sign-making, that considers their texts to be intensely meaningful, and that endeavours to understand from the child's perspective, judging their graphic representations as defective is untenable. At all times, I have endeavoured to study the children's texts carefully and respectfully because I owe them care and respect. I only hope that I have done them at least some justice.

CHAPTER 2

THEORETICAL FRAMEWORK

In this chapter I present the theoretical framework for my study. This establishes the way in which I approach and endeavour to understand how children have made meaning with graphic semiotic resources. The chapter falls into five main sections: graphic representation, sign, mode and multimodality, semiotic resources and design. Many of the ideas that form the basis of my work are relatively new. Multimodality has only recently emerged as a means of understanding communication, and my focus on graphic representation is just one aspect of it. Sign-making as transformation is a very particular branch of semiotics which digresses from the notion of meaning-making as codified reproduction. Related to this, design as a means of understanding how children compose texts is a very different approach from that of traditional linguistics. I have adopted this theoretical position after (and with ongoing) critical engagement with reading always in relation to my data. Nevertheless, the new does not emerge from a vacuum but draws on the rich and varied heritage of existing sociocultural theories.

Graphic representation

This study is an endeavour to understand the semiotic resources of writing and drawing discretely but also in relation to one another as multimodal graphic representational design. Immediately, a problem arises. Literacy (or reading and writing) and drawing have traditionally been theorized separately. There is no homogenized body of material upon which to draw. Furthermore, there is an imbalance between the amount of research into drawing as against literacy as well as discrepancies in how they have been theorized and by whom. Until very recently drawing has been of considerably less interest to educationalists than writing and has remained largely the domain of developmental psychologists (see, for example,

Kellogg, 1969; Golomb, 1974; Goodnow, 1977; Gardner, 1980; Willats, 1997). This research has been largely located in Piaget's theories of linear stages of development from the sensory-motor to symbolic thought and concrete operations, through to the logical abstractions of formal operations (see, for example, Piaget and Inhelder, 1966). It has sought to discover a steady, linear, generalizable progression from the graphic marks of preschoolers to the 'proper', 'realistic' drawing of adolescents, and often under experimental conditions. In contrast, 'New Literacy Studies' over the past decade or so has discarded a sole focus on reading and writing as the decoding and encoding of symbols and has adopted a sociocultural approach. The 'New Literacy Studies' group seeks to understand literacy as a social practice that varies according to who is taking part in the literacy event, where, when, how and why. Growing from the seminal work of the Russian psychologist Lev Vygotsky (1896-1934) there has been diversification within the field of sociocultural theory so that it is by no means single and unified. In the brief sections that follow, I have selected out a small number of key ideas developed by leading figures in the domain of literacy and sociocultural theory more broadly that have been formative in my thinking. Interspersed throughout the remainder of the chapter are references from both the domains of literacy and drawing. This is testament to the multidisciplinary character of a multimodal approach to children's graphic representational design.

Literacy events and practices

The American ethnographer Shirley Brice Heath (1983; 1994) studied *literacy events* as a means of investigating the relationship between home literacy practices and children's school experience of and performance in reading. Literacy events are observable episodes where reading and writing play a greater or lesser role (Barton and Hamilton, 2000, pp.8-9), although in practice fixing their parameters may not be entirely straightforward. Heath discovered that literacy events are differentially shaped and understood according to the particular social, economic and cultural community. These situations are 'actively created, sustained, negotiated, resisted and transformed' by participants (Gee, 2000, p.190).

The notion of *literacy practices* is a means of understanding reading and writing as embedded within particular social and cultural practices, structures and discourses (Barton and Hamilton, 2000, p.7). Brian Street (1984; 1993; 1994; 1998; 2003) argues that viewing literacy as the acquisition of technical skills and as an objective, neutral tool that enhances rationality and critical thought (the 'autonomous' model) is inadequate. His 'ideological' model, originally developed virtually concurrently with Heath's notion of literacy events, positions literacy in the social context. Literacy is not singular, fixed and stable but rather literacies (Street tends to use the plural as a means of capturing diversity) are sociocultural constructs that vary according to social and cultural context, discourses of identity, gender and ethnicity, beliefs, lifestyles and their embedding in power relations (Street, 2003, pp.79-80). What literacy is shifts according to context and domain, each with its own rules, practices and procedures (see also Barton and Hamilton, 1998; Barton, Hamilton and Ivanic, 2000). A sociocultural approach recognizes and seeks to understand the variety in how literacies are handled differently by different people in different contexts.

Akin to the idea of literacy practices and events is the work of Dell Hymes (1994). He seeks to understand the 'ethnography of communication' as 'ways of speaking', 'speech communities', 'speech situations', 'speech events' and 'speech acts'. Hymes, too, suggests that spoken language should not be approached as an 'abstracted form nor as an abstract correlate of a community, but as situated in the flux and pattern of communicative events' and that it should be understood in the context of 'cultural values and beliefs, social institutions and forms, roles and personalities, history and ecology' (ibid, p.12). This model has not been systematically applied to drawing but variations across cultures have been found. Elsbeth Court (1992) studied the drawings of children from three geographically separated and culturally distinct ethnic groups in Kenya, each with a different heritage, language, dominant economy and distinctive visual arts. Content (for example, canoes in a fishing community), graphic schema (for example, cross-hatching incised on vessels) and spatial characteristics (for example, crowded decoration) were strongly connected with the particular ethnic culture (ibid, p.58). For the purposes of this study, I would like to suggest that *graphic representational practices* and *graphic representational events* might be an

extension of the idea of speech and literacy practices and events suggested by Dell Hymes and the 'New Literacy Studies' group. This opens up investigation beyond the linguistic to include image and the visuality of text.

Situatedness

James Gee (2003, p.37) suggests that meaning is always situated because it is 'tied to people's experiences of situated action in the material and social world'. The meanings of words (and images, and other graphic signs) are not general and stable but specific and changing as they are created for and adapted to particular situations (Gee, 1999, p.40; Gee, 2002). For Gee, a word that has one meaning in one context can have a quite different meaning elsewhere (Gee, 2003, pp.29-31). Meanings are therefore infinite (Gee, 1999, p.54) because of the vastness of their past instantiations and because they are constantly made, reinforced, remade and transformed.

According to Gee (1999, p.52), these *situated meanings* do not 'just reside in individual minds'. Meaning is intimately linked with the discourses of particular social, cultural and institutional groups. Indeed, Gee (1992, pp.1-49) and others refer to the 'social mind'. Whilst I find these ideas highly seductive, I am wary of social determinism. Within sociocultural constructs, constraints and shapings, individuals retain agency and every act of sign-making is a transformation (an issue I deal with more fully below).

Interlinked with the notion of situated meaning happening in particular social situations and within particular social groups are other conceptualizations of situatedness. Lave and Wenger's (1991, pp.29-34) *situated learning* is not simply about learning by doing in a particular context but rather about participation in multiple activities within a *community of practice*. 'Apprenticeship' is characterized by a deepening understanding of what it means to be a full participant by involvement in all aspects of a community's work processes and genuine contributions where the success of the apprentice's work is subject to the 'real world' outcomes (ibid, pp.61-87). As they work together towards a shared goal, co-participants explicitly and implicitly share understandings about what is done and what that means (ibid, p.98).

Building on this work, and indeed related to Street's identification of 'autonomous' and 'ideological' models of literacy, is the notion of *situated cognition*. Brown, Collins and Duguid (1989, p.32) argue that, whereas the didactic pedagogy of schools treats knowledge as abstract, inert, self-sufficient and decontextualized (something akin to Street's 'autonomous' model), the activity in which knowledge is developed and deployed is neither ancillary to nor separate from learning and cognition but is ideologically shaped. The social practices and contexts in which teaching and learning take place are constitutive of what is learned. Useful, robust knowledge, Brown, Collins and Duguid assert, occurs in the 'authentic activities' of 'authentic cultures' of communities of practice where there are shared ways of thinking and working (ibid, pp.33-37).

'Graphicity' and 'reading'

Being literate in the contemporary world is not just logocentric but also entails understanding of how meaning can be created beyond words. A shift in medium from paper to the screen opens up the possibility of a shift in what graphic representation is. In hypertexts such as websites, CD-Roms, and presentation software, never mind electronic games, writing may no longer be the dominant mode of representation. Still and moving image and sound expand what texts are. For a generation of children whose leisure is dominated by the screen (Russell and Holmes, 1996; Livingstone and Bovill, 1999; Somekh et al., 2002) this has implications for how text is conceptualized. There currently exists no umbrella term for capturing the full breadth of graphic meaning-making in different social contexts. In response, the New London Group (Cope and Kalantzis, 2000) has suggested the idea of *multiliteracies*. This term aims to capture the multiple forms, sites and purposes of communication within cultural, linguistic and textual diversity, civic pluralism and multilayered lifeworlds (Kress, 2000a, p.142; The New London Group, 2000, p.9, p.18). Likewise, Len Unsworth (2001) uses the term 'multiliteracies' to encompass image as well as writing. Whilst the notion of multiliteracies might be helpful, it retains the smack of the linguistic.

‘Graphicity’ was a term I invented earlier on in my studies as a means of embracing all graphic mark-making irrespective of what it is or how it is made. My focus here was on the existence of marks rather than what they are. This is important in a study that endeavours to explore the relationship between modes of graphic representation. The strength of the term ‘graphicity’ lay in being inclusive. No aspect of graphic mark-making could be neglected. Furthermore, it appeared to be applicable to the electronic medium as well as to the page. ‘Graphicity’ was not an attempt to amalgamate writing and drawing – they are clearly separate sign systems. Rather, it aimed to open up ways of thinking about the ‘fullness’ of graphic representation in the sense that all signs are attended to whatever they might be. Although I ultimately decided to abandon this term because of a potential overload of terminology, its sense pervades how I think about my data.

There currently exists no term to encompass that which is done to representation in graphic texts (notwithstanding what it is) by the interpreter or the meaning-remaker. ‘Sign-remaker’ is my ideal solution because it implies interpretation beyond the linguistic, but it is somewhat clumsy. In the absence of an existing or adequate alternative term, I use ‘reading’ (from the Old English *rædan* meaning ‘to discern’) to denote that which is done to words but also more broadly to encompass the process of interpreting image and the visuality of graphic signs. All signs must be ‘read’ with equal seriousness and nothing can be disregarded in a multimodal approach. My use of inverted commas signals interpretation beyond language. A ‘reader’ interprets any sign irrespective of mode. This is not entirely satisfactory. Yet, I have been uncomfortable with the term ‘viewer’ because, unlike ‘reader’, for me it suggests the act of looking rather than the process of interpretation. Likewise, ‘audience’ implies the act of a largely undefined group hearing or seeing a performance. Whilst I use this term occasionally in connection with the mind mapping which was generated for unknown others, many of the texts in my study were shaped with very specific others in mind.

Representational metafunctions

In his conception of language, and this might also be applied to drawing, Michael Halliday (1994, p.xiii) defines the fundamental, functional components of meaning as the ‘ideational’ or understanding of the world and the ‘interpersonal’ or acting upon others in the environment. Combined with these, the ‘textual’ metafunctional component ‘breathes relevance into the other two’ (ibid). A benefit of this conceptualization is that it distinguishes between the ‘what’ and the ‘who for’ (and implicitly the ‘why’) as distinct from the ‘how’ of communication. Whilst Halliday recognizes the interweaving of these three metafunctions, my analysis suggests firstly that the narrowness of the ideational is insufficient to capture the ‘fullness’ of that which is represented and secondly that the textual is of a different order from the ideational and interpersonal.

Representation is the material realization of knowledge and the social – and other things. Graphic signs express the ideational as an individual’s perspectives on the world, never dissociated from the affective and the attitudinal, and always culturally framed and socially shaped. Beyond the restrictions of a narrow view of the ideational as understanding of the world, that which is represented or communicated is always an interpretation that includes the conceptual, the affective, the attitudinal, the ‘perspectival’ and the experiential (and no doubt other things too). This is at all times interpersonally shaped because it is intended for a particular ‘readership’, even if that ‘reader’ is oneself.

In his study of scientific texts, Jay Lemke suggests a slight variation on the Hallidayan model. He specifies semiotic functions as the ‘presentational’ (a state of affairs), the ‘orientational’ (the interactional which includes the interpersonal and the attitudinal) and the ‘organizational’ (the component parts and the whole text) (Lemke, 1998, pp.93-94). Still there is a separation of the textual from ‘content’ or form from meaning. For me, the ideational, attitudinal, affective and so on are meanings that find expression in form, that is, in representation-as-text. Of course, the textual can be described as form, and this can be vital for analytical purposes, but signs are form combined with meanings. That which is to be communicated can only be mediated

through signs as text. Representation is always sign whether as spoken or written words, image, gesture or facial expression. The ideational, attitudinal, affective and so on are realized as sign, and signs are always interpersonally shaped. Representation as text expresses meanings for others.

Representation and communication

In my analysis I found that children's graphic texts are always messages in that they are the conceptual, affective, attitudinal, 'perspectival' and experiential (and more besides) shaped by social considerations. These are mutually constitutive in that content is chosen and composed with a specific someone in mind. All texts are both representation and communication. Whilst recognizing this intimate interweaving, I do make distinctions between the emphasis on one or the other throughout my study. On the whole, and as in my thesis title, I use the term *representation*. My focus is on signs composed to represent an individual's thinking, feeling, experiences, ideas or conceptualizations. Here, communication is implicit. In contrast, *communication* gives prominence to the fact that the text is intended for a particular someone. It shifts towards attendance to social relations and the prediction of another person's interpretation. This is obvious in messages, letters or notes addressed to specific recipients where power relations are more overtly at work. It is more implicit in curriculum texts intended for the teacher when the stress tends to be on representation. In the way in which I use these terms in my study, 'representation' and 'communication' are not identical, nor are they mutually exclusive, but signal a shift in emphasis.

Sign

'Traditional' semiotics: code

It was in the posthumously published notes of the Swiss linguist Ferdinand de Saussure (1857-1913) that the notion of semiology, as *semiotics* was formerly known, was first proposed. He wrote of his work, '*A science that studies the life of signs in society is conceivable [...] I shall call it semiology (from the Greek *sēmeîon* 'sign')*'

(Saussure, 1966, p.16, his italics). Saussure's principal aim was actually to develop a systematic understanding of the 'laws' of language which had the precision of scientific enquiry (ibid, p.1). To this end, he classified phenomena as absolute binaries (Hodge and Kress, 1988, pp.16-17), something that became a fundamental precept of the work of structuralist semioticians. In his polarization of what language is, Saussure argued that *langue* is the socially shared, rule-governed system of lexis and syntax that is the source of *parole*, the infinite utterances of human speech derived from *langue* (ibid, p.9, p.13). His decision to study *langue* as fixed and absolute is an equivalent to Street's 'autonomous' model. Actually, language can only exist as *parole* because it is always ideologically framed.

Saussure proposed that a *sign* is a double entity, 'not a thing and a name, but a concept and a sound-image', a 'mindful' (my term), abstract signified and a material, sensory signifier (ibid, pp.11-12, pp.65-67). *Sign* is a composite of form or *signifier* and meaning or *signified*. The graphic mark carries the idea – or the idea finds realization in the graphic mark. The one cannot exist without the other. This key concept is a fundamental principle of semiotics although how it is understood has given rise to different theoretical and analytical perspectives. It was Saussure's view that word-signs are (generally) *arbitrary* in the sense that any signifier might be chosen to carry the intended signified (ibid, pp.67-68, pp.73-74). The sounds of spoken words and the marks of writing bear no relation to what the thing being referred to is. Signifiers, he argued, are distinguished by difference (for example, 'bag' is not 'big' or 'bad' or 'tag'). A lasting legacy of Saussure's work is the view held by mainstream semioticians that sign-makers are users of existing and stable systems of codes and rules (see, for example, Hall, 1997; Warburton, 1998). I return to this viewpoint presently.

Through his analysis of French popular culture, Roland Barthes (1915-1980) extended the work of semiotics beyond language and began to study other sign systems such as photographs, gesture and music. Barthes developed the notion of layers of meaning. For him, denotation is the literal meaning of an image (Barthes, 1977, pp.42-46). That which is denoted in a magazine photograph (Barthes, 2000,

pp.117-121) or an advertisement (Barthes, 1977, pp.33-37), he argued, corresponds largely to perception of actual people, things and places, the ‘analagon’ (Barthes, 1977, p.17). He considered the denoted message, this first descriptive level, to be comparatively straightforward and fixed like Saussure’s *langue*. Superimposed on this is Barthes’ second level of signification, the connoted message (Barthes, 1977, pp.46-51) or ‘myth’ (Barthes, 2000, pp.109-117). Connotation is located in the wider realms of social ideology and represents the ideas, beliefs and values of a culture. Whilst Barthes himself recognized the inextricable relationship between literal and symbolic messages (Barthes, 1977, p.42), this distinction might not be quite as straightforward as it at first appears. That which is represented is never separate from cultural and ideological discourse (Foucault, 1981; Fairclough, 1992; Fairclough, 1995). As a consequence, signs can only be (made and) understood situatedly. It seems to me that interpretation is not hierarchical in the sense of a linear journey from the denoted to the connoted. Rather, all signs are socially and culturally shaped and any description is a socially and culturally situated interpretation. ‘The relationship between what we see and what we know is never settled [...] The way we see things is affected by what we know or what we believe’ (Berger, 1972, p.7, p.8).

The American philosopher Charles Sanders Peirce (1839-1914) suggested that there are three kinds of signs: symbolic, iconic and indexical (Rose, 2001, p.78). He described signs that are conventional but arbitrary in Saussurian terms as *symbolic* (Hodge and Kress, 1988, p.22). Visual signs in image are generally *iconic* because their signifiers bear likenesses with that which they signify – there is visual ‘equivalence’ (Golomb, 1974, p.34, p.104; Goodnow, 1977, p.25, p.33, p.112). In *indexical* signs the signifier is associated with causality, such as smoke to imply fire or a footprint to show that someone has passed by (Lister and Wells, 2001, p.79). Iconic and indexical signs cannot be deemed arbitrary because there is a relationship between the original thing and its graphic realization. According to Margaret Iverson (1986, p.85), this is important in accounting for visual as against linguistic signification. A crucial idea posited by Peirce was that *semiosis* is a tripartite *process* consisting of the sign, its object and its ‘interpretant’ (Hodge and Kress, 1988, p.20).

It is action rather than a linguistic structure or code. Sign, object and interpretant are co-related in the semiotic process. Even when a particular interpretation is actualized, 'there always remains an indeterminate range of unactualized possibilities' (Merrell, 1995, p.128). The meanings of signs are never fixed and certain but are always polysemous and constantly subject to change (ibid, p.13).

Social semiotics: transformation

Social semiotics shifts the emphasis to 'ideological complexes' (the sustaining and subversion of hierarchies of power, status and prestige) and seeks to understand sign-making as it happens in particular social contexts (Hodge and Kress, 1988, pp.2-6). It explores how broader social issues such as gender, ethnicity and social class are constructed and reconstructed in sign-making. According to social semiotic theory, it is not that semiosis is subject to the rules of a fixed and absolute code which, because it can be scientifically known, can be used to neutrally decode texts but rather that meaning can only be understood in relation to social practices and social discourse (ibid, p.12). Although Saussure did not disregard the social dimension, this perspective marks an essential shift from his *langue / parole* dichotomy. Children learn to make meaning with the representational resources valued by their culture and saturated with cultural convention in a process of enculturation. Through their experience of graphic texts produced by others and themselves, they learn to adapt that which they wish to communicate to the conventional functionality semiotic resources normally realize.

A fundamental critique of mainstream semiotics is its emphasis on socially enforced structures and codes at the expense of individual meaning-making (ibid, pp.1-2). In a social semiotic approach, mastery of sets of rules as the premise for shared meaning is replaced by an individual's situated semiosis in response to a particular communicational event but always shaped and constrained by the determinations of discourses and practices, and the availability of resources. This position accommodates the sociocultural ideas explored above but recognizes individual agency and argues that these apparently conflicting perspectives can co-exist. Within

the deep-seated habituation of culturally regularized graphic practices there is always agency.

According to Gunther Kress, signs are always *transformations* (see, for example, Kress, 1997, pp.94-96; Kress, 2000b, pp.154-156). This ‘radically different theory of meaning’ (Kress, 2000a, p.142), inspired by the work of Michael Halliday, differs fundamentally from mainstream semiotics (Iverson, 1986, p.84; Kress and van Leeuwen, 1996, p.5). Sign is common to both. The essential difference is that where traditional semioticians see the fusion of signifier and signified as arbitrary, social semioticians consider it to be *motivated*. The combining of material form and mindful meaning is always deliberate rather than a coded replication. This idea contests the traditional semiotic separation of signifier and sign. The sign-maker draws on existing, culturally shaped resources to make meaning. Yet existing resources are never a perfect fit to the needs of the sign-maker and so they must be reshaped. That which is represented is ‘a selection, a reconfiguration, a reshaping, the result of an active, complex process of transformation’ (Jewitt et al., 2001, p.7). The sign that is made is new in the sense that a particular signified has been combined with a particular signifier in response to a specific representational or communicational need. ‘The transformative, re-shaping action is always seemingly present, however invisible’ (Kress, 2000b, p.156). How drawings are composed or how wording is put together is a creative remaking of semiotic resources according to the interests of the sign-maker and what s/he perceives to be apt. ‘Words are not, in my view, ready-made objects or tokens of meaning, which we can simply insert into the chess game of our social interactions. Words are materials out of which we can fashion new signs: and these new signs express our meanings’ (Kress, 1997, p.130). People do not *use* signs – they *make* them. Sign-making is a constant process of transformation which is entirely ordinary.

The origins of word roots and the circumstances in which word-signifiers were invented and became habituated have been largely lost over time. The assumption that this was an arbitrary process is for me contestable. Nevertheless, despite etymological clues about linguistic lexical derivations there appears to me to be some

sense in recognizing the arbitrariness of how particular sounds or graphic marks relate to objects and phenomena *for the speaker or writer*. This, however, is an observation on *signifiers*. In a theory of semiosis as transformation, the signified is always an individual's (culturally shaped) interpretation of a phenomenon combined with a culturally regularized signifier-resource. A sign is consequently always culturally and individually constituted. Transformation is not arbitrary. It always 'reflects and tracks the values, structures, meanings of the social and cultural world of the meaning-maker' (Kress and Mavers, forthcoming). Signs are therefore a complex *mélange* of the interwoven threads of broader sociocultural practices and discourses, the individual's social milieu, the immediate context, the representational event, the available resources and the individual's interest.

This theory of transformation has implications for both individual and cultural change. Firstly, making and remaking meaning transforms individual identity. Sign-making is not without its effects. It shapes individual subjectivity. Every act of meaning is a new response to a particular representational or communicational event based on a person's social, cultural, historical, psychological, physiological and conceptual constitution. It demands some sort of mobilization of previous meaning-making in response to the new rather than the reproduction of learned codes. This has profound implications for how learning is understood. In turn and secondly, individual sign-making has effects on other people and the potential for cultural change on a larger scale. Semiotic resources are not permanently fixed. They are subject to ongoing amendment, alteration and expansion according to wider social acceptance and habituation. The emergence of text messaging (such as CUL8R for 'see you later'), the demise of vocabulary (for example, 'hither and thither' from *The Wind in the Willows* originally published in 1908 (Grahame, 1971, p.9)), the popularization of new meanings for existing words (for example, 'wicked') and the potential abandonment of graphic marks (such as apostrophes) are an outcome of shifting social and cultural practices. Transformation is an unceasing feature of individual meaning-making and changes in practice hold the potential for broader social and cultural effects.

Mode and multimodality

Current theorization

Modes are made up of semiotic resources. Regularities in how people make meaning with semiotic resources in particular historical and cultural contexts are the outcome of habituated social practices. How modes are constituted is dependent on these social practices. According to Gunther Kress and Theo van Leeuwen (2001, p.56), modes are ‘grammars of design’. These *grammars* are semiotically organized and regularized, and have generalized rules for how they can be combined in meaning-making (ibid, p.57). Some semiotic resources are ‘a more or less unordered storehouse of ideas and resources’ available for browsing (ibid, p.112). ‘Grammars, on the other hand, use very broad, abstract classes of items, but provide fairly definite rules for combining them into an infinite number of possible utterances. They are decontextualized and abstract, but also powerful in what can be done with them’ (ibid, p.113). Meta-signs generated by these grammaticalized modes enable the analyst to examine their regularities, to describe how they are organized and to develop theoretical statements (ibid, p.57, p.113). The term ‘grammar’ may prove excessively loaded with existing linguistic overtones. Nevertheless, historically, geographically, socially and culturally located regularity is fundamental to understanding mode.

The affordances and specializations of modes

Different modes are differentially suited to different meanings. They permit certain features of representation and inhibit others. Each mode does certain things best, some things well, other things less well and some things not at all well. The capacities of a mode, its potentialities and limitations for meaning-making, are its *affordances*. The term ‘affordance’ was first conceived by the psychologist James Gibson (1979). He defined it in terms of reciprocity between environment and living thing, for example that the properties of the earth’s surface relative to a particular animal afford support (ibid, p.127). Modal affordance is concerned with the potentialities a mode holds for representation and communication. It is what a semiotic resource can do and what it cannot do, its aptitude for meaning.

How meaning is brought into being, how it is articulated modally has implications for the meanings that are made and that can be remade. Different modes enable different meanings to be made. The clay tokens fashioned by the Sumerians in Mesopotamia at the beginning of the ninth millennium BC for accounting purposes (Olson, 1994, p.72) may have been apt to trade purposes but they could not carry more extended records of beliefs, ideas or narratives. Galileo Galilei's theorems written out as words and subsequent representation as mathematical equations (di Sessa, 2003) might denote the same idea but the shift from the one to the other brings with it different potentialities. The substitution of values and symbols in mathematical formulae enables calculation and thereby more practical application to the solution of actual problems.

Representing ideas as writing or as three-dimensional models (Jewitt et al., 2000a, pp.276-283; Kress et al., 2001, pp.155-172) made particular demands on the conceptualization of 11- and 12-year-olds. The latter forced them to reflect on and then show shape, relative size, positioning, proximity, texture and colour whereas the former demanded a quite different focus on important 'entities' and their relation expressed through verbs such as 'is' and 'has' (Kress, 2003, p.3). Writing 'the cell has a nucleus' is quite different from showing what a nucleus looks like within a cell. Talk might well play its part in the process of image production for young children. Nevertheless, I would argue that it is not, as Vygotsky (1978) claims, that drawing is 'graphic speech that arises on the basis of verbal speech' (p.112) or that 'it is on the basis of speech that all other sign systems are created' (p.113). On the contrary, choice between words as speech or writing and drawing shapes that which can be communicated in highly significant ways (see, for example, Pahl, 1999, pp.76-79; Kenner, 2000a, pp.33-34). Different modes have different ways of representing phenomena and relations between them. They attend to different aspects of meaning (Kress et al., 2001, p.117). How information is modally realized positions the representer, frames that which can be represented and shapes the representation. The modes in which children are asked to communicate their curriculum knowledge, or indeed those they choose for themselves, are significant for what they can communicate and are therefore formative of their thinking and learning.

In academic papers scientists do not construct arguments and present information only verbally but they ‘combine, interconnect and integrate’ words, mathematical expressions and the ‘visual-graphical’ (Lemke, 1998, pp.87-88). It is not the case, Lemke argues, that meanings made in one mode can be made just as effectively in another. Modes are essentially ‘incommensurable’ (ibid, p.110). Choice of mode is therefore critical for what can be communicated. Each mode commits the meaning-maker to the potentialities and constraints of its *functional specializations* (Bearne and Kress, 2001, p.90; Kress et al., 2001, p.16; Kress and van Leeuwen, 2001, p.64) or functional specialisms (Jewitt et al., 2000b, p.332). This refers to the ways in which modes have been historically and culturally specialized to perform certain functions. It is not that one mode is superior to another but that their different affordances and specializations offer different meaning potentialities.

Eleanor Gibson (1982, p.57, p.62) argued that the affordances a natural environment offers vary according to what the living creature is. A similar notion might apply to mode. Young children may hold a different view of affordance from adults. Their drawings can represent sensations such as a hurting knee or tactility such as the feel of a blanket (Brittain, 1979, p.30, p.33). Using ‘gestural representation’, a term used by Vygotsky back in 1935 (1978, p.ix, p.107), one young child created dots across the page to show a bunny hopping (Wolf and Perry, 1988, p.20). Repeated circles can represent the movement of a big wheel, overlaid loops can imply bubbles rising to the surface and staccato stabbings can signify a sneeze (Matthews, 1998, pp.92-93). In mainstream semiotics, this would probably be considered ‘wrong’. Whilst unlike how adults might draw, these representations have validity in their own right as ‘alternative and continuously useful ways of picturing’ (Wolf and Perry, 1988, p.18). They are also signs of how individuals perceive the affordances and functional specializations of mode.

Intermodal reshaping

Shifts from one mode to another bring about shifts in meanings. This becomes particularly apparent on occasions when representation in one mode or a combination

of modes is deliberately reshaped into another or others. For the purposes of this study, I have coined the term *intermodal reshaping* or *intermodal transformation* to designate the deliberate remaking of signs in one mode as signs in another (see Chapter 5, pp.145-158). Representing sales inventories as token impressions in clay rather than as the tokens themselves (Olson, 1994, p.72) might be graphically significant but, as far as remaking in a new mode (intermodal reshaping) is concerned, it is relatively straightforward. The greater the difference between modes, the greater the challenge. Transforming image into writing is much more difficult, and vice versa. Through a process of *transduction* meanings made with certain semiotic resources must be remade with others. How signs have been made with particular semiotic resources must be recognized and analysed so that they can be remade in different ways. Intermodal reshaping therefore entails dealing with the inherent affordances and limitations of modes and their functional specializations. A consequence of reconstituting one kind of modal realization into another is a 'deep reshaping' (Kress et al., 2001, p.99) where the original and the remade texts might be equivalents but remain fundamentally different.

Intramodal reshaping

Young children are fascinated by the relationship between form and meaning, repeatedly experimenting with representations of objects, representations in words and representations of other people's representations (Gardner, 1980, pp.100-112, pp.192-198; Kress, 1997, pp.19-24, p.54, pp.66-73; Pahl, 1999, pp.60-69; Kenner, 2000a, pp.24-25; Wilson, 2000). They 'play' with signifier-resources, exploring the how different forms have different effects. This is not '*copying*'. Signs are never repetitions, reproductions or copies of the original but rather selections and adaptations (Kress et al., 2001, pp.129-130). It is what I have chosen to call *intramodal reshaping* or *intramodal transformation*. I have coined this term to denote the process of remaking meaning made in any one mode into the same mode. In intramodal transformation, a written source becomes writing and a drawn source becomes drawing. These children seem to have been reflecting upon how successfully the visual marks communicated their intended meanings. It is not a case

of copying but a remaking of culturally available resources in the same mode. That their remaking is not always accurate from an adult perspective is an indication that children have interpreted and reshaped graphic representational resources. Children redesign the prior designs of others (Kress, 2000b, p.158).

Problematic issues

Modes have been identified as, for example, speech, writing, image, music, gesture, body movement and three-dimensional models (Kress et al., 2001; Kress and van Leeuwen, 2001). Here, modes are classified as well-acknowledged, broad communicational entities that can exist independently of one another. Multimodality thus defined refers to the co-presence of more than one mode. In the multimodality of face-to-face communication the modes of speech, gesture, facial expression and movement might occur simultaneously or in quick succession within the communicational event (see Kress et al., 2001, pp.42-59; Kress and van Leeuwen, 2001, pp.49-53). On the page, multimodality from this perspective would be a combination of writing and image, extending to moving pictures, animated writing, speech and music on the screen. This begins to raise questions about what can be counted as mode. Are animated writing and images different modes from still writing and images? If they are, this would imply that movement / fixity are features that can constitute mode. Alternatively, the mode remains writing or image but movement becomes another semiotic variable.

However, graphic modes have also been defined more narrowly. Kress and van Leeuwen (2001, pp.56-63) describe layout and punctuation as modes because they are developed, regularized and recognized semiotic resources that can be described. Colour, with its resources of differentiation, saturation, purity, modulation, value and hue, can also be said to constitute a regularized 'grammar' (Kress and van Leeuwen, 2002). This creates a theoretical problem. How can writing be a mode at the same time as punctuation and layout which are part of what writing is? Or how can colour as a mode be part of image-as-mode? This would imply modes within modes. Either writing and image are modes because they are distinct representational entities or

they are multimodes because they consist of writing or drawing and other things such as layout, colour and punctuation. They cannot be both – or can they?

The same issues arise in understanding non-graphic representation. Is speech a single mode or is it a multimode that includes the modes of intonation, tonicity and tone, rhythm, phrasing and pausing (features traditionally known as prosodics)? After all, these features do have historically and culturally regularized patterns that can be described. In his *Diary of a Writer*, Dostoyevsky gave an account of an occasion when different accenting of the same noun six times uninterruptedly in succession carried different thoughts, feelings and ‘even whole trains of reasoning’ – yet was ‘perfectly’ understood within the group (Voloshinov, 1994, p.54; see also Vygotsky, 1986, p.241). Is speech in this instance the mode of communication or has intonation or tonicity become the mode of communication?

Some terminological distinctions

One difficulty lies in how terminology is habitually used. ‘Writing’ commonly refers simultaneously to four different things: the act of graphic composition, words-as-marks that appear on the graphic surface, the finished product as graphic text and the written form as against speech or drawing. This confuses issues of semiotic significance. For the purposes of this study, it is necessary to distinguish between them. I use the term *language-as-writing* to refer explicitly to wording. This excludes anything beyond words, namely punctuation, presentation (such as colour or boldening) or layout. An analytical construct, this ‘stripped’ notion of language (or ‘just words’) is the stuff of linguistics. Similarly, *drawing-as-image* is an analytical reference to the lines of drawing stripped of its materiality. This, of course, cannot exist in actuality. *Graphic representation* is the product of sign-making. This includes all that the representation is and goes beyond the ‘stripped’ constructs of language-as-writing and drawing-as-image to include, for example, presentational features. I use *writing-as-representation* and *drawing-as-representation* to refer to the materially realized representations of the sign-maker as they appear in actuality. A *graphic text* is the final ‘thing’ in its entirety. This includes representation and how it is set out on

the graphic surface but it refers to the product as an artefact. It encompasses the chosen medium as substance and surface (see p.54 below), affixing materials such as sticky tape or staples, attached objects, and signs of the process of production such as imprints, crumpling, creasing or spills (Ormerod and Ivanic, 2000, p.103; Ormerod and Ivanic, 2002, p.69). These distinctions become important in defining mode.

Potential resolutions to what mode might be

Reconciling the above definitions of mode in relation to what graphic multimodality might be has been a concern for me throughout this study. I anticipate that these issues will be resolved over time. Tentatively and as an interim measure, I would like to offer three alternative possibilities as potential resolutions to what mode and multimodality might be. I then append a resolution suggested by Kress and van Leeuwen.

To preface this, what emerged as a critical feature in my understanding of mode is the distinction between sign and signifier. This might seem obvious but I have found it to be of fundamental importance. Modes are not made up of signs but of semiotic resources. Material texts are the graphic places where signs appear. Semiotic resources are the 'stuff' from which signs are made. If it is accepted that modes comprise signifiers or semiotic resources and texts contain representations as signs, then how can texts be described as multimodal? Provisionally, I would like to suggest that the multimodality of texts refers to the semiotic resources that were drawn upon in the process of transformation. Signs are modally resourced. Their signifiers come from culturally constituted modes. Multiple modes render texts multimodal. Multiple signs render texts multisemiotic.

A first possible solution might be to define mode as a multiply sourced resource which provides all that is needed for a means of representation that can exist independently of others (for example, writing, drawing, speech or sign language). If this were the case, a mode would consist of the full range of semiotic resources required to produce a self-contained text. As far as writing is concerned, this would

include the resources of language-as-writing, presentation as material appearance, punctuation and layout (there may be others). This conceptualization recognizes the intimate interrelationships between these resources and the fact that they are often all co-present in a written text. Mode would always hold the potential for multisemiosis through the interplay of contrasting semiotic resources. Like the intonation of speech or the mouthing of signing, if any one modal constituent were to be removed the mode would be fundamentally altered. A strength of this approach is its comprehensiveness. If mode is an entity which provides all that is needed to make a self-contained text, then graphic multimodality would be a bringing together of the inclusive modes of writing and image.

A second solution might be to classify the distinctly different semiotic resources that make up drawing or writing as modes. Modes would then become the parts rather than the whole. If a mode is a collection, grouping or system of resources of a similar type, then full stops, commas, exclamation marks, question marks, colons and dashes would belong together as the mode of punctuation. Other things such as boldening, underlining or enlargement would belong together as 'styles' of presentation. With regard to writing, language-as-writing, presentation, punctuation and layout would be classed as separate modes. Making a graphic text would entail the culturally regularized design process of bringing together these different modes. If this were the case, writing would be described as multimodal because it draws on multiple modes. Language-as-writing-as-mode is then readily extracted for theoretical and analytical purposes, which of course is what linguists have been doing for years. A benefit of describing writing as multimodal is that it draws attention to signifying features beyond the linguistic. It opens up scope for studying the full range of signs in written texts. This second proposal hinges on whether semiotic resources such as presentational features, punctuation and layout can be thought of as modes in their own right.

Thirdly, an idea I have developed as a compromise between the two positions above may or may not prove helpful in the long term. It builds on the idea of multiple modes making up what writing and drawing are explored in the second proposal but

takes cognisance of the singularity of entities in the first. My suggestion is that graphic representation can be thought of as *multimodal composites* and *multimodal compounds*. A benefit of this terminology is that both terms derive from the Latin *com* meaning ‘together’ and *ponere* meaning ‘to place’. Multimodal composites and compounds are a placing together of different modes. A *composite* is a whole made up of a diffusion of different parts. Those parts are inextricably bonded in the whole. Writing can be described as a multimodal composite. It is a whole, an independent means of representation, but it consists of interwoven parts (or modes) as language-as-writing, presentation, layout and punctuation. In graphic texts, these appear in different quantities and configurations but are always combined in a complex interweaving. In contrast, elements are brought together in a *compound* are juxtaposed and co-existing, but they are readily separated. Such is the case with texts that include writing and image. Each retains its own distinct and independently existing identity, unlike presentational features or punctuation which generally subsist only in relation to wording or images. When blended together within a multimodal compound, image and writing become mutually inter-reliant as complementary parts of the whole but they remain readily distinguishable. What becomes interesting is how the shared modes of presentation and layout (and punctuation where applicable) interrelate within and between writing and drawing in multimodal compounds or, in other words, the relationship between composites and shared resources within a compound – hence the focus of this study.

A fourth solution is one proposed by Kress and van Leeuwen (2001, pp.113-114). They suggest that what is recognized as modal and what that modality means are dependent on who the representer or interpreter is. Modes are explicitly known and understood differently by experts in specialized domains from non-specialists. For example, aromatherapists can recognize about fifty basic smells and their combinations in different substances (ibid). A problem with this is that in practice, people actually draw on diverse semiotic resources in ways that are so embedded as to be handled almost subliminally. Whether or not they are explicitly conscious of modes, they still communicate with them. Another hypothesis suggested by Kress in discussion is that what is not a mode in one instantiation can become a mode

elsewhere. Gesture can be part of signing-as-mode but can also exist independently. Similarly, layout can be described as a mode when it is dealt with separately from the composition of writing or image, as in the arrangement and presentation of textual items in newspaper and magazine design. What is vital here is that mode is able to stand alone, as in the first solution above. What is also crucial is that, just as there can be no absolute *langue* apart from *parole*, modes are not fixed but shift and change according to how people make meaning with them.

Mode cannot be one thing and all things. My hesitation over this theoretical dilemma has caused me to revisit this fundamental question again and again. Having read, re-read and read again my core texts, I continue to reserve judgment and anticipate that, multimodality being a theory in its infancy, it is an issue that will be settled over time. Of course, mode and multimodality are theoretical constructs. They are not already existing, awaiting their secrets to be unlocked and ‘correct’ answers about what they are to be discovered. Rather, multimodality is a means of understanding the ‘fullness’ of what representation is. It is an endeavour to attend to all signs irrespective of what they are and to understand how they interrelate. Multimodality is a means of investigating how representational practices, products and discourses are realized in diverse and wide-ranging non-graphic and graphic texts.

In endeavouring to understand the semiotic resources that are shared and distinct in writing-as-representation and drawing-as-representation, I have adopted a cautious approach. On the one hand, I am wary of committing myself to something new and unsettled (and maybe unsettling). On the other hand, I feel that, in order to proceed, at least a provisional fixing of what mode and multimodality might be is necessary for the purposes of this study. Perhaps it is legitimate in a ‘specialized’ analysis (by which I do not mean that I have special skills but that this study looks at writing and drawing from a very particular approach) to open up the notion of writing and drawing as multimodal. In part, my empirical work is an analysis of semiotic resources that belong together because they share certain characteristics. It is convenient to call these modes. More importantly, compound and composite multimodality is an open approach to understanding what makes up graphic

representation. However, I reiterate that this is a provisional position and I hold back from any dogmatic assertions about what mode and multimodality might be.

Semiotic resources

A significant shift in social semiotics is the appearance of the term ‘resource’ as against ‘code’ (van Leeuwen, 1999, pp.4-5; Jewitt and Oyamo, 2001, p.134).

Meaning is made with existing semiotic resources rather than the notion of systems of codes being used. ‘Use is replaced by remaking, which is transformation; and the notion of the semiotic system is now replaced by that of a dynamic, constantly remade and re-organised set of semiotic resources’ (Kress, 2000b, p.157). The question is: what are semiotic resources? This raises a number of fundamental issues: how semiotic resources might be defined; how the semiotic resources of graphic representation might be grouped together (as modes); which semiotic resources make up a mode; and the semiotic resources available to individuals.

Some definitions and distinctions

Based on my understanding of what I have read and my analysis of that which appears in forthcoming chapters, for the purposes of this study I make the following terminological and theoretical distinctions. The terms ‘word’ and ‘language-as-writing’ have dual roles in a semiotic approach: as signifiers and as signs. Words (or linguistic lexis) are some of the *signifiers* or the *signifier-resources* of writing (and speech). They are existing forms that writers can draw upon in the transformative process of sign-making. Similarly, language-as-writing is made up of *lexicogrammatical signifiers* or *lexicogrammatical resources* which are available for sign-making. On the other hand, the graphic marks as words and as language-as-writing that appear on the page or screen are signs. In the former scenario words and language-as-writing are forms without specific signifieds attached whereas the latter have. It might therefore be more apt to talk about word-signifiers and word-signs, and language-as-writing-signifiers and language-as-writing-signs. This is hugely clumsy but it is nevertheless an important distinction. How does this apply to drawing or

number? Similar issues arise. Criterial form and criterial attributes (see Chapter 4, pp.87-101) are some of the *signifier-resources* of drawing. These are drawing signifiers that are made into drawing signs but the signs appear as criterial form and criterial attributes. Numbers and the symbols associated with them (for example, '+', '=') can be either signifiers or signs. These normally have different names when combined as textual signs, namely sums or equations.

This raises a further issue with regard to distinguishing between a signifier-resource and a semiotic resource. To recap, the term 'signifier' focuses on form only whereas 'semiotic' derives from the Greek *sēmeîon* for 'sign' and refers to form and meaning. I have toyed with the idea that a signifier-resource becomes a semiotic resource when an individual works it into a sign. If this were the case, signifier-resources would be forms available for making signs whereas semiotic resources would be those resources which were chosen and worked upon to make signs. Semiotic resources would then mark the shared space between mode and text, the 'borderland' to borrow a discourse term from James Gee (1996, pp.162-166). In the process of sign-making, signifier-resources become semiotic resources as they are made into the signs of graphic texts. If this is reasonable, whether the inquirer examines signifier-resources or semiotic resources depends on whether the focus is on potentiality or realization.

The semiotic resources of graphic representation

Language-as-writing is fundamental to writing-as-text just as drawing-as-image is essential to image-as-text. Without them writing and drawing simply do not exist. This 'stripped' notion of representation is an analytical construct that extracts wording or drawing from the 'fullness' of what the text is. Actually, language-as-writing and image-as-drawing are not 'disembodied' abstractions and can never appear apart from their materiality. So what else makes up graphic representation? Below, I consider three key features that emerged from my empirical work – presentation, layout and punctuation – and how these create 'reading' paths. I also comment on the semiotic resources of medium.

a) Presentation

Presentation resources are distinct from the resources of language-as-writing or drawing-as-image. They offer choices that are separate from selecting and combining words or constructing the lines of an image. The ways in which writing and drawing are presented are essential design decisions. Presentation is never merely an appendage. It carries meaning in some way related to the drawing or writing 'lexis' it realizes or that realizes it – or maybe it is a matter of co-realization.

Language-as-writing and drawing-as-image are always materially realized as graphic marks made on some sort of graphic surface by some sort of tool. This presupposes *materiality*. How writing and image are made is significant. *Substance* is not just the *medium* for text production. Choice of substance is bound up with purpose. It makes signs that are crucial to the reader's understanding of what texts are by signifying a particular time and place, a particular method of production and a particular representational practice. Biro signifies something different from a gold marker or wax crayon from glitter pen. Materiality can also carry the ideational (Ormerod and Ivanic, 2002, pp.72-73, p.79). Furthermore, the manner in which tools are used carries meaning. Applying a sharp or blunt pencil lightly or heavily is significant, just as italics or emboldening in electronically generated texts make meaning. This *accentuation* provides *emphasis* and draws attention to relative *salience* in the visuality of the text. *Colour* is a semiotic resource of graphic representation. It is perhaps such an intrinsic aspect of drawing that it becomes transparent but that does not mean that it is meaningless. Colour in written text has a long history. To a non-reader of Ancient Egyptian hieratic script, the dual colouring in a medical text dating from the eighteenth dynasty (David, 1988, p.114) is apparently random. In fact, red as against black pigment highlights sections of special interest. It is a form of differentiation. These weightings are not restricted to writing but also appear in image (O'Toole, 1994, p.29). All choices and applications of substance are semiotically significant. That significance is socially and culturally shaped, individually constituted and situationally specific.

The ‘founts’ (as fonts were formerly known) of fifteenth century print were stylistically diverse and extraordinarily intricate because they were an endeavour to replicate handwritten script (Graddol, 1996, p.78). Consequential standardization persisted until the end of the nineteenth century when the increasing demands of a consumer society led to the invention of a range of new typefaces (ibid, pp.78-79). Today, a plethora of fonts is available on any standard computer – and even more on the web. This infinite range, along with the potentialities of colour, size, style and animation, opens up limitless possibilities for typographical meaning-making as the norm for children.

Presentation might appear ‘lexical’ because it is something that is done to individual textual items. On the face of it, it could not then be considered a mode because it is not ‘grammaticalized’ in Kress and van Leeuwen’s terms. However, just as the properties of colour can be identified and viewed as a ‘grammar’ (Kress and van Leeuwen, 2002), there may be scope for similar analysis of other presentational resources. Furthermore, it is the interplay between different instantiations of presentation within individual textual items and across the full text that puts presentational semiotic resources into a relationship with one another. This brings about ‘syntactical’ relationships.

b) Layout

In Anglo Saxon England, continuous writing was made up of evenly spaced letters or *scripto continua* (Parkes, 1991, p.xvi). Absence of *spacing* gave no *visual* clues about where words, clauses and sentences began and ended. Seventh century Irish scribes first introduced word separation as a means of facilitating access to and improving intelligibility of information communicated in Latin, a Romance language unlike Irish (ibid, pp1-4). Parkes calls this spacing the ‘grammar of legibility’ (ibid, p.2). In contrast, when Irish scribes began to copy texts in their own native language in the first half of the eighth century, words with a close syntactical connection were copied as a single unit (ibid, p.4). Space between words and clauses was a way of making meaning. It framed textual items. Spacing is not just a feature of writing. White space is significant for how interrelationships between images, or indeed images and

writing, within a text are understood. Proximity and distance is a kind of framing that shows connection and disconnection.

Over three and a half thousand years before Irish scribes modified the *scripto continua* of Latin manuscripts, other strategies were in place for showing discrete items of text. An impressed clay tablet from Ur dated 2960 BC is an inventory of the contents of a storehouse (Olson, 1994, pp.73-74). Each entry consists of a product (represented by a symbol such as a jar standing on a pointed base to denote beer) and an amount (marks made with the end and edge of a stylus to denote tens and units). In order to make a distinction between each commodity *lines* were clearly incised around each entry. The effect is a division of the tablet into cells. This is a form of framing. Hieroglyphs were chiselled or painted in columns with dividing vertical or (later) horizontal lines (Putnam, 1990, p.86) and oval-shaped cartouches enclosed the names of Egyptian pharaohs. Even in early instantiations of writing there were *framing* devices.

In contemporary texts, framing is a way of showing discreteness and connection (van Leeuwen, 1996, p.96). Framelines such as lines, borders or white space can separate textual items. On the other hand, shared colour, thickness or style of line can connect parts within the whole (Kress and van Leeuwen, 1996, pp.214-218). Framing can be implicit within images. In Botticelli's 'Primavera', how figures are composed in relation to one another, that is their vectors, rhythmic patterning and compositional framing, is a means of organizing the painting into separate and connected regions (O'Toole, 1994, p.7, pp.23-29). Framing is not just textual. It can give indications of how an individual thought about a topic through the relationships s/he constructed between textual items.

Where items are positioned in the semiotic space of the graphic surface is not arbitrary. Arranging textual elements in relation to one another within the graphic frame creates a 'grammatical' construction or visual 'syntax' (van Leeuwen, 2001, p.92). One aspect of this is '*information value*' (Kress and van Leeuwen, 1996, pp.183-211). Centrality denotes a main focus whilst location towards the periphery of

the page or screen marginalizes (ibid, pp.203-211). This has implications for notions of hierarchy, the superordinate and its subordinates. According to Halliday (1989, p.55), each 'information unit' of speech contains complementary known and unknown information, the former preceding the latter. Related to the orientation of written English the given (on the left) leads to the new (on the right); that which is taken to be accepted, acknowledged or recognized leads to that which is unfamiliar, novel or un-agreed (Kress and van Leeuwen, 1996, pp.186-192). Top to bottom can also move from the relatively 'ideal' or generalized to the relatively 'real' or empirical and detailed (ibid, pp.193-202). Positioning is not superficial but can provide traces of the structures of ideas, knowledge and concepts (Kress, 2003, p.16).

c) Punctuation

Seventh century Irish scribes also developed the *littera notabilior* (a more noticeable letter) or capital letter. Its more prominent size or shape in relation to surrounding letters visually pronounced its greater importance and thereby identified a new text or a new section of a text (Parkes, 1991, p.xvii, pp.1-2, p.8). The addition of marks such as the comma-like *punctus* helped to separate phrases, clauses, sentences or sections of text (ibid, p.2, p.7). These *punctuation marks* were a means of aiding reading aloud. There was a shift to syntactic principles in the eighteenth and nineteenth centuries when more widespread literacy and access to books led to individual silent reading (Hall, 1996, p.9).

According to Nigel Hall (1996, p.11), this small group of marks has resulted in a complex system 'riddled with inconsistencies'. In research into contemporary texts made by people from the age of 6 through to adulthood, the function of punctuation marks was elocutionary (for example, pausing and intonation), provided grammatical framing (for example, main and subordinated clauses), organized text into meaningful units and satisfied what was perceived as an adequate quantity (Kress, 1982; Hall, 1996; Ivanic, 1996; Martens and Goodman, 1996). In addition to the somewhat more pressing demands of spelling and neatness (and, I would add, composing content), punctuation marks tended to be largely redundant in the classroom-based writing of 6-year-olds (Hall, 1998b, pp.31-33). Where they did appear, full stops occurred at the

end of lines or page, or were distributed evenly throughout the text, and children's explanations were couched in terms of space, position, distance and length, ideas that were reinforced by the layout of reading books and teachers' procedural rather than explanatory comments (Hall, 1998b, pp.32-33; Hall, 1999, pp.181-191). Hall (1999) calls this 'graphic' rather than linguistic punctuation. He suggests that children's understanding of the functionality of punctuation is an ongoing process developed as they become more analytical (Hall, 1998a, p.15) and that they move from visual punctuation to 'true linguistic segmentation' (ibid, p.12). In a semiotic approach, punctuation marks are meaning-making resources. Which marks are made, how and why varies according to the individual's situated meaning intentionality.

Punctuation is not restricted to writing. Connecting lines in diagrams are forms of punctuation that shows relationships or associations. Lines and arrows between graphic elements can have narrative and conceptual meanings (Kress and van Leeuwen, 1996, pp.43-118). Directional arrows (with arrowheads) such as those in maps or flowcharts can indicate unfolding actions and events, change and transitory spatial arrangements (ibid, p.56). They might imply the sequential or the simultaneous. Lines in conceptual diagrams such as tree structures show hierarchical relationships as taxonomies (superordinates and subordinates) whereas the interconnectivity of networks (complexly linked diagrams) is a labyrinth of intersecting relations (ibid, p.85). As in writing, lines and arrows 'punctuate' images, words and symbols, showing connections between textual elements.

'Reading' paths

Individually and in combination, presentation, layout and punctuation create '*reading paths*'. They guide how the 'reader' 'reads'. Accentuation as size or boldening, or positioning in the centre of the graphic area is a means of showing relative salience. It draws the eye to a particular feature of the text and thereby signals a preferred order of 'reading'. In comparison with the (relatively) mandatory linearity of continuous narrative writing, multimodal compounds invite multiple 'reading' paths, for example circular, diagonal, spiralling, linear or descending (Kress and van

Leeuwen, 1996, p.219). Sign-makers create preferred 'reading' paths to different degrees so that how a text is 'read' may be more or less insistent and more or less predictable.

Medium

The affordances and limitations of *medium* are determined by its properties, and those properties define, shape or suggest what might or might not be done graphically. Graphic *surface* is more than a neutral site for mark-making. Its size, shape, texture, colour, durability and potential for modification are criterial. Marble signifies permanence whereas wax tablets (Ong, 1982, p.94) or 'post-its' carry a sense of transience; glass implies fragility and porcelain the special; a fresh sheet of white paper is quite a different semiotic resource from the back of a used envelope or a leaf of parchment. Texture and weight, experienced kinaesthetically as sound and tactility (compare, for example, sugar paper, laminated card and tissue paper), are significant for sign-making potentiality. Colour is a means of drawing attention as in a fluorescent orange poster or implying sobriety such as grey for the front cover of a policy document. Surfaces can also carry different smells either intrinsic to themselves as materials, deliberately applied (for example, a perfumed letter) or contextually instantiated (for example, a musty smell suggests age or damp). Some material surfaces are graphically evocative and may prompt particular sign-making (Pahl, 1999). For the most part, the flatness and emptiness of a blank sheet of paper are not intrinsically suggestive. The page holds the potential for innumerable possibilities. It is when paper is folded or cut or when marks are made on it using different tools and substances that it becomes a semiotic artefact rather than a semiotic resource. The *substance* from which representation is composed is also a medium, although marks made by tools on a graphic surface become signs. This has been considered above (see p.49).

As well as being a socially, culturally and historically located practice, writing is a technology (Clanchy, 1979, pp.88-115). How people write, how much they write, what, why and when they write are linked with the literacy technology they use

(Lankshear, Snyder and Green, 2000, p.25). This also applies to image. Computer facilities open up a whole range of potentialities not possible on the page. Automatic functions provide feedback on spelling and grammar; provisionality facilitates redrafting, manipulation and amendment; the capacity and range of information on the web provides a vast resource; and interconnectivity enables rapid communicational exchange (DfEE, 1998b, pp.28-29). How people communicate graphically is not a case of technological determinism. It is the interplay between the developments in and increasing permutation of electronic technologies in the home, workplace and community and social shaping of how and why they are being used in everyday life that are significant for what graphic representation is.

It is noteworthy that *way* in which layout, presentation and punctuation are made differs between electronic and manual methods of production. This has physical implications in that different actions, skills and conceptualizations are required according to medium. On the page, spacing is made by lifting the pencil as it is moved elsewhere whereas on the computer it entails pressing the space bar and moving the mouse whilst holding or not holding down the mouse button. On the page, letters, punctuation and spacing, and their emboldening and underlining (but not usually colour), can be made with a single tool. In computer-generated writing, they have to be made separately, namely with the keyboard (until voice recognition becomes more widely available) and different facilities available on the tool bar. On the page, erasing, overwriting and indentations are signs that suggest dissatisfaction or shifts in thinking. These marks, lost in electronic texts, can provide vital clues in understanding the process of design. My point is that whilst the graphic aim might remain the same, the processes for achieving that aim vary according to medium, and the final products bear differential clues about the process.

Semiotic resources available to individuals

Semiotic resources become available to individuals through their participation in representational events shaped by socially, historically and culturally located representational practices (see pp.26-27 above). That which is deemed an apt

semiotic resource is informed by the individual's range of previous and ongoing encounters with and making of signs in a variety of social contexts and for a range of purposes, and analysis of their perceived effectiveness. The resources available to any one individual vary according to that person's graphic history. This reservoir is socially shared but personally constructed.

Corrado Ricci (1887), George Kerschensteiner (1905) and Georges-Henri Luquet (1913, 1927) argued that young children draw what they know (the conceptual or 'intellectual realism') not what they see (the perceptual or 'visual realism') (Cox, 1992, p.91). This idea was later taken up by Jean Piaget (Piaget, 1956, pp.49-52; Piaget and Inhelder, 1966, pp.63-68). He claimed that children move through developmental stages that lead from topological drawing (intellectual realism) to projective geometry (visual realism). For him, the endpoint was drawing with increasingly 'realistic' perspective. There is a problem with this. Preschoolers often omit arms from their drawings of people (Golomb, 1974, p.104; Goodnow, 1977, p.65) but they know what arms are. Omission does not necessarily mean lack of knowledge. Children may not draw everything they know about. Incompleteness is a feature of abstraction (Arnheim, 1969, p.137).

I would argue that it is not a case of an age-related shift from the intellectual to the visual but rather that children make meaning with the semiotic resources available to them according to perceived need. Drawing a handle on a cup that cannot actually be seen (Freeman and Janikoun, 1972) or adjusting line drawings to make them look more like tables (Lee, 1989) is not failure but making meaning. It is a picking out of salient features (Krascum, Tregenza and Whitehead, 1996, p.454). Children's apparent wish not to leave the identity of the drawing in doubt implies consideration for the needs of the viewer – quite the opposite of Piaget's (1929, p.167) notion of 'egocentricism' where, he claims, the child 'has not yet discovered the multiplicity of possible perspectives and remains blind to all but his own as if that were the only one possible'.

The semiotic resources available to young children should not be underestimated. More recent research has shown that, even from the age of 3 or 4, children draw from multiple viewpoints (see, for example, Matthews, 1999, p.89). Nursery-aged children's moves between text squiggles and meticulously formed lettering was not a case of a linear progression from one type of representation to another, from 'scribble' to alphabetic forms (Kenner, 2000c, pp.254-264). The co-presence of narrative, map and game in the same text (Barrs, 1988; Pahl, 2001) implies that children integrate different semiotic resources according to what they perceive to be the most apt way of representing their interest. In each case, the children called upon different semiotic resources according to their immediate interests and perceived representational appropriateness. It may not be that children fail to see the need for different ways of drawing and writing but that they are in the process of building up a repertoire of semiotic resources. Learning to represent through drawing is not a case of development stages to a single endpoint but discovering a range of resources from which to choose (Wolf and Perry, 1988, p.18, p.21) and how they are conventionally integrated or related.

Graphic representational resources are located geographically in space as well as historically in time and are always culture specific. For the Walbiri people from the Yuendumu settlement in Australia, drawings were part of telling 'sand stories' (Munn, 1973). Identical symbols could carry different meanings, for example a vertical line might represent a recumbent animal, a fighting stick or directional movement (ibid, p.65) but the particular meaning was clear as signs were made as an integral feature of oral narrative. Which semiotic resources are available to individuals is dependent upon the representational practices of those around them.

Design

For me, the notion of design is fundamental to understanding graphic representation. It presupposes the theory of transformation and the notion of multimodality explored above. Within the regularities of socially and culturally shaped *design practices*, children are active, deliberate and thoughtful meaning-makers. They choose, shape

and combine semiotic resources from those available to them according to what they perceive as apt. Design is always interested, always motivated and always creative. *Interest* is more than that which describes an individual's immediate attention, although it includes this. It is how phenomena are conceived as a consequence of the individual's physiological, psychological, emotional, cultural and social history (Kress, 1997, p.11, pp.88-91) and how ideas, thoughts, feelings and attitudes are expressed in response to a particular representational or communicational need.

The New London Group (2000, pp.20-23) bases its notion of multiliteracies as design on three interwoven concepts: available designs, designing and the redesigned. 'Available designs' are existing, historically and continuously shaped semiotic resources available for meaning-making which include such variables as discourse, genre and dialect. 'Design' is always transformation of individual subjectivity and relations with others but might be more or less predictable or more or less radically creative. 'The redesigned' as the consequence of design is always new meaning through which the identity of the meaning-maker is also renegotiated and reconstructed. These views are entirely consistent with the theoretical framework outlined above.

Design as intent to mean

Graphic sign-making is always an interpretation. Interpretation is an essential feature of design. Rhoda Kellogg's (1969) elaborate identification and categorization of what she called the 'scribbling' marks made by pre-schoolers was highly detailed but focused on form rather than form and meaning. She considered the mark-making of preschoolers to be motor action undertaken and enjoyed for its own sake, accidental and without representational intentionality. Indeed, Claire Golomb (1974, p.33, p.177) called it 'scribble chaos' and suggested that the first 'meaningful forms' come later with enclosing lines (ibid, p.77). This led to children's drawings being seen as immature and deficient, a view I do not share. More recent research, however, suggests that young children's drawing is not 'random, impulsive, chaotic' (Matthews, 1999, p.4). Intense multidirectional lines, shading of areas or 'patches'

can represent the solidity of a human, animal or make-believe form (Buckham, 1994, pp. 134-137; Matthews, 1997, p.34). The inscribed 'slashes' made by children at around 20 months may be intended to represent existence, number or position rather than shape, colour or volume (Wolf and Perry, 1988, p.20). Conventionality and intended meaning-making should not be confused (Harste, Woodward and Burke, 1984, p.117). Unconventionality suggests a different prioritization from that of more mature drawers (Matthews, 1998, p.90, p.97) but does not imply meaninglessness. Whilst unlike the signs of more mature graphic communicators these marks are marks of meaning. Representations are neither haphazard nor accidental but are made with deliberation and purposefulness and are characterized by an intent to mean.

Choosing, shaping and combining

An essential feature of design is *choice*. As part of the process of deciding what a text will do and how, the designer must select appropriate semiotic resources according to their suitability for the task in hand. From the repertoire of what might be selected, choice (and that which was not chosen) represents what was deemed the most apt means of representation. Choice of writing or drawing commits the sign-maker to its particular affordances, its potentialities and constraints (see pp.37-39 above). This selectivity is intensely meaningful as writing and drawing compel particular shapes to meaning. Choice is critical for what can be communicated and how. Composite mode (writing or drawing) is therefore significant for having been selected in the first place. Where the resources of presentation, layout and punctuation have been chosen is also significant and is in itself a sign. It frames what can be communicated. For example, salience might be shown through colour, boldening or enlargement. Decisions about which semiotic resources are apt, how, why, where and when, are ongoing throughout the process of designing and making. Whatever the text, be it a multimodal composite or a multimodal compound, that which is to be communicated must be distributed across modes. The designer must decide which work each mode will do. This is a complex network of decision-making where signs are made to operate interdependently and complementarily. Texts are suffused with the consequences of choice. These signs are crucial for understanding multimodal design.

Once the mode has been selected children must make decisions about how to *shape* meaning according to the semiotic resources available to them. Existing resources are never a perfect fit to the needs of the sign-maker and so they must be reshaped in the direction of the design (Kress, 1997, p.155). It is a case of transforming semiotic resources according to best fit. Design is therefore prospective and is always oriented towards imagining different and new possibilities (ibid). If a needed resource is unavailable or elusive, the individual is forced to use the next best thing, the nearest resource available in his or her semiotic repertoire. This may entail using a familiar form but reshaping it to a different meaning. The semiotic complexities implicit in the texts examined in later chapters suggests not that children are ‘unreflective, if not ignorant, consumers’ (Wertsch, 1998, pp.28-29) of these culturally ready-to-hand resources but rather that they recognize, either consciously or subliminally, multiple ways of making meaning which are constantly adjusted according to the particular situation. As children observe the signs made by others on an everyday basis, they analyse and evaluate, and then adapt ways of making meaning. To a greater or lesser extent each new text is a journey of exploration, experimentation and creativity.

A third key feature of design is *combining*. Combining semiotic resources is the process of integrating and interweaving different semiotic resources. It entails organization and an imposition of order. Representationally, it is the bringing together of semiotic resources into a coherent and cohesive whole. This entails deciding on the best way of making meaning with the semiotic resource to hand in relation to what other semiotic resources are doing elsewhere in the text. The designer must consider what came before and what will come next. Each composition is a kaleidoscopic transformation where adjustment of one facet has implications for the whole. It is a complex orchestration. Combining graphic resources is not semiotically superficial. The ‘co-deployment’ of multiple semiotic systems enables different meanings to be made (Lemke, 1998, p.110). The outcome of this combination is an interaction between the signs of the same and different modes working together more or less successfully in a more or less synthesized whole.

Design as process and product

I would like to suggest that, like the term 'writing', the term 'design' can refer both to process and product, and these are entirely connected. The *process* of design (designing as mindful action) is the creative planning through which the product comes into being and all the decision-making that this entails. The *product* of design (design as artefact) is the outcome of that process. The process of multimodal design entails choosing, shaping and combining semiotic resources. The graphic product of the design process, the material design, is the appearance of those semiotic resources which were chosen, shaped and combined to make the material text. As a consequence, process and product can be separated in time and space but must always be understood in relation to one another.

Design is the process of mindfully making that which is to be realized materially in production. It is mindful planning, the thinking through of the 'what', 'how', 'why' and 'who for' of composition as the communicator settles on the most effective means of making meaning. Largely internal and temporal, these processes are accessible for analysis to a greater or lesser extent. Clues about ways of communicating information and of dealing with the social context, might be implicit within the material graphic text but the decision-making process of sign-making is hidden in the mind, largely lost and only to be understood by that which appears materially. Design figures separately but interrelatedly as process and product. Whilst temporally and locationally distinct, they are inextricably interwoven. Design as product in the material text represents the final semiotic settling of the graphic maker.

The process of design is not the same as the process of production. Production is the act of making. The process of design is mindful planning. Nevertheless, I would like to suggest that there can be a dynamic interaction between them. Design can shape production and production can shape design. Jacqueline Goodnow (1977, p.19) suggested that what children include or omit in their drawings of the human figure is dependent on how they begin. She warned against assigning meaning to features of drawing when their form might be a means of dealing with the problems of the compositional structure already drawn (*ibid*, p.48). Marks on the page can be

suggestive of the next step. However, her interpretation not only privileges form above meaning but also fails to recognize meaning-making as part of the process of design in production. As the act of drawing is temporally sequential, that which is drawn first does have consequences for what comes next (Goodnow, 1977, pp.59-81; Brittain, 1979, p.31) because meaning-making is also a process of interpretation. Indeed, Goodnow's own experiments demonstrate how mindful design and material realization can be mutually formative. When children were given a circle with two dots at its lower or left arc and asked to make it into a human figure, they adapted and transformed what was there in order to make it meaningful. For example, children represented people standing on their heads or lying down, or made them into animals (Goodnow, 1977, pp.74-77). The children's additions to the original drawing provide insights into their semiotic thinking. Indeed, Goodnow herself noted how constraints were rejected, accepted, evaded or creatively negated in a redefinition of the problem. For me, Goodnow's interpretation is a misunderstanding of the iterative process of meaning-making as design and production. Form is fundamental to meaning, but it is not a case of predominance of form over meaning. Rather, these children engaged in a process of interpretative meaning-making and meaning-remaking. They attended to form and meaning, and created form and meaning.

The sufficiency of design

I have coined the term *sufficiency* to refer to the measurement of the success of a graphic representational design against given criteria. Those criteria may be explicit or implicit but they are nevertheless there, and they are highly particularized. Within the school context where assessment and testing are a way of making judgments against defined curriculum goals and specified standards of achievement, children must constantly make decisions about sufficiency in the detail and depth of their graphic work. That which counts as sufficient may change from subject to subject and teacher to teacher. Sufficiency even across the curriculum is therefore highly situated. However, sufficiency is also part and parcel of graphic representation and communication beyond the school walls. Children learn how, when, where and with whom certain expressions of meaning are and are not appropriate. Learning to

differentiate between contexts and to recognize contextual variables is not easy. Whilst relative stabilities in sign-making enable meanings to be readily shared and understood, each sign remains situated and context-bound. A signifier might be linked with one meaning in one situation but elsewhere connected with quite another. Meaning-making is dependent on highly complex contextual variables. This is why children sometimes make unintentional faux pas which are interpreted by convention-laden adults as inappropriate or even impertinent. Children have to learn to recognize and understand the subtlety of signs which can be complicated by multiple variables and may be fitting in one situation but not another.

The parameters for representational sufficiency shift. Sufficiency is dependent on purpose and who is participating in the communicational exchange. That which is apt in one situation may be lack of aptness in another. As part of the process of design and prior to production, that which is to be represented and the person or people for whom the communication is intended must be taken into account. Judgments must be made about what is known and what needs to be known which in turn is dependent on interpersonal power relations. This has implications for register. That which can go unexplained in one situation may need to be realigned for someone else somewhere else. Any definition of sufficiency can therefore only be provisional.

Coda

This complexly interwoven but I hope theoretically consistent position frames the way in which I proceed with my empirical work and forms the basis for the way in which I endeavour to understand children's graphic representation. Through my analysis and interpretation, I begin to explore some of the problematic issues outlined above and make tentative suggestions about how graphic representation can be reconceptualized as multimodal design.

CHAPTER 3

METHODOLOGY

In this chapter I set out my methodological approach. Firstly, I explain the criteria which guided my data collection. I then list what the texts in my dataset are, describe how I gathered them, provide contextual information, explain how I present them and comment on ethical issues. Finally, I discuss how I proceed with my analysis. My social semiotic / multimodal approach follows from the theoretical framework set out in Chapter 2 and should be understood in relation to it.

Criteria for data collection

My aim in this study is to investigate how children's graphic representation can be understood as multimodal design. I examine the range of semiotic resources present in children's texts, how they carry meaning and how they interrelate. Hence, it is textual products that must constitute my dataset – but which texts? It was necessary to decide upon the principles that would guide my selection of texts in order to provide the data necessary to respond to my research question. The criteria I developed cohere with the themes of my theoretical framework and my thesis title, namely graphic representation (including transformation), multimodality, design (including social practices and contexts) and children.

Graphic representation

To reiterate, by 'graphic representation' I mean any sort of mark-making on any sort of graphic surface. For the most part, I decided to focus on children's writing and drawing because these dominate their graphic representation in school and are also significant in their sign-making at home. Variations in mark-making substances would be important in understanding what is deemed apt for the particular

representational design. My decision to exclude painting was to avoid moving into the domain of art. For children living at the turn of the second millennium, graphic representation on the computer is part and parcel of their everyday lives. It would therefore be important to include examples of electronic texts. The shift to the screen has implications for what graphic representation is. Animation offers potentialities not possible on the page. Whilst children do draw with electronic paint packages, they also choose, place and manipulate existing images. To ignore this would be to disregard a key feature of their experience of graphic representational design.

I also sought varying stimuli for graphic representation. Materially present 'things' provide a source for analysing transformation from the actual to the graphically represented. Drawing an item is a (culturally shaped) process of deciding how to remake a tangible object on the page, just as writing about it demands analytical interpretation. 'Copying', that which I denote an intramodal transformation, provides an opportunity to study what happens when meanings are remade in the same mode, for example how a written source is composed as writing or a drawn source as drawing (see Chapter 2, pp.40-41). Intermodal transformation is concerned with how meanings made in one mode or more become meanings in another or others such as speech into writing (see Chapter 2, pp.39-40). In addition, 'experiential' transformation is an analytical process of interpretation as an individual's experience of events, actions and occurrences are recalled for graphic representation. Sometimes, the motivation is internally induced as an idea that springs to mind. Of course, in actuality it is not quite as simple or straightforward as this. For example, drawing a materially present object or reproducing a written text cannot be divorced from a person's interpretation of associated experiences.

Multimodality

Understanding how children's graphic representation can be reconceptualized as multimodal design demands attendance to the full range of signs evident in children's graphic texts. The words that are written, the pictures that are drawn, the images that are chosen, and how they are presented and set out in relation to one another on the

graphic surface are the 'stuff' of my analysis. This would require examination of drawing discretely, writing discretely and co-present writing and image (both as drawing and as ready-made pictures). Such an approach would be crucial in identifying semiotic resources, hypothesizing how they carry meaning and understanding how they interrelate within the independent multimodal composites of drawing and writing and how they work together as multimodal compounds.

Genre has implications for modal weighting and balance. Image and (alphabetical and numerical) writing in different proportions and configurations offer scope for investigating their effects on modal affordance and functional specialization. The presence or absence of writing and drawing, the amount of space they are allocated and how they are made to carry meaning demands consideration. What is the significance of single words, short phrases, single sentences or more extended writing as they appear independently of or co-presently with individual images or more extensive drawing? Does this have implications for functional load or are there fixed functions in what writing and drawing are able to do irrespective of genre? What happens when textual items are set out in different configurations within the space of the graphic surface, when lines separate them in different ways and when they appear in different sizes and colours? I discarded examination of any single genre as overly restrictive in a study of graphic multimodality. However, I did decide to concentrate on non-fiction texts.

Design

I use the term 'design' to refer to the transformative process of choosing, shaping and combining semiotic resources according to the particular representational need (see Chapter 2, pp.59-60). The product of design is an individual's final semiotic settling as it appears in the signs of graphic representation (see Chapter 2, p.61). It is in material signs where I look for clues about the semiotic resources children have transformed for their particular purposes. This is not guesswork. Traces of design decisions in graphic texts are implicit indicators of how representation was understood. This decision-making process is for the most part hidden but that which

appears materially is a record, albeit a cryptic one, that provides traces of how the communicator ultimately conceived the text as apt. The finished text provides traces of design decisions.

This study is not a search for fixed semiotic resources akin to Saussure's (1966) notion of *langue* (see Chapter 2, p.32) or the 'autonomous' model identified by Street (1984) (see Chapter 2, p.26). There can be no such thing. All graphic representation proceeds from particular social practices (see Chapter 2, p.26). I decided to gather snapshots of texts which represent sign-making in different contexts for different purposes and for different recipients. Texts created at home, at school and in the wider community respond to this range. Furthermore, such texts provide scope for examining how multimodal graphic design is affected by prescription as against more open occasions.

The classroom is a particular social context. Children must respond to teacher-stipulated tasks located within particular subject domains. Curriculum texts created at school provide an opportunity to understand how children represent their subject knowledge and understanding graphically when content and format are more or less heavily prescribed. Materials generated for evaluation purposes shift graphic representation to the concerns of the wider community. Here, texts are made for unknown adults and for purposes beyond the everyday. The research instruments I was responsible for designing and / or administering and / or reporting on were semi-structured. Whilst scripted instructions stipulated mode to a large degree, there was scope for divergence in what was represented, how and where. Social practices in children's leisure time can differ from the classroom in significant ways. Texts created in informal settings provide an opportunity to study autonomously initiated materials generated independently of and undirected by adults, and arising from the children's own interests. In this more open context, children have greater freedom with regard to how they make meaning and for whom. I hypothesized that these different social practices and contexts would be significant for how children conceptualize graphic representational design and how they choose, shape and combine semiotic resources accordingly.

The children

Another decision was to concentrate on the primary phase rather than foundation or secondary. My reasons for this were twofold. Firstly, this age range coheres with my experience. I have taught both as a Key Stage One class teacher and a primary advisory teacher across many schools, have worked in initial teacher education (primary) and have provided continuing professional development courses for primary teachers. In my more recent evaluation work I have had opportunities gain experience of research with this age range, for example in designing research instruments, observing and interviewing children in schools, and reading related academic texts. Secondly, this is an age group where the boundaries between writing and drawing as separate sign systems are largely fixed yet representation in different modes still retains some openness. Primary-aged children are able to write fairly extensively yet scope for drawing has not yet been supplanted by the dominance of writing.

In my examination of single texts I identify, describe and analyse the semiotic resources evident in children's multimodal graphic design. Different examples provide insights into different aspects of meaning-making. On occasions where different children have undertaken the same task in response to the same instructions and in the same social context, the process of transformation results in similarities and variations in their graphic design. These signs are clues to understanding individual variance in the multimodal design of children's graphic representation.

The data

My data are children's graphic texts. In order to describe these texts, to explain how I gathered them and to provide contextual details in a way that is manageable and coherent, I here consider them under three broad categories: curriculum work produced in the classroom, materials generated for evaluation purposes and texts produced in children's leisure time.

Curriculum work produced in the classroom

These texts comprise:

- Six pieces of work making up a science topic on light undertaken by three children including three full texts and extracts from the three others.
- A history worksheet on crops completed by three children.
- An overview of the 124 worksheets in one child's mathematics folder.
- A piece of work produced in a religious education lesson with supporting evidence from a second.
- Two design and technology reports.

Having worked particularly closely with a cluster of primary schools in the North West of England over the years in my roles in the local education authority and higher education, approaching head teachers was not a foray into the unknown. Of the four schools I originally contacted, two were willing to participate. I had built up good professional relationships with the head teachers and staff in the past and, in both cases, my request was welcomed with support. In May 2002 and subsequently in July 2002, the class teachers from a Year 2 class in each school gathered the texts of three children across the curriculum for whole of the current academic year. This amounted to a large data source produced over a nine-month period (September 2001 to May 2002) and an 11-month period (September 2001 to July 2002) respectively.

From the first school I received the curriculum work of three Year 2 children, two girls and one boy. Daniel was the youngest child in his year group. He remained age 6 throughout the academic year. Katie was two months and Rachel six months older than him. I received eight workbooks for each child which comprised English (comprehension, handwriting, language and non-fiction), mathematics, science, history and geography and a folder of additional literacy and numeracy work. From this wealth of texts it was necessary to apply my criteria in the selection of a small number for inclusion in my study. Every text satisfied the need for everyday curriculum work undertaken in the classroom. Worksheets constituted a large proportion of graphic tasks across subjects. As this volume was significant for the graphic representation the children were experiencing on an everyday basis, their

inclusion seemed to me to be important. Worksheets stipulate where marks can be made in which mode. Sometimes single words or numbers were required in response to questions, sometimes more extended wording or drawing was demanded. This variation had implications for design possibilities. In some instances, the page had been structured by the class teacher (for example, ruled lines dividing the graphic area). This had implications for scope in text-level design. On other occasions, the children produced their curriculum work on a blank page. Whilst this ostensibly provided greater scope for choice of mode, there are more or less strict generic rules about what can be inscribed, how and where. Involvement of the second school was largely a check against atypicality. I received 12 workbooks for each of three children: Megan, Jessica and Owen. These comprised literacy, writing, grammar, handwriting, numeracy, practical maths, science, history, design and technology, information technology, religious education and an art sketchbook.

Selecting what to include and exclude from this extensive data source was determined by my criteria which were developed in response to my research question. Firstly, an overview of the 124 worksheets in Daniel's mathematics folder (it could have been any of the three children) over a full academic year was an opportunity to study graphic representational design in a heavily prescribed context. I was careful not to include examples taken from commercially produced worksheets because of copyright issues. Secondly, a series of texts on the science topic of light undertaken over one half term provided a range of multimodal combinations, different genres and various levels of prescription. They also included transformation from materially present things, experiential transformation and intramodal transformation. With the exception of the final piece of work, the seven texts (I exclude a wordsearch) were produced roughly at weekly intervals over a period of one month (October to December 2001). The history-based 'Crops on the Farm' worksheet was an example of framing that recurred frequently in the children's work but not in the group on the theme of light. These texts offered opportunities for comparisons between the multimodal graphic designs of three children. Thirdly, one text from each child in the second school provided outstanding evidence required to respond to my research question at a final stage in my data collection. The substance Megan chose for her

representation of the Holy Spirit added a new dimension beyond the pencil-only drawings of the mind maps. Owen's and Jessica's design and technology reports differed in the proportionality of writing and drawing and their layout, offering potential insights into how multimodal composites are combined in multimodal compounds.

Materials generated for evaluation purposes

These texts comprise:

- The 'Computers in My World' mind maps of one boy and one girl, along with the four others and extracts from a further two.
- One full 'Being in GridClub' mind map and extracts from two others.
- A child's interview transcription.

My examination of image-based mind maps is a meta-analysis of data produced for two evaluation projects I was working on concurrently with my doctoral studies. The aims of the evaluations and those of this study are quite different. The 'Computers in My World' mind maps were generated for a funded evaluation project I worked on between 2000 and 2002. The brief of the ImpaCT2 project¹ was to evaluate the impact of networked technologies on educational attainment and the mind maps were an attempt to gain insights into children's conceptualizations of the computer. I did not compose the mind mapping instructions but I was heavily involved in developing a method of content analysis for the quantitative strand of the research. We received over 2,000 maps from 60 different primary and secondary schools across England in June 2000 and a slightly smaller number when the task was repeated one year later. My analysis of the multimodal design of the mind maps was quite independent of the evaluation. It was undertaken separately from and entirely without the collaboration of any other team member but with the permission of the project directors and the government agency. Once colleagues became aware of this work, I was asked to

¹ The ImpaCT2 evaluation (1999-2002) was commissioned by the Department for Education and Skills (DfES), formerly the Department for Education and Employment (DfEE), and the British Educational Communications and Technology Agency (Becta). This two-year evaluation was run jointly by the University of Nottingham, the Open University and Manchester Metropolitan University.

undertake similar semiotic analysis for the purposes of the evaluation, that is, with a focus on how children conceived computers in their world not how the mind maps can be understood multimodally.

The scripted instructions for the 'Computers in My World' mind mapping gave hints about content in prompting the children to think about types of computers, the places where they are used, how they are connected, the people who use them and why, and simple / complex computer systems. Created quickly, these maps are snapshots of children's ideas at a particular moment in time. A time limit of 30 minutes was allowed for the task in total, that is approximately 20 minutes for drawing with around five minutes at the end for either writing a list of drawings or labelling them. The class teacher read out a scripted introduction and standardized instructions to the class. Those mind maps appearing in my study were produced in June 2000 by one Year 5 class of 25 9- and 10-year-olds in a primary school in the North West of England. My reason for selecting this class was the variation of content and structure of the maps which suggested that the teacher had given latitude for individual thinking rather than demonstrating a 'correct' way of map-making. My analysis focuses principally on the maps of two children, a boy (Oliver) and a girl (Amy). Reference to six others represents 32% of the class set in total. Whilst different drawing capabilities were apparent, any of the maps would have been equally suitable to examine image composition. The four additional full maps exemplify contrasting organizational features which are representative of different types of map structure.

On occasion, I call upon what the children wrote in an associated 15-minute writing task that was undertaken seven to 10 days after the mind mapping. Again the class was asked to 'help the researchers', this time through imaginative writing on what an alien would need to know in order to understand computer systems in our world and what they can do.

I also draw on individual interviews conducted in March 2001 in this school and in June 2001 in a second primary school also located in the North West of England. The interviews focused on children's conceptualizations of 'Computers in My World'

according to the focus of this aspect of the evaluation (see Mavers, Somekh and Restorick, 2002; Somekh et al., 2002; Somekh and Mavers, 2003). My thesis is a study of the multimodality of children's graphic representation. It is not about children's opinions. Verbatim quotations included in my study are taken from times when children's talk by chance veered towards graphic multimodal design. Whilst interesting, it is the children's graphic texts which are the data enabling me to respond to my research question. The occasions when I draw upon what the children said or wrote does not suggest inadequacy in what drawing is able to represent but is rather child-sourced supporting evidence.

As a result of my growing specialization in the area of mind mapping, I was solely responsible for designing the scripted instructions for and semiotic analysis of mind mapping in the subsequent GridClub evaluation². GridClub is a protected online environment for 7- to 11-year-olds. In my evaluation role I received 35 maps from three different primary schools across England on the theme of 'Being in GridClub'. The analysis appearing in this study focuses on one full mind map and extracts from a further two. Again, my interest in multimodal design was quite different from the evaluation focus which (in this aspect of the work) sought to understand how children conceptualized this online environment.

In December 2002, Abigail (just turned 11 years of age) and Rosie (age 8) from a primary school on the south coast of England created mind maps entitled 'Being in GridClub'. I administered the task and was present throughout. Gaining an insight into the children's perceptions of their social experiences was the primary aim of the mind mapping. The scripted instructions described the focus in a statement and three questions: 'We want to understand what it's like being a member of GridClub with lots of other people. Who is part of GridClub and what kinds of things do they do? What do you do in GridClub and who do you meet? How do people work together in GridClub?' For the purposes of this study, I investigate their maps from a multimodal

² Funded by the Department for Education and Skills (DfES) and managed by the British Educational and Communications Technology Agency (Becta), a team of researchers from Manchester Metropolitan University undertook an evaluation of GridClub from September 2001 to March 2003.

design perspective. Drawing on interview data gathered as part of my evaluation visits to this school again provides interesting but peripheral supporting evidence.

My study of Hannah's interview transcription is a meta-analysis of a child's research produced for the ImpaCT2 evaluation. It is the outcome of an interview she conducted in school in November 2001. I was responsible for developing the guidelines for teachers and children and I contributed to the analysis of the 52 reports submitted from 10 primary and secondary schools. The aim of the peer interviewing within the evaluation was to provide an opportunity for children's 'voice' to be heard as they discussed issues that concerned them with a particular focus on electronic games, the Internet, mobile phones and rules about using electronic technologies at home. This is in no way similar to my concern for how Hannah designed her account as graphic multimodal design. Just one of many I received, 11-year-old Hannah's report stood out from the rest because it is a full verbatim transcription. What is important for my work is that it is an intermodal transformation (see Chapter 2, pp.39-40). Hannah remade the interactions of the interview on the page. Of significance for my study is her interpretative work (Powney and Watts, 1987, p.143) as she endeavoured to recapture the original multimodal experience from its recording as sound into writing. As well as the 13-page handwritten transcription I received a seven minute 22 second cassette recording of the interview. This proved invaluable in my analysis in that I was able to compare the audio source with Hannah's graphic remaking. It enabled me to examine how she had composed her graphic representational design and to hypothesize about the process of transformation.

Texts produced in children's leisure time

These texts comprise:

- An email exchange between a child and her uncle, along with an email sent by a child to her grandmother.
- A message from a child to her aunt and uncle.

- A child's web pages (including electronic notes sent by friends and peers) and her 'reading' of them.

Decisions had to be made about how I would gain access to children's graphic representation generated autonomously in their leisure time. One option would have been to approach schools. I decided against this because gaining contact with parents through school would have been an additional onus on teachers and a request beyond their classroom remit, and also because the 'filter' of the school might have had repercussions for what was selected. Making direct requests to colleagues whom I met on a regular basis enabled me to explain why I needed examples and under what conditions, and to discuss the context of production.

Kathleen, age 6, initiated an email interchange with her uncle at 17:02 one Sunday evening in November 2000. Over a five-day period the exchange comprised four messages, two from each participant. Kathleen's mother, a colleague of mine, came across the electronic dialogue midstream and, with the permission of both messagers, forwarded it to me at a time when I was seeking examples of children's graphic representation autonomously generated at home. Laurel, age 8, contacted her grandmother by email at 21:05 on a Thursday evening four days later in November 2000. Laurel's grandmother, also a colleague of mine, alerted me to her granddaughter's email message in response to my recent request.

A second strategy was vigilance in my own everyday life. Two incidents proved important for my study. Kerry is a member of my own extended family. She created her heart message at home for my partner and me and it was sent through the post by her father. This was important at a time when I was seeking to understand the relationship between materiality and medium. Her crafting of the graphic surface also provided a shift from represented framing. This challenged me to investigate some of the different forms and functions of framing and how children both respond to represented frames and compose their own.

In a school-based lunchtime club in October 2002, Bethany, with a friend beside her, entered a protected online environment for 7- to 11-year-olds. I was video recording the girls as part of my evaluation work. Actually, Bethany chose not to enter an online club or to play 'edutainment' games which was the focus of my GridClub research. Rather, she decided to view and add to her web pages, a popular and by no means unusual pursuit for GridClubbers. The Think.com environment in which this took place is associated with GridClub but was beyond the immediate remit of the evaluation. This video clip of just under six minutes proved to be fascinating. Firstly, it was an example of electronic texts autonomously and independently created by a 10-year-old child. It marked a shift from drawing to the selection, manipulation and placing of ready-made images found on the web and taken with a digital camera. Secondly, what is interesting about this snapshot is that Bethany composed the web pages she subsequently read. She created her pages with the intentionality of them being 'read' by other children in the environment but how she 'read' them herself was an example of an actual 'reading'. My justification for momentarily slipping between analysis of textual products and an example of 'reading' a textual product is that it provided insights into multimodal design – and ones that would have been much more difficult to access through any other means.

The process of selection

In practice, gathering a range of graphic texts in response to my research question required a certain degree of flexibility. What came first chronologically had implications for what could be selected next. The email exchange between Kathleen and her uncle provided an example of electronic writing in an extended family relationship. Subsequent to this, mind mapping created on A3 paper with pencil was generated for unknown researchers. The former was entirely writing and the latter predominantly image-based. From these different texts themes began to emerge such as the criterial attributes of drawing and the semiosis of space. This pointed to difference and commonality that would require further investigation in other texts. As my analysis proceeded, sometimes it was a case of investigating a semiotic resource further in order to explore whether other instantiations of the same semiotic resource

shared similar functionality. For example, does space undertake similar work irrespective of mode and medium? Sometimes, it was a case of seeking more extensive appearances of a particular semiotic resource such as punctuation. Sometimes, it was a case of absence. For example, the email exchange and the mind maps excluded variations in substance. It was therefore necessary to include texts where children had chosen different colours and mark-making tools.

A benefit of gathering the curriculum and leisure-time texts subsequent to their production was that, at the time of making, there was no thought of them being used for research. Kathleen's (and Laurel's) emails, Bethany's web pages and Kerry's heart, and the curriculum texts too, exist by virtue of the original purposes for which they were created and the conditions under which they were produced. A disadvantage is that detailed recording of the context of graphic making is lost. Where possible and relevant, I have sought and provided retrospective contextual information. Another drawback was that interviewing was not feasible with these retrospectively gathered materials because of the time lapse between production and analysis. As children's reflections on their graphic representational design is additional supporting evidence and not the data source itself, this has not in any way inhibited my theorization.

Organizing and presenting the texts

Organizing the data within my thesis was never straightforward. Originally, I had wanted to present my analysis as discrete chapters focusing on the semiotic resources of language-as-writing, drawing-as-image, presentation, layout and punctuation. In practice, the data do not fall as easily as this; they are not compartmentalized in this way. Identification of distinct semiotic resources as modes is one thing, but the multimodality of graphic representation is essentially an interweaving of different semiotic resources. They can only be understood in relation to one another. There was no way that identification of semiotic resources, how they carry meaning and how they interrelate (the way in which I investigate my research question) could be separated out for this very reason. It was necessary to find a means of organization

that did not entail recalling texts on a number of different occasions. This hopping back and forth would have made the thesis bitty and would have disrupted flow for the reader. My resolution was to allocate one chapter each to the multimodal composites of drawing and writing and a third to multimodal compounds (drawing and image together). In practice, this meant some revisiting of already partially analysed data in my final empirical chapter but it cohered with how I proposed to investigate my research question, was manageable and, I think, makes sense to the reader.

Including reproductions of the children's graphic representation within my main text rather than as appendices was vital. The children's texts are not subsidiary supporting evidence. They are the 'stuff' of my analysis. At a glance, they are able to communicate directly with the 'reader' and to show in a moment what is explored at length in writing. This is critical for a study located in a theory of social semiotics / multimodality. Intermodal transformation has methodological implications. Any worded description of an image changes its structures (Barthes, 1977, pp.18-19). This also applies other aspects of graphic representation such as colour, boldening and spacing. My description is not the same as the original semiotic resources. It makes them into something else. Inclusion in my main text also provides opportunities for alternative interpretations by the 'reader'. The unfeasibility of including examples from the protected online environment for children requires the reader to imagine Bethany's web pages on the basis of my description.

My transcription of children's spoken interview comments is an intermodal reshaping too. As speech is clausal rather than sentenced, I have used backslashes to show pausing between phrases. Omitted talk is marked as [...] and I have used inverted commas to show reported speech. It may be that, in the future, electronically presented academic texts will be statutory because of their expanded multimodal capabilities in comparison with print.

One of the semiotic resources I explore in my study is the materiality of graphic texts. A reproduction is very different from an original. Whilst line and colour are retained,

the original materiality is lost. The scanned version of Megan's Pentecost text (Figure 4.12a, p.116) necessarily lost the changing visuality and tactility made by wax crayon. What could be seen and felt in her workbook had to be described in words. Similarly, the actual reflective materials glued into the children's science books such as small samples of tinsel became two-dimensional copies (Figure 4.1, p.89). Indentations remaining after erasing were also lost (Figure 6.3, p.182 and Figure 6.5c, p.189). What seemed important was to make the scanned reproductions as alike the originals as possible. Size also had to be remade. Reduction of the A3 mind maps changes what they are (see, for example, Figure 4.3, p.93 and Figure 4.4, p.95). Reproductions are always second best to the originals.

The emails were never anything but screen-based in the actual exchange process. In order to present them in print it was necessary to change the medium, that is from the screen to the page. That which was generated, read and responded to on the computer is here remade on paper. What the reader sees is therefore different from what the participants experienced. In an attempt to replicate how the emails looked on the screen, I used the table facility to remake their boxed structure, then copied and pasted the forwarded messages into their main frames. The spelling, capitalization and spacing are exactly the same as the originals. As a checking strategy and for analysis purposes, I switched on the 'show all' facility. In identifying precisely where the space bar and enter key had been pressed I could be sure that the remade texts were absolutely accurate. Where the content rather than the presentation of writing was criterial, such as some excerpts from Hannah's transcription or where I have extracted examples from displayed texts, I have reproduced written text electronically. Whilst the 'look' of the original handwritten texts is lost, I have always replicated spellings, deletions and punctuation. This is not only faithful to what was done but it also provides information crucial to understanding the children's graphic representational design.

Ethical issues

Ethical considerations are always a crucial aspect of research. This is a complex area and one without fixed guidelines because ethics tend to be situation-specific (House, 1990, p.158; Miles and Huberman, 1994, p.289). Certain ethical questions arise in all studies and, whilst normative action cannot be prescribed, there is broad agreement on areas that require careful consideration. These cluster around honesty, trust and mutual respect. My analysis does not measure one child against another. Such comparison is not the aim of my study. In endeavouring to see graphic representation from the child's point of view, I always aimed to conduct my research sensitively, empathetically and with serious and detailed engagement (see also Reason and Rowan, 1981, p.245; Crotty, 1998, p.109).

As relevant, I sought the signed permission of parents, children and school staff, as well as approaching project directors, the government agency that commissioned the evaluations and the commercial company that provides the online environment. With regard to the curriculum work, prior written consent to proceed was given by a principal adviser with the proviso that I took into consideration the pressures on teachers' time. Each head and class teacher approved the wording of permission letters to parents. In the letter, I explained that I would not need to meet the children, that the names of the children would be changed in order to protect their identity and that the name of the school would not be given. I have been careful to ensure that the 'real' names of children and their schools have been electronically erased, adjusted or trimmed off in curriculum and evaluation examples. Gaining permission to study Bethany's web pages and her 'reading' of them as they appeared on the video entailed contacting the Think.com lawyers in the United States. As this is a protected online environment, I was required to submit a variety of paperwork (a research proposal with clear identification of research activities, verification that this was a genuine project, written parental and school consent and confirmation that I would not maintain any personal information on individuals). I sought and received permission to undertake meta-analysis of the ImpaCT2 mind mapping and interview transcription from the project directors and from the government agency which commissioned the work. In the GridClub project, which I was involved in from the

start, I obtained written permission for the children to take part in the evaluation. In administering the mind mapping task within this project I always checked that children were happy to participate, explained that their maps would subsequently be analysed and reported on, asked their permission to audio record and gave them ample opportunity to withdraw at any point. Again, I sought and received permission to include materials from the project director and the government agency which commissioned the evaluation.

On the basis of one of the children asking me to use her 'real' name (with her mother's full agreement), in the case of texts produced informally I asked whether the actual name or a pseudonym was preferred. I also sought and received the signed permission of the children themselves, believing in the integrity of children and respecting their ability and right to make decisions about their work being seen and written about (see also Alderson, 2000, p.243). On the one hand, I believe that one should be careful of underestimating children and should show respect for their wishes. Explanation to children is one thing. That they understand the full implications of what they are giving their permission to is another. Once published there is a permanence that cannot be reversed. However, these were all joint adult / child decisions. Furthermore, my work is a celebration of children's sign-making and nowhere a criticism. The children deserve credit for what they have done. In any case, all family names have been either changed or omitted and all email addresses have been anonymized.

Submission of the relevant sections of the final draft to the government agency and the commercial company, and drafts to teachers and parents where appropriate and possible, I felt was important ethically. I received no objections to my work. Ensuing discussions with class teachers were helpful in that I was able to check on some procedural points and contextual detail.

Analysing the data

Interpretation

Descriptions and analyses are always interpretations. There can be no such thing as 'pure' or 'immaculate' description because any account is filtered through the researcher's perceptions (Wolcott, 1994, p.13, p.15). These are necessarily shaped by the inquirer's experiences, opinions and views of the world. Furthermore, every methodology is 'theory-laden' (Powney and Watts, 1987, p.181). 'Without a theory, there is nothing to research' (Silverman, 1993, p.1). My methodology derives from the very particular theoretical perspective described in Chapter 2. I take the position that graphic representational design is always a process of transformation. I aim to understand the complexities of how children have transformed semiotic resources in their graphic multimodal designs. In approaching my selected texts from this particular theoretical approach and with the specific analytical tools of social semiotics, textual 'stuff' became data (see also Brown and Dowling, 1998, p.80). My analyses are always hypothetical. I do not claim to have found definitive 'truths' but rather suggest how children's graphic representation might be understood within this theoretical framework.

From signs to semiotic resources

My way to identifying and understanding the semiotic resources of children's graphic representation is through how they appear as signs. The signs are the means to the semiotic resources. My analysis is based on the premise that a finished text signifies the individual's final semiotic settling on what was deemed to be apt to the particular representational need within the given context (see Chapter 2, p.61). It hinges on my definition of three essential features of multimodal design: choice, shaping and combination (see Chapter 2, pp.59-60). A crucial aspect of this is commonality and difference. What is shared between the multimodal composites of writing and drawing and what is different? What happens when they appear together as multimodal compounds? Does the functionality of semiotic resources remain stable or does it shift from text to text? To reiterate, for writing and drawing discretely and combined in the same text, at all times my analysis revolves around the key questions

identified in Chapter 1: what are the semiotic resources, how do they carry meaning and how do they interrelate? This is the means by which I endeavour to understand graphic representation as multimodal design.

My study seeks to understand how semiotic resources work independently and interdependently in children's graphic representation. Firstly, at the level of individual textual items, this provides scope for extracting individual signs as single words or parts of drawings for highly detailed analysis. I momentarily disconnect signifiers and signifieds in order to describe form and explore possible meanings. With regard to images, this is a case of describing and analysing their component parts. Where the stimulus for sign-making is materially present (the tinsel) or entails intermodal reshaping (Hannah's interview transcription), understanding transformation entails description of the source and analysis of how it became graphic. Secondly, examining signs in relation to their immediate context provides the next level up, for example how parts of individual drawings integrate with the whole or how a word fits within the clause in which it sits. Where appropriate, I draw on the well-established functional grammar of Michael Halliday (1994) to examine how children have shaped their wording. Finally, I investigate how signs interrelate with signs elsewhere in the text, both as like semiotic resources (for example, punctuation in one place as against punctuation elsewhere in the text) and in different modes (for example, what happens in drawn as against written 'lexis'). Here, I draw on the methods developed by Kress and van Leeuwen (1996) and van Leeuwen (1998). This analytical approach enables me to examine how the children chose, shaped and blended signs within and between modes, and to explore the shared and different functionality of different semiotic resources.

The process of analysis

My early analysis carried the surprise of the unforeseen and the unexpected. As time went on, the richness of meaning in the children's texts became astonishing in its very ordinariness. I began to see patterns of continuity as well as discrepancies. Theoretical implications emerged through a process of thorough and systematic

analysis. Sometimes, these were immediately manifest and sometimes they unfolded gradually. I allowed myself the space to explore and rework ideas and to extend my theorization with fresh insights. New theoretical possibilities emerged with each revisiting of individual texts both discretely and in the light of subsequent interpretations of other texts.

For me, writing was an essential feature of the process of inquiry. Continuous text was the means by which I described, analysed and interpreted such data as Kathleen's email, Kerry's heart message, the mind maps and the science curriculum texts. Drafted, revised and refined over time, it was a way of exploring ideas and moving towards understanding. Writing was a dynamic, creative process, 'an open place, a method of discovery' (Richardson, 2000, pp.924-925). This was not a licence to unconstrained freedom. 'Wordsmithing' demanded painstaking, reading-informed choice of technical terms and careful attention to wording in an effort to create precision, to say what I wanted (or was able) to say clearly within the affordances of written language.

With more extensive texts, such as Hannah's 1,205-word transcription, a systematic means of documenting my analysis was necessary. Constructing a table which catalogued the occurrences of phenomena enabled me to compare Hannah's transcription with mine, something that required repeated cross-referencing with the audio recording. This became my source for studying patterns and variations in how she had transcribed, and a site for noting analytical memos as reminders of hypotheses to be investigated and ideas to be explored or expanded (see Lofland and Lofland, 1995, pp.105-106).

The temporality of the video recording had implications for my analysis of Bethany's web pages. Analysis required frequent backtracking, rechecking and re-measuring because shifts happened so quickly. Examination of images could only be done from a frozen screen and entailed copying down her writing and sketching her images and the structures of her pages using pen and paper. This demanded repeated revisiting in order to check features such as colour, underlining, relative size and directionality.

Video was invaluable in analysing how Bethany went about ‘reading’ her pages. Scrolling, the position and movement of the on-screen arrow, and her head and eye position gave robust clues about what she was attending to. Using a stopwatch, the ‘real’ time of video enabled me take precise measurements of scrolling from one part of the page to another and time spent in examining particular features of the pages. Where the speed at which she moved between items was excessively rapid, frame-by-frame viewing became helpful.

The process of my work was characterized by a constant interplay between existing theory, analysis of my data and my own theorization. Peter Reason and John Rowan call this a cycle of ‘re-search’ (Reason and Rowan, 1981, p.247). It bears some resemblance to what Wilhelm Dilthey (1833-1911) called the ‘hermeneutic circle’ where understanding consists of circular and spiral relationships between the parts and the whole, between what is known and unknown, between the phenomenon and the wider context, and between the knower and the known (Rowan and Reason, 1981, p.135, p.244; Smith, 1989, p.134; Crotty, 1998, p.92; Schwandt, 2000, p.193; Patton, 2002, p.114). Whilst my analyses of the semiotic resources of individual texts remained substantively settled from the start, responding to my research question (and in doing so theorizing in this new area) was by no means unchallenging. I returned frequently to key emerging ideas, expanding and refining them in the light of more recent interpretation and re-reading of my core texts. Some hypothetical theorization crystallized rapidly, other conceptualizations shifted and changed over time, and some ideas remain unsettled. My study does not purport to being ‘correct’ or fixed or final. It is a way of opening up discussion on the possibility of graphic representation being understood as multimodal design.

CHAPTER 4

THE SEMIOTIC RESOURCES OF DRAWING

In this chapter I ask the questions: *what are the semiotic resources of children's drawing, how do they carry meaning and how do they interrelate?* I describe the signs children have made and endeavour to understand why they made them in the ways they did. Whilst the mindful process of decision-making is necessarily lost in the product, that which appears as graphic representation is a final settling on which semiotic resources were deemed most apt for the task in hand. My aim is to identify, describe and analyse the semiotic resources within these examples and to understand the meanings they make. To do this, I study individual drawings and explore interrelationships between drawings in the genre of image-based mind mapping.

I explore five occasions when children were called upon to represent their knowledge as drawing. The class-based curriculum texts in science and religious education are contrasting in that the children were required to draw an actual thing (a reflective material chosen and affixed to the page), something transient that had been seen in the past (a firework) and an abstract idea (the Holy Spirit). Image-based mind maps generated for research purposes were an opportunity to represent experiential knowledge and knowledge of the wider world. Their focus is on drawing electronic resources and how they interrelate, and being a member of an online club.

Interestingly, both the curriculum texts and the mind maps are compoundly multimodal in that the children were required to include writing as well as drawing, albeit in different proportions and with different functionality. I revisit this in my subsequent empirical chapters.

The extent to which tasks are prescribed, how modes are stipulated and the way in which graphic representation is predetermined through the pre-structuring of the page

are significant for choice and creativity, and hence for representational design. In the texts examined in this chapter, drawing was stipulated by both teacher and researcher, as were the graphic surfaces and tools the children were allowed to use. Nevertheless, the children did have choice within varying parameters and they shaped and combined semiotic resources according to their particular interests. Texts made by different children in the same class and in response to the same instructions bear similarities but their fundamental differences are evidence of the process of transformation as each individual made meaning in sometimes overtly and sometimes subtly different ways. As a primary concern for the children was representing the ideational, I seek to understand what was transformed and how in the process of sign-making through detailed examination of their image composition. Their knowledge and understanding were also intended to be communicated to others (a teacher and a researcher), and so the ideational was shaped towards how they perceived this social relationship. These interpersonal meanings are always present even if implicitly in the children's drawing.

The 'lexis' of drawing as a semiotic resource

Criteria form

As part of a science topic on light, Year 2 children (6-year-olds) engaged in an activity where they investigated which materials have reflective properties. Following class discussion and explanation of the task they were about to undertake, the teacher worked with groups as they undertook an experiment with a toy Paddington Bear, a 'black box', a torch and a range of materials. The aim was to discover which materials did or did not reflect light. As an outcome of conducting the experiment, the children completed an A4 worksheet the following day. The instructions read:

<p><u>Keeping Paddington safe in the dark</u> Can you choose a material for Paddington to wear on his night time walk? Remember – it must be seen when the car's lights shine on it.</p>
--

The children were required to imagine the hypothetical situation of Paddington walking in the darkness of night. The actual event is not shown (the children were not asked to draw the car with its headlights shining on Paddington) but rather the scientific implications are analytically extracted. On the basis of their experimental findings each child chose one of the materials they had identified as having reflective properties, cut off a small piece and glued it onto the worksheet. They also drew where they would position their choice on Paddington's clothing to keep him safe in the dark, coloured the outline image and wrote down a sentence from the board.

On the face of it, this might seem like 'just' a drawing, colouring, gluing and copying activity. Actually, the children's drawing and writing (the latter is analysed in Chapter 5, pp.143-144) are significant for understanding their thinking. Seemingly, the tight constraints of this graphic activity inhibited any potential for creativity. There is a 'sameness' about what the children did. Yet examination of the completed worksheets reveals variations that imply subtle inflections of meaning. Whilst there are threads of similarity each child's meaning-making varies. Despite the apparent prescription of this worksheet that stipulated mode (here you must draw or apply colour and here you must write) the resultant texts are similar but not identical. These differences are evidence of individual transformations.

In the original texts I had both the children's actual choices of reflective materials and their actual representations of them, unlike the scanned versions presented here. I examine how three children transformed the actual into the represented and how they captured what, for them, communicated the essence of the reflective materials for this piece of curriculum work. Using a blue coloured pencil, Rachel made a representation of tinsel on Paddington's hat through bold, firm, repeatedly overlaid strokes (Figure 4.1a and enlarged in Figure 4.2ai). She showed three single lines intersecting a central spine. How did this compare with the affixed sample of 'real' tinsel? Both were blue and both had strands that looked like straight lines. However, Rachel chose to draw just three strands compared with the multiple strands of the actual tinsel sample. Why? Her drawing seems to be an analytical representation of the structure of tinsel: this is how tinsel is made – a central core with single strands emanating from it.

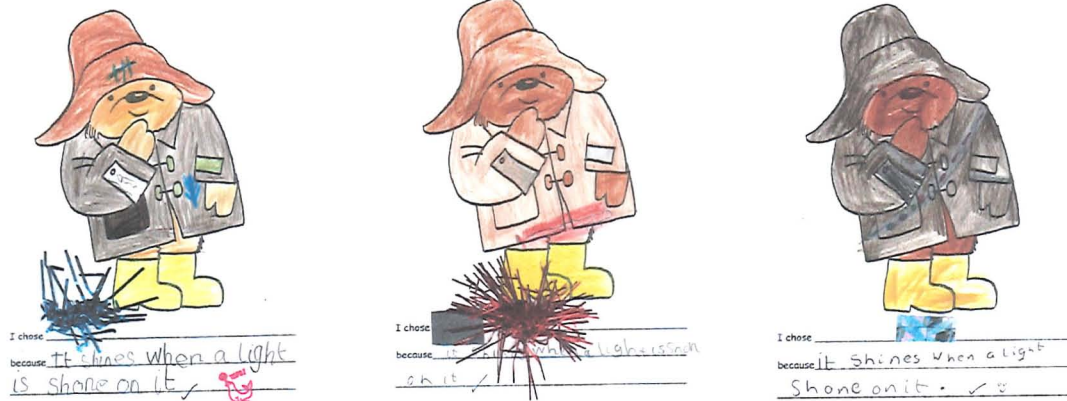
However, she then went on to draw a second version on Paddington's coat (Figure 4.1a and enlarged in Figure 4.2ai). This shares certain features with the representation on Paddington's hat: blueness, a central core and attached straight strands. However, it looks very different. More feather-like, it communicates mass and texture.

Figure 4.1 'Keeping Paddington safe in the dark'

a) Rachel

b) Daniel

c) Katie



Here are two contrasting representations of the same material thing. It is not that one representation is accurate and the other is mistaken. Rather, Rachel showed two different ways of representing, one a more diagrammatic form and the other with a greater focus on the perceptual; she showed the structure of tinsel and what it looks (and feels) like. This communicates her conceptual understanding of what tinsel is scientifically. The pink stamp (a seal balancing a ball with the accompanying praise 'TOPS!') marks her teacher's approval of the sufficiency of the piece of work in terms of assessment. The capacities of drawing allowed the communication of conceptual thinking that would not have been possible in the mode of writing. Image enabled Rachel to show what the word 'tinsel' could not.

Daniel captured the texture of tinsel in a different way (Figure 4.1b and enlarged in Figure 4.2b). Positioned on the hem of Paddington's coat, with pencil he drew a horizontally aligned sausage shape with twelve short equidistant lines emanating from the uppermost outline and six from the lower edge. Whilst similar in composition to Rachel's, he gave the core greater solidity than the strands,

presumably a transformation of how it felt. Daniel thereby captured the tangibility of tinsel as a material whose strands have a texture of delicate, insubstantial solidity yet is squeezable to a core. Again, this is an analysis of form. (Note how the shape of the cuffs apparently eliminated the need for complex sign-making in representing the flatness of an inflexible silver-coated laminate.) In contrast with Rachel's representation of tinsel, however, Daniel then coloured heavily in red over his pencilled frame. This gives an impression of fullness. The density of 'redness' seemingly draws attention to the mass of colour reflecting light according to the focus of the task.

Figure 4.2 'Keeping Paddington safe in the dark' (enlargements)

a) Rachel

b) Daniel

c) Katie



Katie's choice was a piece of card whose glossy surface was made up of irregularly tessellating straight-sided shapes (Figure 4.1c). When the light shone on this silver face, it had the effect of multiple colours (pinks, greens, blues and golds) which changed with head movement, an effect partially apparent in scanning. How did Katie deal with this in her representation? Prior to her heavy dark brown colouring of the coat, she drew with pencil a curved band from Paddington's left shoulder to the hem of his coat on the opposite side. She coloured this grey. Katie then used pencil crayons to superimpose three straight lines and one ellipse in red on the upper section of the band and below six circles in yellow, red, green, purple, blue and blue (repeated). The grey base colour apparently represents the silver of the card and the coloured shapes its multicoloured reflections. Katie's omission of pencil outlines implies transience, the here and gone of the reflections.

Katie did not choose tinsel for her reflective material in this task. However, she did draw it in decision table nine days earlier (enlarged in Figure 4.2c). Katie drew a

skeletal structure in pencil like Rachel's (a central horizontal line with nine short vertical strokes crossing it) and coloured solidly over it in pale blue in a similar way to Daniel. She surrounded this with a dark blue, rectangular, non-pencil enclosed border. This may be another way of differentiating between the solid core and flimsy strands, that is, showing structure and texture. Alternatively, it may be a representation of the visual effects of the tinsel's 'blueness', its haze or sparkle. The mixture of a pencil frame with dual colouring seems to be a transformation of the structural, textural and reflective properties of tinsel. This mix of solidity and transience, 'touchability' and visuality, represents her particular idea of tinsel in this scientific framing.

Interest in an object can be 'condensed' into its 'criterial' or defining characteristics (Kress and van Leeuwen, 1996, p.6, p.11; Kress, 1997, p.12). For example, a series of circles made by a 3-year-old represented a car (Kress and van Leeuwen, 1996, p.11; Kress, 1997, p.12). In this two-step metaphor, a car is most like wheels and wheels are most like circles. Repetition of the same shapes captures the distilled essence of the thing. In order to differentiate between the overall appearance of an item rather than the details of its features, I prefer to use the term *criterial form*. In each case, the criterial form of the tinsel drawings represents its essential make-up as specific to the task. Tinsel on a Christmas card might have been shown differently, for example as a string of overlaid loops. The children composed their drawings to communicate their scientific understanding of the properties of this material. Each drawing of tinsel was an individual transformation that endeavoured to portray the children's ideas about its 'truth'. Shaped for the domain of science, they showed structure, appearance, texture, colour and reflected light as relevant to the task focus on reflective properties. They communicated their perceptual and conceptual ideas, scientifically framed and shaped by their own interests, knowledge and experience. Criterial form was shaped according to the highly specific perceived ideational need.

The children were called upon to demonstrate their knowledge to their teacher in a scientific framing. Science requires accurate experimental findings predicated on systematic investigational procedures, observations and deductions. The children's

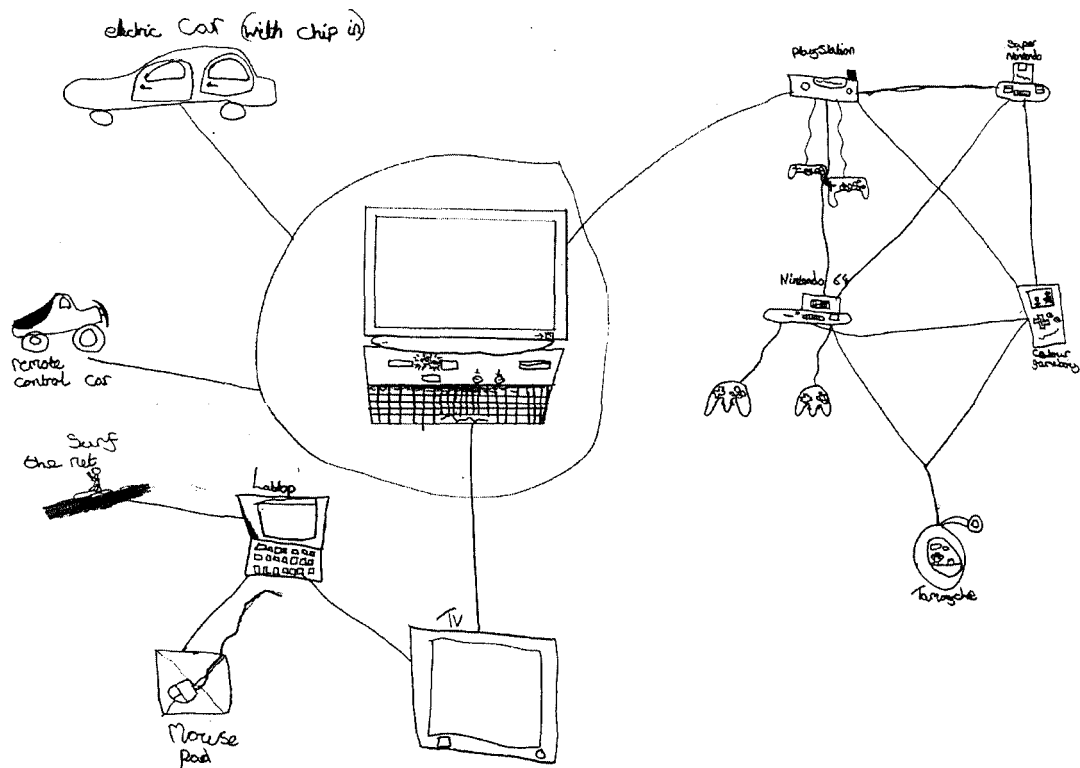
consequent scientific knowledge had to be represented graphically. In response, they appear to have drawn through and for the ‘eye of theory’ (the academic and conceptual) and the ‘eye of what was seen’ (the empirical and perceptual). The children’s drawings suggest that that how the signs they made were represented is closely aligned with ‘being a scientist’. A fundamental aspect of subject capability is learning its representational conventions. The capacities and sufficiencies of drawing in science are both like and unlike those of drawing in other subjects. There is therefore a close relationship between subject knowledge and subject representation. Scientific drawing is part of the ‘habitus’ (Bourdieu, 1977, pp.78-95) of being a scientist, what it means to ‘draw science’ – a kind of *representational habitus*. Scientific reporting, here recorded in drawing, required scientific representational sufficiency and all the disciplinary understandings that go with it.

*Criteria attributes*³

For research purposes 9- and 10-year-old children undertook mind mapping on the theme of ‘Computers in My World’. The scripted introduction to the task, read out by their teacher, established drawing as the primary means of representation: ‘Drawing is a useful way of communicating your ideas [...] We want you to tell us your ideas by drawing a mind map instead of writing’. The instructions asked the class to communicate their thinking with researchers through ‘quick and simple’ drawings that did not take too long to produce and did not need to be ‘perfect’. The mode had implications for what could be communicated. Oliver’s map (Figure 4.3) is object-rich. It comprises 12 nodes (individual images), 11 of which are ‘things’ and one a visual pun (a representation of surfing the net). The nodes are drawn as two-dimensional images from a frontal view and at eye level. Exclusion of colour was stipulated in the instructions but Oliver’s omission of shading and background were design decisions, as these were not mentioned in the script. This has the modality effect (a term borrowed from linguistics to denote ‘truth value’) of portraying the actual rather than the imagined, the ‘truth’ as he perceived it.

³ Parts of this section have already been published: Mavers, D. (2003) ‘Communicating Meanings through Image Composition, Spatial Arrangement and Links in Primary School Student Mind Maps’. In C. Jewitt and G. Kress (eds), *Multimodal Literacy* (pp.19-33). New York: Peter Lang.

Figure 4.3 Oliver's map



'Quick and simple' drawing may result in apparent minimalism but this belies the complexity of the process of design. Whilst lacking the 'analogical plenitude' (Barthes, 1977, p.18) of photographs which replicate the original more or less as we might see it 'in the flesh', Oliver's mind map drawings are suffused with analytical and interpretative plenitude. They are not exact replicas of the originals that were their source materially and experientially. They are complex semiotic transformations. An exhaustive re-presentation of each precise detail was not deemed necessary in this transformative work. Oliver represented the aspects of electronic games that he considered criterial, those foregrounded features that, for him, demanded specification according to the task focus. He selected out that which makes them uniquely identifiable. For example, as well as the overall shape of electronic games, the buttons, handsets, wires, cards and screen displays define what makes each item distinctively individual. These key features are not metaphors in the same way as the 3-year-old's circles to represent a car. They are the *criterial attributes* of the electronic games, the features that portray each individual object's unique

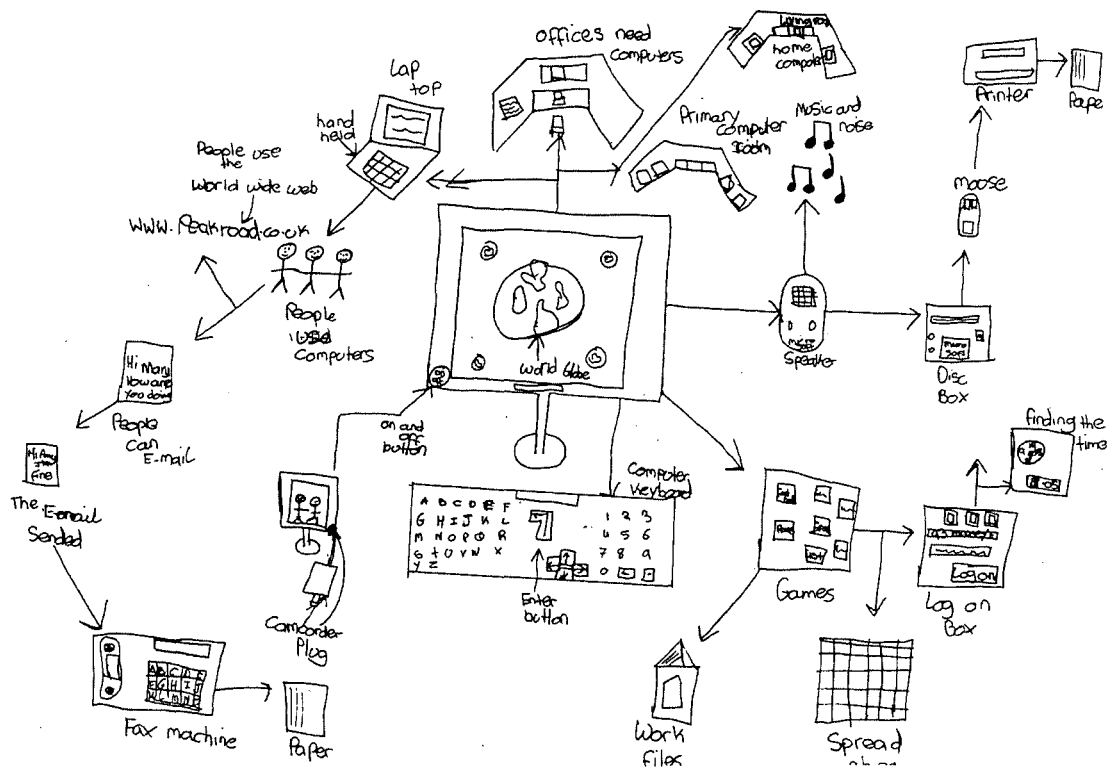
identifiers clearly and precisely. Drawing on Hallidayan functional linguistics, Kress and van Leeuwen (1996, p.97) call these 'possessive' attributes.

In his drawings of technological games equipment, Oliver endeavoured to be as precise as he could by making the criterial attributes of his images as transparently 'readable' as possible. One 10-year-old boy said of the detail within his electronic game representations, 'They're like the clearest things that you see on them.' Oliver's map was also oriented towards the intended 'readership' which was a defined but personally unfamiliar group. In explaining how he chose to represent an electronic game, another boy said, 'I was looking for the most popular game thing there which probably everybody that's gone through town has seen it in the shop window.' It was a case of establishing common ground, composing the drawing so that it would put the sign-maker and the sign-remaker into a position of shared understanding. This is consideration of an appropriate handling of social relationships.

Children explained why they had selected particular criterial attributes in their drawings of games technologies with reference to three phenomena: experience, consumer-related media and social communication. Their intimate familiarity with games technologies, evident in their depiction of precise shapes, relative dimensions and criterial attributes, were said to be related to their experiences of using them. One girl said, 'You have to press some buttons that are arrows / and two other buttons which are to shoot and jump / like Mario and everything / those type of games.' Children often explained the operating procedures of electronic games using the term 'control'. This may indicate a thinking process something like 'games are about control and control is through buttons'. Here, the object, the using of the object and the concepts arising from that use inform the shaping of the representational design. In one child's description of small vertical lines in a Nintendo image, its appearance and his knowledge of its functionality were interwoven: 'It's got little grids at the back you know to stop it heating up and fusing.' What the object looks like and what it does were therefore combined in the semiosis of the drawing. Children said that they saw and heard about electronic games on the television, in shops, in catalogues or magazines, and in the playground: 'Because it's just popular / everybody knows

about them because like adverts / and like everybody talks about them and things.’ Thus, whilst the electronic games images communicate that which has been visually perceived, they can also carry knowledge and understanding resulting from personal experience and talk. Choice and shaping of criterial attributes are traces of that which is known, understood, experienced and thought about. The representations are therefore an amalgam of the individual’s perceptual and / or experiential and / or conceptual and / or social world and signify some sort of polysemic semiosis where these ‘knowings’ are inextricably, differentially and complexly interrelated.

Figure 4.4 Amy’s map



Whilst there are similarities between Oliver’s and Amy’s (Figure 4.4) drawings, variations in their criterial attributes imply differences in their particular interests. Both children drew a detailed representation of a computer. Oliver used a ruler to draw his keyboard. He divided the outline shape into five rows of 21 keys, excepting what we take to be the space bar (97 keys in total). A replication of the exact number of keys on an actual keyboard was unnecessary to convey the meaning he intended,

that is equally sized serried ranks of keys. The squiggles over the top row and the space bar imply that keys carry graphic symbols and possibly that they are related to that which appears on the screen. This information apparently removed the need for exhaustive character representations on each individual key. Amy dealt with the keyboard quite differently. She did not define individual keys but she was explicit about the symbols they carry. Apart from the 't', all 26 letters of the alphabet are written in capitals (as on a keyboard) and in alphabetical order (unlike a keyboard, although few of us would be able to replicate the order of keys from memory). Amy also included each number beginning at '1' and ending on '0', again using left to right and top to bottom orientation. The implication is knowledge that the full scope of the English numeric and alphabetic systems are present on the keyboard. The two symbols on the keys to the bottom right of the keyboard ('<' and '^') indicate her awareness of characters available for use in numerical formulae, punctuation or other presentational devices. Her inclusion of the enter key (specifically labelled) with the appropriate symbol (inverted) and the arrow keys shows further knowledge of the keyboard, possibly for functionality as command or control keys. Both Oliver and Amy distilled and emphasized features to anchor meaning, to fix the viewer's attention, but with different shades of meaning.

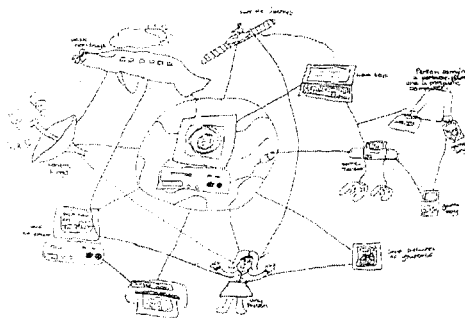
In the mind maps, criterial attributes are not limited to the representation of actual 'things'. They also carry figurative meanings. In order to communicate particular ideas, Simone and Nathalie composed what I have chosen to call 'integrated' nodes, that which Kress and van Leeuwen (1996, p.50) might designate a 'compound' diagrammatic form. In combining images of computers and the world in a format different from how they would actually appear in the world, they created visual metaphors. These are meaningful in relation to the map theme.

Simone's integrated node ingeniously communicates the idea of containing and containment (Figure 4.5a). In the centre of the screen, and hence at the very heart of the map, is a world image. The globe's spherical shape and landmasses separated by sea are culturally conventional ways of depicting the world as an iconographic image. The precise size and shape of the continents appear to be unnecessary to

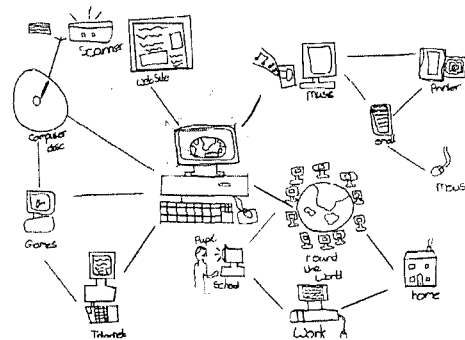
communicate the meaning she intended, presumably the global. The marks around the globe's periphery suggest repeated pencil movement in a circular motion. This may be an equivalent of underlining which has the effect of emphasizing roundness or it may suggest rotation. Its shape also connects the contained and containing worlds. The production of a second surrounding globe both frames the node and extends its meaning. Whilst computers are located in the world, the world is located within computers; the world is inside the computer inside the world. Similarly, Nathalie drew an image of the world inside her central computer screen (Figure 4.5b). Like Simone's and Amy's drawings, there is some sort of notion of access to the world through the computer. To the right of this central node is a world image encircled by ten computers. The implication is computers around the world. In her associated writing undertaken around one week later, Nathalie wrote, 'Computers are made for people to send messages to each other [...] Computers are connected to one another around the world so they can send messages to each other'.

Figure 4.5 'Integrated' nodes

a) Simone



b) Nathalie



These are powerful expressions of meaning. Interpretatively 'costly' (Barthes, 1977, p.41), the girls' symbolism challenges the 'reader'. It exacts deliberation. Simone and Nathalie designed integrated nodes where dual-image configurations of the actual communicate the metaphorical. Each nodal constituent has an essential interrelationship with the other in that the one contextualizes the other. The girls interpreted meanings wordlessly through drawing. Image here is able to do what writing would do less succinctly. This is no mere illustration. Their shaping of form

and meaning goes beyond the seen to the imagined, the actual to the metaphorical. The girls' integrated nodes not only carry ideational meanings in representing knowledge and understanding of 'Computers in My World' but also demonstrate their creative design capabilities in communicating through the resources of drawing.

Similarities and differences in representations of the same or similar objects in the same map are of significance. Amy's central nodes (the monitor and keyboard) contrast sharply with representations of computers elsewhere in her map. Like her keyboard image described above, her monitor node is detailed. A screen displaying images is framed by a surround with a power button to its bottom left and stands on a plinth which comprises a stem and a circular base. The link between the monitor and the keyboard suggests some sort of connectivity, presumably causality between tapping keys carrying symbols and visual or functional effects on the screen. Amy did not give other computer images this detail. The laptop node shows the shape of the resource, that it is a single unit, its 'openability' through use of perspective, its screen with text squiggles and the presence of a keyboard, here with keys but minus characters. This reduced detail may imply its redundancy, replication of criterial attributes shown in the central nodes being deemed unnecessary. In the light of this given, the laptop's portability becomes the new.

The change in criterial focus between the central computer and the laptop becomes even more pronounced in the nodes which show location. Each of the three rooms (office, living room and school 'Primary computer room') is represented three-dimensionally as if viewed from the doorway. The rooms are depicted as plans rather than pictures. Drawn from a high angle this gives a bird's eye view and enables Amy to provide information about the number and positioning of computers. That the shapes in the rooms are intended to represent computers is contextually inferred in relation to the map's theme ('Computers in My World'). Had the focus of the task been different one would expect different items to have been chosen for representation and the shapes to have different meanings. It is notable that the plan-like symbols representing the computers in each location are similar in that they are all squareish shapes but differentiated in that they are made up of varying

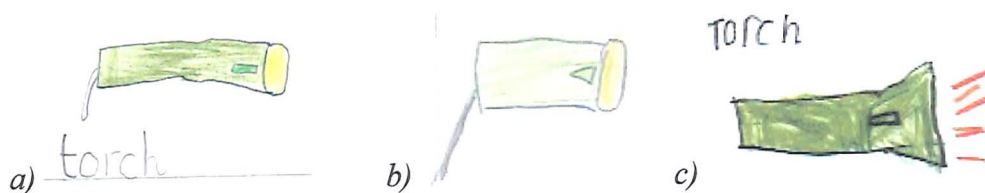
configurations. The conjoined squares representing the office computer may depict a laptop, as in the adjacent node. Amy said, 'Some people in businesses they have laptops.' Squares inside squares are used in the home location. The representation closer to the label 'home computer' seems to be a desktop, the one to the left may be a digital television. Amy commented, 'I've got the Internet on my television as well.' The school computers are even less detailed (squares). The replacement of computer criterial attributes with shapes is a sign of a shift in Amy's thinking. Whilst the move to *symbolic representation* is likely to be task-related in that time constraints required speedy drawing, and there was limited availability of space within the node, these shapes have a particular function. They represent 'computerness' where focal vision is on the existence, positioning and number of computers in a particular setting rather than on their criterial attributes. In these nodes, Amy's attention shifts to the locations where computers are found and their specific characteristics. The given (the details provided in the central node and the laptop's portability) leads to the new – the contrasting locational settings in which computers can be found. A certain perception of the world of work seems to be expressed in the office node: the single computer on the desk facing a window with a single chair, and the framed squiggly lines on the office wall, possibly implying a chart or certificate rather than a picture. This suggests a different experience from school where the multiple computers are not given tables or chairs, the primary feature of the computer suite apparently being its multiple machines.

Thus, the same or similar items can be represented in different ways according to the particular role they are intended to fulfil. Contrasting levels of detail appear to have been motivated by Amy's key meaning intentionality for each node, its *criterial focus*. The detailed criterial attributes of the central computer show its main identifying features. Reduced detail or a move to abstract symbolic shapes marks a shift in focus. Different representational purposes therefore result in different compositional detail of the same or similar items according to the particular function they are required to fulfil. Furthermore, the design of a drawing's 'lexis' is contingent on its purpose in relation to the whole. Choice and shaping of criterial attributes are related to the organization of the full text. At whole-text level each textual constituent

relates to the theme of the map. However, there are subtle interrelationships between nodes which remove the need for repetition and build on the known with the new. This implies that children are mindful of these different levels in their textual design (something akin to word, sentence and text level in writing) and that they are able to combine signs and relationships between signs into a coherent and meaningful whole. Meaning-making is layered.

Shifts in criterial attributes according to the purpose of the image were also evident in a 6-year-old's curriculum work. On three occasions in the science topic on light Rachel drew a torch. These are shown in chronological order in Figure 4.6. There was one week between the production of her first and second and images, and 15 days between the second and third. There are continuities and discontinuities between each representation. In chronological appearance, the first two occurrences share similarities in their shape, orientation, colour, carrying strap, switch (with a variation in shape and hue) and representation of glow. However, in Figure 4.6c the carrying strap is omitted and the switch is not differentiated by colour although it is given an emboldened outline. Here, Rachel flared the light emitting end and portrayed its light as rays. Just as Amy did with her computer drawings, Rachel adjusted the criterial attributes of the same object to convey a shift of meaning.

Figure 4.6 Rachel's torches



All three worksheets from which the torch images are taken were entitled 'Sources of Light'. However, there were conceptual differences between the first two tasks and the third. The first was a random identification of any light source and the second a categorization into four types of artificial and natural light. In both cases Rachel depicted torch-as-object, a 'thing' that is a source of light. The third worksheet, however, was a comparison between source of light / not source of light. The children

predicted and then undertook an experiment to discover which objects emitted light. The image shown in Figure 4.6c taken from this worksheet shows a subtle but important shift in focus. Instead of concentration on the torch as an object, attention is on its light emitting qualities. In this instance the portrayal of beams of light was criterial and Rachel adjusted her image's criterial attributes accordingly. Rays were added and object features such as the carrying strap and the colour of the switch were omitted. She focused on what the torch does (its functionality) rather than solely on what it looks like (its appearance). Design is contingent on the purpose of the representational work.

*Style and orientation*⁴

Slight adjustments in the wording of the instructions originally used for the 'Computers in My World' maps had astonishing effects in the 'Being in GridClub' mind maps. Image-based, the mind mapping was again described as a means of communicating with researchers 'by drawing instead of writing' and helping them to 'understand what you think'. How to compose the maps was left largely to the individual. The children were advised to 'start with your first drawing and then you draw other things as they come to your mind. It doesn't matter what order you draw things in'. They were also asked to 'show the researchers how things are linked in your mind' by drawing 'lines between the drawings that you feel are linked'. Unlike the 'Computers in My World' maps, however, the children were asked to label links using two or three words. In order not to influence the way in which the maps might subsequently be composed, in the preparatory phase the children were invited to draw two or three images on a flipchart and to add one worded link, but gestures were made to indicate a variety of ways in which the maps might be set out.

The 'Being in GridClub' maps are multimodal compounds because they include both drawing and writing. Neither can be discounted in understanding the 'fullness' of the

⁴ An earlier draft of this section was presented as part of a conference paper: Mavers, D. (2003) *Children Drawing Children: Representing an Online Club in Mind Mapping*. International Federation for Information Processing (IFIP) Working Group 3.5 on Informatics and Elementary Education, Sydney, Australia (July 2003).

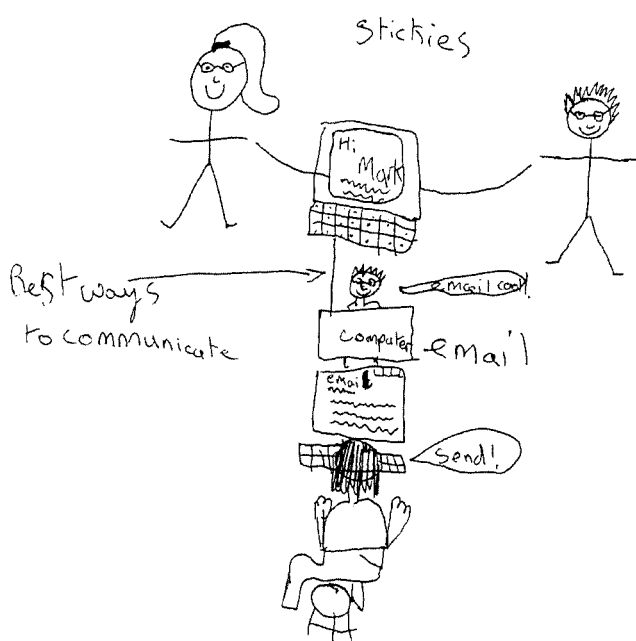
children's meanings. Whilst I recognize the co-construction of meaning as drawing and writing interrelate, here my focus is on how the children drew club members.

Firstly, the style of composition, namely as diagram or picture, is significant for meaning. Secondly, the orientation of figures is significant for the representation of social relationships. By 'orientation' I mean forward-, back- or side-facing. This is simultaneously meaningful in two ways. Firstly, how figures are oriented towards each other within the maps are signs of intratextual constructions of meaning, that is how social relations within the club are to be understood. Secondly, their orientation also constructs a relationship with the map 'reader'. Ideational information is inextricably interwoven with the interpersonal. The drawings provide implicit but crucial semiotic detail vital for understanding what it means to be a club member.

'Best ways to communicate' (Figure 4.7) is a node taken from 11-year-old Abigail's map. Positioned at the top of the node, centred and framed by white space, the word 'stickies' names a means of communication that may be unfamiliar to an adult reader. Within her drawing, Abigail's choice of the greeting 'Hi Mark' establishes an informal register and the two lines of text squiggles show that a sticky is a short note. That stickies are exchanged through the medium of the computer is established by the positioning of the message inside the screen with its juxtaposed keyboard (note the dots on each key implying text input). The link to the computer below also reinforces the medium of connectivity – stickies are about sending and receiving electronic messages. Interpersonal exchange is shown in diagrammatic linkage of the two stick figures (note the gender mix, as in the node below) through the computer. The 'information value' (Kress and van Leeuwen, 1996, pp.183-190) of this linear arrangement in English left to right directionality suggests that Abigail herself (the known messenger shown through glasses and a pony tail) is the 'given' who leads through the sticky to the 'new' (another member of the club). This ordering constructs a fundamental precept of communication theory: maker, text, receiver (Saussure, 1966, pp.11-13). This is factual information-giving. The image shows the 'who', the 'what', the 'how' and the 'why' of sticky exchange in the environment. Abigail chose to represent this node frontally. Eye-to-eye, her figures address the

'reader' directly. Kress and van Leeuwen (1996, pp.126-127) call this 'demand'. There is a direct connectivity between the figures on the page and the 'audience'. She calls upon her 'readership' to notice that club members are linked by electronic sticky communication and to get a notion of what that messaging is.

Figure 4.7 A node from Abigail's map



Underneath, the drawing that focuses on email exchange in the environment is composed quite differently. It is pictorial. Abigail drew 'whole' people (although only the head and shoulders of the boy can be seen) rather than stick figures and omitted links. The children are sitting at the computer facing one another. The 'reader' sees the back of one and the face of the other. Why this shift in orientation? There seem to be two reasons. Firstly, the 'vectors' (Kress and van Leeuwen, 1996, pp.43-48) between the figures carry the transactional. Vectors are the equivalent of verbs in language. They imply the actional or the dramatic. To borrow terms from Hallidayan functional grammar, the girl is the Actor. She is oriented directly towards the boy who is the Goal of her action through the tool of the computer. Unlike the diagrammatic sticky node above, this is a narrative clip. There, Abigail depicted the form and content of a sticky and showed the sequence of exchange as a distilled

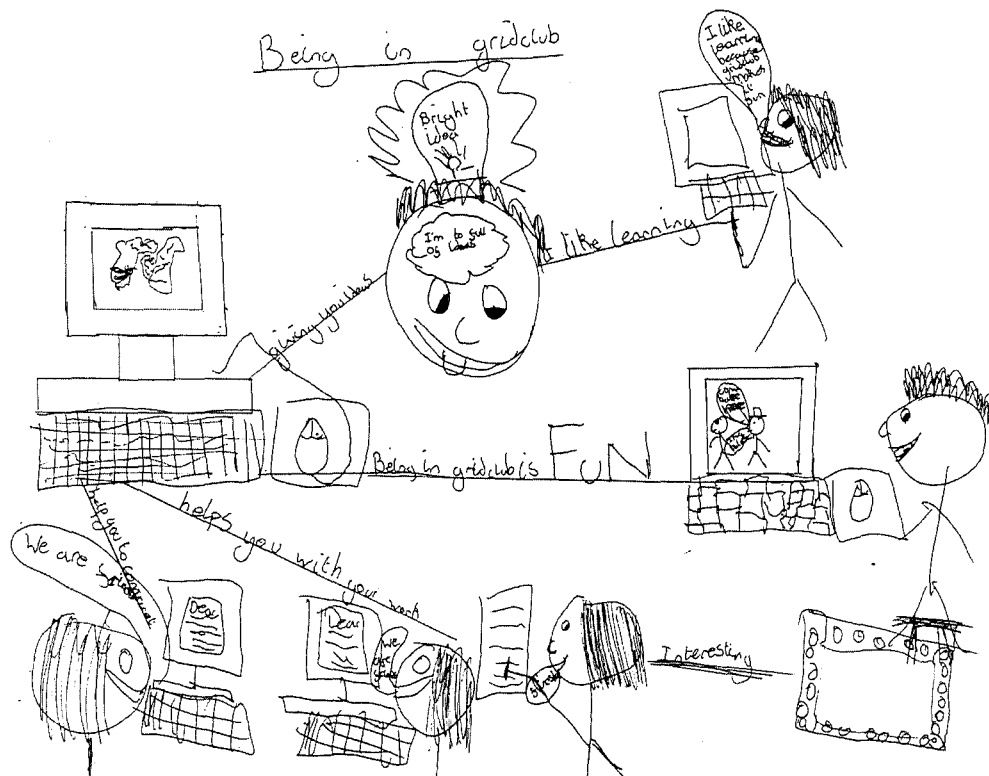
analysis. Here, the email messagers are currently engaged in a communicational event. The directionality of the girl's hands suggests typing and the speech bubble 'send!' shows her making things happen. Just as the female is depicted first in the left to right orientation in the sticky node, the girl here is larger, shown in full and is the initiator of the exchange. The smiling boy at the computer facing her has evidently just received the girl's email with pleasure ('e-mail cool!').

Secondly, the orientation of the figures constructs a different relationship with the adult 'reader' from that above. If drawing the girl from a back view does not exclude the 'reader', it nevertheless implies that her attention is elsewhere. She is engaged with what is on the screen rather than directly addressing the audience as in the sticky node. The inferred focus of the back-oriented child invites the 'reader' to share the object of her attention. Showing what is displayed on the screen reveals that the preoccupied child is absorbed in email. Although Abigail shows that an email message is comparatively longer than a sticky, she keeps its precise content indefinite (text squiggles) and does not specify register. Whereas frontal orientation in the sticky node constructs an open invitation, here the 'reader' is allowed an insight into interpersonal communication between two individuals. This private exchange is going on and the viewer can be temporarily privy to it. Kress and van Leeuwen (1996, pp.126-127) call this 'offer'. The 'Best ways to communicate' node as a whole implies a tension between communicating information as requested by the researchers and entry into the private or semi-private world of the environment.

A similar phenomenon is evident in Rosie's map (Figure 4.8). Rosie (age 8) drew her stick figures in profile. These side views similarly imply that the children's attention is directed elsewhere. The activities they are absorbed in are revealed to the 'reader' in the front-facing screens. However, by positioning the figures' irises so that gaze is directed as 'demand', Rosie invites her viewers in. The laughing and smiling mouths (shown by the presence or absence of teeth) inform the 'reader' that this will be a pleasurable experience, further reinforced by the near-central, semi-capitalized 'FuN'. This is a clever balance between engagement and disengagement. Rosie responds to the research request for information about membership of an online club

yet hints at the privacy of this child-only environment. Simultaneously, she explicitly registers her represented members' knowledge of being looked at and creates a polite response by recognizing the 'see-er', but she also communicates a firm message that the business of GridClub is what the figures are oriented towards. Of note is absence of irises in the communication node to the bottom left of the map. Here, the friends (see the speech bubbles) are engaged with one another. The adult viewer is allowed to see but is not invited in.

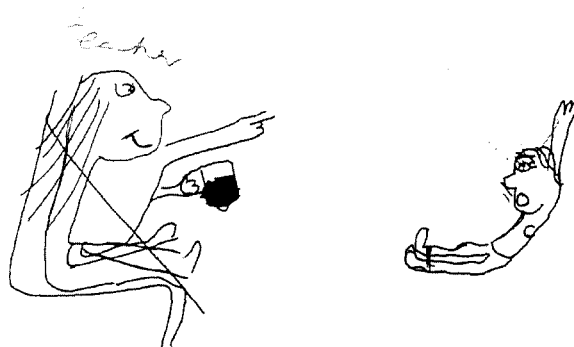
Figure 4.8 Rosie's map



The largely equal sizing of figures in Abigail's and Rosie's maps implies equivalence and the collective. This seems to have literal and metaphorical meaning. It shows the children's perception of the environment as being for people of broadly similar physical size (children). The like size also implies equality in that all children in the environment are of equal importance. Contrast with this is shown in Ricky's image of a teacher questioning a child (Figure 4.9). This drawing is clearly intended to be a face-to-face rather than an electronic exchange. Seated on a chair, the teacher is

holding a half full mug in her left hand and pointing to a child to give him permission to answer a question. The child, composed to be smaller, positioned on a lower horizontal plane and tilted away from the teacher, is seated on the floor without a chair (or mug), his mouth open as he answers. This drawing is suffused with notions of power relations. The teacher is in a position of authority whereas the child is diminutive. Nevertheless, this is not a negative image. The teacher is smiling and looks directly at the child, and there is a hint of action and dynamism in her flowing hair. This is rather an observation of a fact of classroom life. However, it is a distinction from the relative equality between children as members of the online club. It contrasts children in the classroom environment with children in the club environment.

Figure 4.9 A node from Ricky's map



These maps contain both diagrammatic and pictorial drawing, resulting in a mixture between the conceptual and the narrative. For example, whilst images convey facts about the online environment, the vectors between figures and their relationship to 'things' carry the transactional, the interpersonal and the dramatic. Orientation is significant not only for the relationship between the drawn figures and the 'reader' but also for how the 'reader' is expected to position him/herself in relation to the club and club members. In-depth semiotic analysis of the children's drawings of children reveals the astonishing. These images are by no means simplistic but carry layers of meaning. Multifunctional, multifaceted and multisemiotic, their design implicitly portrays a range of facts and perceptions about what it means to 'be' in this online club.

Other semiotic resources in image-based texts

*Layout, links and size*⁵

The diagrammatic genre of mind mapping also enabled the children to make signs at text level. In explaining how to go about composing the mind maps on 'Computers in My World' the scripted instructions asked map-makers to make links as lines but no precise direction was given as to how.

You start with your first drawing and then you draw other things as they come to your mind. The order in which you do the drawings is not important but it is important that you draw lines between the drawings that you feel are linked. The idea is to draw all the things you want to tell people about and show how they are linked in your mind by drawing lines linking them.

Whilst linking images was made explicit, how they were linked was the individual child's decision. Nowhere was there specification on layout; they could position nodes wherever they wished. The children were given A3 sheets of paper that were not in any way inscriptionally pre-marked. Within this semi-structured framing the map-makers were thereby given relative freedom with regard to sign-making on a blank sheet. The ways in which the children presented, framed, positioned and linked the drawings in their mind maps are significant. They created 'reading' paths (see Chapter 2, pp.53-54) and represented particular ideational conceptualizations.

In the centre of Oliver's map (Figure 4.3, p.93) is an enlarged and detailed representation of a computer framed by a pencilled circle. This gives it salience as the map's central focus, its title or theme. To its right, electronic games stand out as an unambiguous grouping. This is achieved in three ways. Firstly, their positioning in the space of the page as a distinct cluster surrounded by white space gives them identity as a group. Secondly, the similarities of their criterial attributes unite them (one child said, 'Because like they're the same things almost') whilst their dissimilarities differentiate them ('They would see the difference in the controls and

⁵ Parts of this section have already been published: Mavers, D. (2003) 'Communicating Meanings through Image Composition, Spatial Arrangement and Links in Primary School Student Mind Maps'. In C. Jewitt and G. Kress (eds), *Multimodal Literacy* (pp.19-33). New York: Peter Lang.

that'). Thirdly, the discreteness of the grouping is further emphasized by the single link to the central node whereas the interconnections within the group show relationships between intra-group nodes. When asked why map constituents had been linked in the way they had one child replied, 'Because they're all the same equipment / they've got the same purpose or something / to be made / and they're all computers really / so they're a family or something / something like that / that's why I joined them all up.' Another child commented,

Well I was just linking them together to give a clearer view to somebody that's reading it / to say that these are all games and they're linked together / so the Nintendo is a game but the PlayStation 2 if I connect it to it they'll see that it is a game but it's a different type of make / somebody could think that's a video player couldn't they / if they didn't know what it was / that's why I linked them together / so if you know what one is / a game / if you link them together the rest of them must be games.

The four links drawn from the framed central node imply exit at any point of its circularity. This gives 'readers' freedom to explore in an order of their own choice. Within the electronic games 'family', however, Oliver both gave the 'reader' control and suggested a preferred pathway. His choice of 'PlayStation' as the only image directly linked to the title node (and therefore likely to be the first image looked at) may be to do with sensitivity to the needs of the 'reader'. Of all five electronic games, he appears to have considered this the most well-known and therefore the most apt starting point for an unknown 'readership' which may not share this knowledge located largely in children's culture. The interconnections within the grouping give freedom to explore in any direction, with the exception of the lowest node, 'Tamogche'. This is linked only to the 'Nintendo 64' and 'Colour gameboy'. Oliver appears to have selected and positioned items carefully to create a pathway leading the 'reader' from the more well known 'PlayStation' to the less well known 'Tamogche' (see Kress and van Leeuwen, 1996, pp.203-211; Jewitt and Oyamo, 2001, pp.147-149). This shows consideration of 'readers' who may not be as knowledgeable as the maker.

Unlike the electronic games family, the grouping of technological items linked together to the bottom left of Oliver's map is not self-explanatory. As labelling the lines between nodes was not a task requirement, 'reading' of the links necessitates an inference, what the interpreter thinks might be meant. There may be implied subtleties around 'is like' (for example, perceptually or functionally), 'is connected to' or 'gives access to' (for example, technologically) or 'is associated with' (for example, locationally or conceptually). Here, linkage and positioning inform the 'reader' that some sort of connection or association is intended.

Positioning and linkage can work together interdependently in a *semiotic partnership* where, together, they orchestrate to communicate the maker's meaning. In Amy's map (Figure 4.4, p.95) layout and links take on a more authoritative role in bringing together dissimilar images which do not share criterial attributes but do share like functional, operational, locational and conceptual characteristics. This forces the reader to work at making meaning. Amy organized her mind map into four distinctly classified areas:

- Items of technological equipment making up a computer system are shown to the right and extreme top right-hand corner of the page. These are the computer's physical components: the central monitor with its adjoined keyboard is linked to the speaker (with its 'Music and noise' association), a 'Disc Box' (not a box containing discs but the processing unit with on / off / eject buttons or sockets for input devices, a rectangular drive and a 'Microsoft' label), a mouse and a printer (with a paper association).
- At the top centre of her map, Amy drew locations where computers can be found: home (living room), workplace (office) and school ('Primary computer room').
- The eight nodes to the left-hand side of the page suggest computer-based functionality as information and communication: the web (note the correct content, order and 'punctuation' of the school address), email (here for personal / social purposes), fax (oral communication via the telephone and written information on the adjacent page) and video (moving image).

- To the bottom right of the map are resources available on a computer: games, 'Work files', a spreadsheet, 'Log on Box' and 'finding the time'.

Amy's four classifications (items making up a computer system, locations of use, information and communication, and computer resources) might be summarized as the 'what', 'where', 'why' and 'how' of computer use. These 'families' are not necessarily exhaustive and may be exemplars of the type. For example, Amy did not draw specific electronic games equipment. Rather, she identified 'types' of games using words in boxes ('football', 'races', 'space' and 'text'). A transfer to 'text squiggles' appears to imply that other games are available but that Amy either did not have the time or the knowledge to add more. It is rather like a visual etcetera. As an explanation of exemplification, one child commented, 'And there's a lot more but they're the basic ones that everybody knows.'

This interpretation of Amy's map structure is supported by her writing and interview comments. Of the three paragraphs of her writing, the first gives a description of the computer's material components (items making up a computer system), followed by a second on use of the computer for various purposes such as email and games (information and communication) and how this is done using CDs and saving files (computer resources), whilst the third focuses on places where computers are used 'in homes, in offices, in school and all round the world' (locations of use). When asked why she joined the nodes as she did in her interview, Amy replied,

It was in sections / and then like on this half I've done what you can find on the computer like the keyboard and the speaker and all that / that one just went off there / and then I've done where you can find computers / and then saying how emails work because I've done a laptop and then world wide web and then emails and then going on to fax machines / and then what you can find in computers like you can find the spreadsheets and work files and games and all that.

Her written and spoken words are linear and necessarily impose a temporal order on her sign-making. In contrast, the spatiality of the mind map is able to show these classifications simultaneously.

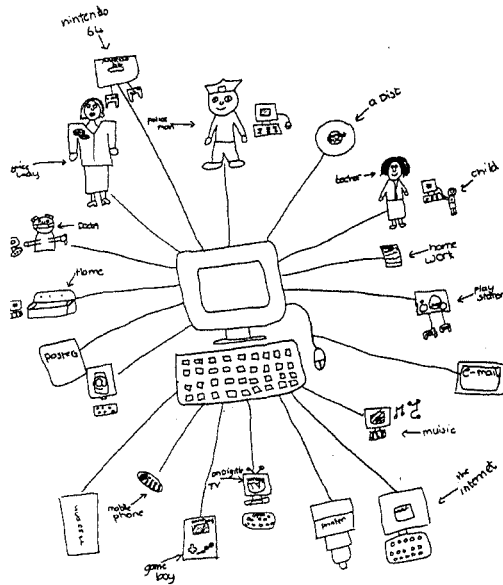
Amy's two linked focal nodes (the monitor and keyboard) are enlarged. This domination of the page through both size and positioning is significant. Its function is to present the central nodes as the map's title (the superordinate), formulating the central hub from which all other ideas (the subordinates) emanate. It is also an implied starting point for the 'reading' of the map. Textually, the central node is an anchoring hub to which the 'reader' returns after each venturing out. It leads to the unknown but must always remain the elemental root. All surrounding nodes are of a relatively equal size and broadly equidistant. This implies that there is no particular order in which the designated routes to the four classified areas should be followed. The map therefore invites a non-hierarchical 'reading'. On the other hand, the arrowheaded links to single images within each grouping might indicate Amy's preference for her map to be read in a particular directionality. They may be intended to deliberately guide the order in which the images should be sequentially viewed and interpreted within each classified area. The 'reader' is given choice with regard to the order in which the sub-classifications might be explored but is then intentionally led through that section. There are therefore alternative and preferred pathways through the map.

Seven other mind maps in the class set of 25 (28%) show similar classifying characteristics, some more developed than others. Other children made different signs through layout. Four maps have a hub structure rather like a 'spider' diagram. Here, emanating rays link the enlarged and centrally positioned node to images around the periphery of the page. This is neatly exemplified in Kelly's map (Figure 4.10a). The central computer node is clearly the superordinate. The implication is that each outer node should be interpreted in relation to the central node. Entry is possible at any point and a methodical clockwise or anticlockwise 'reading' route is reasonable but neither necessary nor controllable. Once the 'reader' has interpreted the hierarchy of the structure, recognizing each peripheral node as some sort of exemplification of the superordinate, the links take on a different role. Rather than being perceptual connectors where the eye is required to trace each line in its exiting from and returning to the central node, they become mental links. The 'reader' holds the superordinate as a given and 'reads' the adjoined drawings on the basis of this

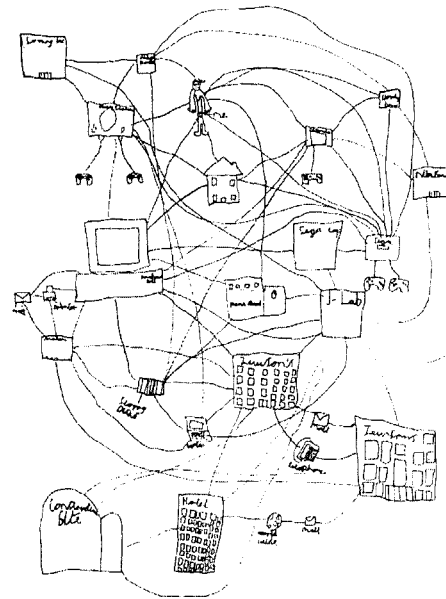
conceptual understanding. Whilst, occasionally, possible associations in adjacent images appear feasible (for example, the 'teacher' and 'child' next to 'home work') there are no systematic classifications as in the previous examples.

Figure 4.10 Map structuring

a) Hub structure (Kelly)



b) Non-hierarchical structure (Tom)



Tom's map (Figure 4.10b) is the most typical of a non-hierarchical structure in this class set. The fairly even distancing between nodes and their complex linking together suggest relatively equal status. Arguably, the 'Packard Bell' computer to the centre left, the second largest node in the map, might be seen as the superordinate. It also has the greatest number of lines emanating from it, 13 in total. Nevertheless, any node might be chosen as a starting point for map exploration. There is no beginning, centre or end. Tom structured his map in a way that gives the 'reader' freedom, but with that freedom comes demand. There is linearity in that each link leads to another node but, apart from four occasions when there is only a dual choice, in most cases the reader must make the decision about which of many links to follow. In doing so, the serious 'reader' must also try to understand the possible meanings of those associations – as I once overheard someone saying, 'Maybe you're not reading it hard enough'.

Of course, the ‘reader’ has power in the act of ‘reading’ and may choose to disregard the links and focus only on the nodes. Unlike the hub example above, Tom’s images are not just examples of the superordinate. Towards the top of the map, Tom drew himself (‘me’). There are nine links emanating from this drawing to eight other nodes: ‘Ridge Racer’, ‘Play Station’, home (unlabelled), ‘Nintendo’, ‘Donkey Kong’, ‘Sega’ (linked twice), ‘Packard Bell’ and ‘Peak Road’ (pseudonym of his school). These images may represent what is most important to him within the framing of ‘Computers in My World’. Indeed the closest is a drawing of (presumably) *his* home and the other four nearest linked nodes are electronic games. Positioned further away is his school, and locations in the community are more distant. His arrangement of nodes is therefore symbolic. He shows widening spheres in relation to himself. The complexity of a non-hierarchical structure brings with it an expanded interpretational scope for choice depending on the interest of the ‘reader’ yet the subtle but semi-open possibilities created by the maker remain there to be discovered. There is a tension between interpretational anticipation, interpretational potentiality and interpretational actuality.

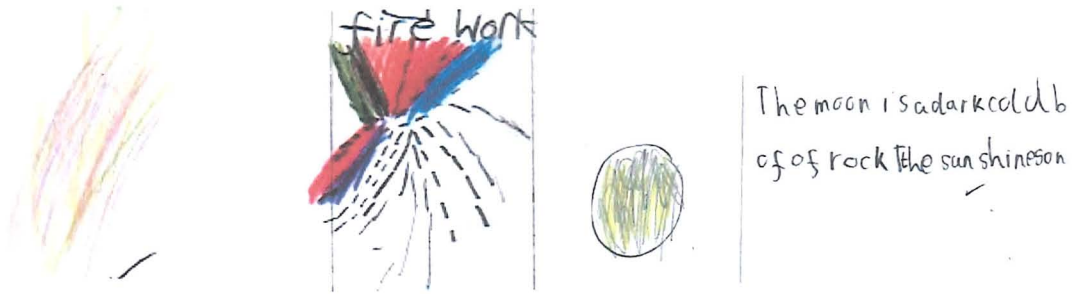
Colour and materiality

Another task in the Year 2 science project on light was to identify natural and artificial sources of light. Rachel chose to represent a firework display (Figure 4.11a). The upward movement of her crayon strokes represents a rising motion. By following the same curved, ascendant directionality with a number of colours gently applied, she mixed colours in overlapping strokes and thereby expanded their spectrum. This suggests an indeterminate range of hues in an upward explosion of colour. Her omission of a pencil outline differentiates this drawing from the solid objects she drew elsewhere in the worksheet (shown in full in Figure 6.4a, p.187) including the torch shown in Figure 4.6b. It communicates ethereality and untouchability, similar to her drawing of a torch’s beams (Figure 4.6c) where she made six straight lines in orange crayon to represent light. Perceptually and conceptually significant, this communicates the intangibility of light; the torch’s rays can enable things to be seen but cannot be felt as a solid materiality. Omission of a pencil outline appears to

represent emitted light as inaccessible to touch compared with the tangible and concrete pencil outlined torch-as-object, the seeing-enabler as against the seen.

Figure 4.11 *Semiosis of hue and saturation*

a) Rachel's firework b) Katie's firework c) Daniel's moon



In identifying natural and artificial sources of light, Katie also chose to draw a firework but she made different signs (Figure 4.11b). Her separate pencil lines number over 60 in total. A specific interpretation must have motivated this detail. Many of the broken lines are short and equidistant but some are longer towards their outermost point (see bottom centre and bottom centre left). This stringed disconnection, along with the directionality of her colouring strokes, seems to represent the moment of explosion when multiple single sparks travel outwards, and are here and gone. Katie also varied the pressure used to make her pencil lines. Some are heavy, bold strokes whereas others are comparatively paler, suggesting a lighter touch. This combination of heaviness and length may imply different intensities of light, strong at the epicentre and fading as the sparks travel. In addition to movement, the image therefore also portrays the temporal. Furthermore, Katie partially coloured her image in bold bands of red, blue and black. This represents the firework's outburst of colour, its intensity seemingly representing brightness. But why did she not colour the whole of the image? It could be that the colouring suggests solidity and she wished to retain a sense of the transitory, the brightness that is here and gone. Katie's image is more than an illustration. The lines (of different lengths and disconnected), hues (red, blue and black) and saturations (pale and dark) of her drawing are information carriers – they communicate her knowledge of scientific concepts, here the properties of light. Knowing is not only represented through

words. Colour choice and substance application are also powerful sign-making resources.

Semiosis in crayon stroke is also evident in Daniel's representation of the moon (Figure 4.11c). The directionality of colouring strokes is often regulated by the line of the image's outline framing, coinciding with the dominant line and almost invariably in a straight rather than circular pattern. Furthermore, colouring normally meets the pencil outline. Daniel varied this for a very particular reason. Within the bold circular pencil outline of his moon he coloured vertical strokes of yellow with gaps around the circumference, superimposed with gently 'scribbled' black crayon. The effect is a combination of colours. At first sight, and in view of standards of neatness required in curriculum work, it would be tempting to say that this is untidy, even sloppy. This, however, would be both an adult misinterpretation of the signs Daniel made and a failure to recognize the development in his scientific knowledge. Towards the beginning of the project and at a week's interval, Daniel represented the moon twice. On these two occasions he drew a circle in pencil which he left uncoloured. The piece of work shown in Figure 4.11c was completed six weeks later. Opposite his image Daniel wrote from the board the words, 'The moon is a dark, cold ball of of rock The sun shines on it'. Here is a clue to his choice of colour and the semiosis of his colouring strokes. The lightly applied black strokes appear to represent the cold, grey rockiness of the moon and the yellow the reflection of the sun's light. He showed lunar surface and solar reflections on that surface. This is not just a decorative illustration nor is it thoughtless. Through his choice and application of colour, Daniel conveyed scientific concepts in a very precise and particular way. Like Katie and Rachel, he made subtle signs that represented his knowing about the properties of light.

Line, colour and substance often work interdependently in sign-making. Their combined semiosis is effectively exemplified in one 7-year-old's representation of the Holy Spirit (Figure 4.12a). Megan's religious education text is entitled 'The Story of Pentecost'. In her writing she stated, 'The holy spirit looked like wind and a little fire'. Her subsequent drawing of the Holy Spirit comprises circular swirls of yellow

superimposed over peach. Its lines seem to convey the movement of wind whereas its colours are akin to those of flames. A similar colour scheme was apparent in her image of the fiery sun drawn approximately 15 weeks earlier (Figure 4.12b). This combination of line and colour represents a union of wind and fire as expressed in her writing. Furthermore, there are similarities with Rachel's firework and Katie's reflective material. Megan's exclusion of a pencil outline for the Holy Spirit captures its 'spirituality' compared with the solid physicality of her images of people which were drawn in pencil and subsequently coloured in. Through outline or no outline she thereby distinguished between 'spiritual' and human form. Megan's choice of colour within the picture as a whole is also significant. Associations between the Holy Spirit and the red and yellow of the clothes worn by Jesus in comparison with the green and multicoloured dots of those of the 'Discipal' (disciple) seem to imply that something is shared between Jesus and the Holy Spirit. Interestingly, this colour scheme links with her image of God (Figure 4.12b). This is a complex theological concept. The Trinity is three (God, Jesus and the Holy Spirit) yet one (shown in their shared colouring). Megan's drawing of the Holy Spirit is by no means a meaningless scribble. Metaphorically, in her representation she cleverly captured difficult theological concepts: the visual representation of an abstract idea and the relationship between the Holy Spirit and Jesus.

Figure 4.12 *Semiosis of colour and materiality (Megan)*

a) 'The story of Pentecost'

b) 'My favourite person'



Megan made further signs through her chosen mark-making substance. She used pencil crayons to colour her (lead) pencil outlined drawings of Jesus and a disciple. However, she made her representation of the Holy Spirit with wax crayon. Why did she do this? Her shift of substance had significant somatic effects not evident in the scanned reproduction. Firstly, it had a visual impact. Shining as the light caught it, the waxy veneer gave off a certain glossy iridescence. Movement of the head and page had the effect of changing hues and at certain angles the substance assumed an almost luminous look. Secondly, the image provided a different tactile experience for the sign-remaker. Passing the fingers over the page, the Holy Spirit image had an exceptional tactility in relation to the textual constituents around it. It was smooth, unlike the indentations made by the pencil strokes, and tacky. Megan seemed to be showing difference and implying ethereality, some sort of 'shining' quality or maybe the heat or gleam of the Holy Spirit's fire-like quality. At any rate, the properties of wax crayon were clearly more suited to the task of representing this complicated abstract idea than coloured pencil. Megan endeavoured to make her representation of the Holy Spirit as precise, exact and 'truthful' as she could for this purpose and in this context. The multisemiosis of her drawing was expressed through the effects of the combined signifiers of line, colour and substance to communicate her mindful signifieds.

Discussion

These examples provide insights into both the powerful communicative potentialities of drawing and children's design practices in choosing and shaping the semiotic resources available to them. The children demonstrated extraordinary skill in making meaning through the affordances of drawing. Their curriculum and mind mapping drawings are not just illustrations. They are representations of analytical and interpretative thinking. They provide traces of what was in children's minds at a specific moment in time, complex amalgams of their perceptions, experience, knowledge and conceptions. The children communicated effectively, economically, skilfully and succinctly that which would not have been so easy or even possible with words. Their compositions are intensely meaningful. They selected out and

represented the key features of (mainly) objects as pertinent to the focus of the task. Made analytically explicit, the subtleties of their drawings indicate that children are able to draw on a range of representational resources in their image production and these carry intricacies of meaning. In a culture where words have been historically predominant, less trust is invested in images. Yet detailed analysis of these drawings reveals astonishing layers of meaning.

The apparently effortless act of drawing masks the complex process of transformation. Graphic representations are marks that stand for something else. The lines, dots, shapes and shading of the children's drawings were not replications. This is not possible in any transformation from the actual to the page. They were a representational remaking of objects, people, events or ideas. Their drawings were like the original in some respects in that they had visual equivalence but in many respects they were not. Three-dimensionality had to be shown on a flat surface, relations in time had to be depicted as relations in space, size had to be reconfigured, texture had to be remade. There were omissions, additions and adjustments. The children's drawings of particular occurrences, such as the explosion of a firework (Figure 4.11 a, p.114) or the sending of an email (Figure 4.7, p.103), were transformations of the synaesthesia of the original experience into marks on a graphic surface. Events had to be remade in such a way that multiplicities of signs in one location were distilled into something else somewhere else. Temporality such as sparks flying (Figure 4.11 b, p.114), changing visibility such as the reflections of a laminate (Figure 4.1c, p.89) and aural information such as music (Figure 4.5b, p.97) may not 'translate' easily into the spatiality of drawing. Image-makers are limited to the relatively reduced semiotic resources of two-dimensional drawing compared with the synaesthesia of the original experience. As part of the process of graphic sign-making children must make decisions about what the text will do. The final product is an analytical and interpretative distillation. It is not an exact replica of the original that was its source materially or experientially. It is the outcome of a process of transformation, from experience of phenomena in the world to inner and outer sign-making, the latter as graphic representation. Semiosis is motivated by a particular representational interest. It is the result of complex semiotic transformation.

Once the mode has been selected by them or for them children must make decisions about how to make meaning with the semiotic resources available to them. In school there are shifts in what drawing is as children move between the subjects of the curriculum. Scope for imagination and expressiveness in art is different from the diagrammatic drawing of science, the factual images of history contrast with the symbolism of geographical maps. Rachel, Daniel and Katie composed their drawings on the topic of light to be apt for the scientific domain. In the newly encountered genre of mind mapping, it was deemed legitimate for these boundaries to blur. Abigail drew iconic stick figures in diagrammatic form but underneath drew 'whole' people in a pictorial narrative clip (Figure 4.7, p.103). She integrated different semiotic resources according to best fit and in relation to the particular signs she wished to make. Children develop 'a repertoire of different drawings systems and an incipient knowledge of how each is powerful' (Wolf and Perry, 1988, p.22). How semiotic resources are powerful is always situated. How they are chosen and shaped is dependent on perceived representational need.

So what are the semiotic resources of drawing? How can they be understood in a way that is systematic, that accommodates different genres and that is manageable? Provisionally, and based on the evidence above, I would like to suggest three main groupings of semiotic resources in drawing: 'lexis', presentation and layout. Punctuation also becomes relevant in diagrammatic genres.

- 1) In linguistics the term '*lexis*', from the Greek for 'word', is generally used to refer to the words of a language. Whilst I am loath to impose the terminology of linguistics onto a mode that has quite different affordances and functional specializations, there currently exists no better term to denote the individual images within a full drawing. I would like to suggest that the term image '*lexis*' (with inverted commas) might be usefully employed to refer to a 'stripped' version of a drawing, its 'bare bones'. The lines that make up the *critical form* of tinsel (Figure 4.1, p.89) or the *critical attributes* of Oliver's PlayStation (Figure 4.3, p.93) would be the drawing's '*lexis*'. Exclusion of colour and the waxy materiality of the Holy Spirit representation (Figure 4.12a, p.116) would be this

drawing's stripped form. Of course, this segregation is not possible in actuality. Images are drawn with particular substances and appear on a graphic surface in relation to other images. However, it does provide a means of pulling apart the semiotic resources that make up individual drawings for analytical purposes.

- 2) All drawing has to be realized materially, whether as marks on a cave wall, light on a computer screen, indentations in sand or incisions in clay. The images in this chapter appeared as substances applied by tools to surfaces. Substance is a semiotic resource. Used as a *medium* for sign-making it appears in the text as *materiality*. Substance can make signs that are critical for how a phenomenon is understood, like Megan's swapping to wax crayon in her representation of the Holy Spirit (Figure 4.12a, p.116). Another property of substance is *colour*. Variation in hue can be significant for how representations are understood, as in Megan's replicated colouring for the Holy Spirit and Jesus in contrast with the variant colour scheme for the disciple (Figure 4.12a, p.116). Furthermore, the manner in which tools are used carries meaning. The effects of the *application* of a tool to a graphic surface in drawing are semiotic resources. Using the tip, the point or the side of a sharp or blunt tool and pressing down lightly or heavily make signs that might be significant for ideational content as in Daniel's moon (Figure 4.11c, p.114) and Katie's firework (Figure 4.11b, p.114). It can also construct interpersonal meanings as in Rosie's firm shading of pupils (Figure 4.8, p.105), which was also a form of emphasis. Finally, the *size* of an image in relation to others is significant. The enlarged central nodes in the 'Computers in My World' maps worked as titles and the smaller sizing of the subordinates conveyed equality. The *presentational* variations of materiality, colour, emboldening and size are significant in drawing design.
- 3) The way in which image 'lexis' is arranged in the space of the inscriptional surface is a design decision. The page holds the potential for innumerable possible arrangements. The signs children made in the graphic *layout* of the mind maps were suffused with meaning. *Positioning* was significant for the arrangement of images in relation to one another. The centrality of Kelly's

computer node (Figure 4.10a, p.112) established it as the map's theme whilst those on the periphery of the page were exemplars. Tom's top to bottom directionality showed relative importance (Figure 4.10b, p.112). Leaving white space in Oliver's map was a means of framing (Figure 4.3, p.93). It marked groupings of related items and separated off that which did not belong. The positioning of Amy's four 'families' was classificatory (Figure 4.4, p.95). Layout in the mind maps was neither superficial nor meaningless. It provided traces of the children's conceptualizations.

- 4) In the diagrammatic genre of mind mapping, the *punctuation* of lines and arrows between images carried meaning. They were neither random nor accidental. Their function was to show how textual items were related and interrelated. Absence of written explanation rendered the precise import of the links subject to some conjecture (note here a functional specialization of writing). Possible meanings might include 'is a', 'goes with', 'has a', 'contains a' or 'is like'. At any rate, they were indicators of how children connected ideas in relation to the map's theme.

Separating out the semiotic resources of drawing was essential for my analytical purposes. However, in practice they worked together in complex and subtle ways. This was evident at the level of 'lexis' and at text level. Firstly, an interweaving of semiotic resources was evident in individual drawings. In her representation of the Holy Spirit, Megan made three different but intimately interrelated signs simultaneously in one representational act: in line (its wind-like characteristic), in colour (its fire-like characteristic) and in materiality (its ethereal characteristic) with the same wax crayon tool (Figure 4.12a, p.116). Line as swirls, colour as peach and yellow and materiality as shine were the signifier-resources which she deemed most apt for her signifieds. Her choice of colour as one variable and substance as another were simultaneously realized graphically as overlaid loops. As inextricably interrelated semiotic resources line, colour and substance within the representation carried meanings individually and as a synthesized whole. The accepted equation in semiotic theory is 'signifier + signified = sign'. In Megan's Holy Spirit image the formula is '(line + wind) + (colour + fire) + (substance + ethereality) = Holy Spirit'

or 'sign + sign + sign = representation'. The outcome was a *synthesized sign complex* or a *sign composite* where the parts had meaning in themselves but also worked together in an overall representational sign. This representation was a complex composite of metaphors, skilfully and strikingly brought together but in a way that was quite understated. Whilst the drawing did not bear traces of the processes of problem-solving and decision-making, its complexity is suggestive of them. Megan's representation of the Holy Spirit was the consequence of an ultimate resolution with regard to which semiotic resources to integrate and how, in a way that was both apt and concise. There is nothing simple here. The complexity is that her design is multiply semiotic. My point is that semiotic resources work in intricately interrelated ways at the level of 'lexis'.

Secondly, the distinctiveness and interweaving of semiotic resources were evident at text level. It was through combining presentational features, layout and punctuation that Oliver and Amy created 'reading' paths in their mind maps (Figure 4.3, p.93 and Figure 4.4, p.95). These apparently have two interlinked functions. Firstly, they guided how the 'reader' engages with the text. Together, size, spatial positioning and links constructed relative salience. This established how the 'reader' approaches the text and showed how the parts should be understood in relation to the whole. The children indicated preferred pathways to a greater or lesser extent. Sometimes certain 'reading' paths were suggested more insistently than others. Whatever, they were always subject to the interested response of the 'reader'. Secondly, the creation of 'reading' paths appears to have been a means by which children made sense for themselves as well as for others. One map-maker said, 'I've put them in order like that / it's more neater to me.' Another commented, 'So really I used these to try and organize what I was going to actually use it for / and just so that I could understand.' This implies that the positioning of nodes and the making of links were organizational tools that aided their own thinking. These children saw their mind maps as a means of mediating meaning between themselves and the 'reader' but also as a way of exploring their own ideas, in effect communicating with themselves. This would indicate that learning as inner sign-making can be in some way supported or extended by externalizing ideas, here on the page. In turn, this suggests that our own

meaning-making for ourselves and our own communication with ourselves are culturally shaped and can be self-shaped not only by internal sign-making but also a process of inner to outer to inner sign-making – some sort of complex interplay between the internal and the external. As the culturally shaped social self avails itself of conventional representational design features, the mediation of graphic representation becomes an enabler of thinking. This, in turn, implies that conceptualization is intimately linked with learned interpersonal communication strategies that are turned back upon ourselves. Graphically and ideationally we treat ourselves as social beings.

The relationship between mindful and outward representation is notoriously elusive. To what extent inner sign-making is different from that which is composed graphically, and to what extent it is shaped by graphic representational convention remains an unanswered and maybe unanswerable question. Two interrelated theoretical issues arise as a consequence of the maps. Firstly, we are able to think about phenomena in certain ways because semiotic resources have been developed to allow it. Secondly, graphic representation enables us to know and understand in ways that would not be possible without it. Jay Lemke takes this idea further in his study of scientific texts. He writes, ‘Nothing is really being ‘re-presented’ here; there is no separate entity, no pure mental idea, apart from the meanings made with the specific material systems of semiotic resources our culture provides us with’ (Lemke, 1998, pp.110-111). What inward sign-making is lies beyond the scope of this study. However, that knowledge and understanding are bound up with the potentialities of communicational resources seems to me unassailable. We know and understand in particular ways because of the semiotic resources of graphic representational design. Yet, paradoxically, we are barely aware them. The ready-to-hand semiotic resources with which we make meaning in our own particular culture and community are so embedded in everyday living that they are ‘just there’ (see also Wertsch, 1998, pp.28-29).

CHAPTER 5

THE SEMIOTIC RESOURCES OF WRITING

In this chapter I ask the questions: *what are the semiotic resources of children's writing, how do they carry meaning and how do they interrelate?* I endeavour to unpick how the written form is constituted. Whilst language-as-writing remains the focal semiotic resource, others are co-present and work with wording to make meaning beyond wording. Firstly, I examine a series of emails exchanged between a child and her uncle and electronic notes shared by children in a protected online environment. These asynchronous online messages were sent and received in the children's leisure time at home and at school respectively. Graphic representational design is characterized by the interests of the maker and what s/he considers will be maximally understood by the recipient. Sign-makers are always attentive to the social. In these messages sent to both known people (a member of the extended family and friends) and unknown others (peers elsewhere across the country), the interpersonal comes to the fore. Underlying the children's choice and shaping of semiotic resources is a concern for sufficiency. The ideational message must be adequate to the particular interpersonal need as perceived by the communicator. Children's perceptions of sufficiency as defined by what the texts are therefore become a key theme in my analysis.

Secondly, I study an interview planned, conducted, audio recorded and transcribed by an 11-year-old. It is an example of a particular form of intermodal reshaping. Hannah remade a communicative event experienced as face-to-face interaction and recorded on a cassette, transforming it into lettered representation on the page. This might seem a straightforward if demanding re-presentation of language that was sound into language as visibility. However, the transcription clearly presented certain challenges and resolutions. What is of particular interest with regard to semiotic resources is how

she transformed the signs of the cassette recording and the original event into signs on the page. Hannah's interview transcription is a graphic remaking. She did not make the ideational, attitudinal, experiential, affective or 'perspectival' as this content came into being during the girls' discussion, but she did remake it as a transcription. Nor did she make the social – this is what the girls did during the interview event. However, she did interpret and remake the interpersonal for the reader. In making one kind of text into another, her focus was on the compositional; her interest was in multimodal design for the reader's reading. Transforming the options available in her written repertoire, Hannah recreated writing for this new purpose. My analysis explores how spoken words (plus other modes of communication) became written words. I examine how Hannah endeavoured to remake the 'fullness' of the interview on the page. It is a study of how semiotic resources in one or more modes became semiotic resources in another or others, and what was lost, gained or reformulated in the process, and how.

Co-functioning semiotic resources⁶

Choice

Kathleen's decision to email her uncle was entirely her own. Without the presence let alone the knowledge of her parents, she instigated the communicative exchange. This is significant because the sending and receiving of messages was undertaken quite autonomously. Kathleen decided on the content of her message, the person with whom she wished to communicate and the means by which the interchange would be realized. This implies a number of interrelated prior decisions that demonstrate this 6-year-old's knowledge about the communicational potentialities of mode and medium, and the social context in which the representational event was located. Firstly, Kathleen's choice of email is significant. She might have chosen to write a handwritten note, to draw a picture or to use the telephone. However, she selected email as the most appropriate means of communication for this purpose at this time.

⁶ An earlier draft of this section has been presented at a conference: Mavers, D. (2001) *Traces of Meaning: A Young Child's Sign-Making in Interpersonal Electronic Communication*. Cultures of Learning: Risk, Uncertainty and Education Conference, Bristol, UK (April 2001).

Why? Based on her experience, Kathleen clearly considered the lettered form alone to be adequate to her needs. This had implications for the kinds of signs she could make. Secondly, the mode was bound up with the medium, and that medium had consequences for her sign-making. Compared with the individuality of handwriting, computer-generated text in email (currently) precludes the personal ‘touches’ possible with pen and paper. It standardizes text in that writing looks the same no matter who wrote it. It also inhibits the ease of swapping to drawing which is not an issue with pencil and paper. Thirdly, ownership of her own email address reflects the family’s literacy practices; her parents had a positive attitude towards electronic communication. Independent insertion of her uncle’s email address and autonomous sending at 17:02 on a Sunday evening demonstrate Kathleen’s technological capability. Seminal to her decision to use email may have been concepts relating to temporality and distance, the speed and ease of exchange over time and space. She may also have been aware of economic considerations (an email is less expensive than a telephone call).

The two-way process of communication is clearly evident in the exchange between Kathleen and her uncle. Although each email remains a separate message created at a different time, in a different location and in different circumstances, the texts are semiotically interwoven in a joint construction of meaning. Each message articulates the interests of the individual but is also shaped to the perceived needs of the other. Some elements are taken up and developed whilst others are ignored and dropped. Understanding the exchange includes the parts (each individual message) and the whole series (the parts in relation to the whole). Although the asynchronism of email removes the immediacy of synchronous interaction through the limits of time and space there is nevertheless a sequential flow of graphic utterance and response.

Words and wording

The message brought good news (Figure 5.1). Kathleen communicated a matter of great import to someone special who would value her achievement and share her pleasure. Concise, her message includes a greeting (‘hey’), names (‘kathleen’,

‘martin’, ‘I’), temporal information (‘last week’) and the main focus (‘very good news’, ‘new baeg’). Her wording seems to have been designed to afford maximal transparency. It has linear cohesion and coherence in that each word and group of words has its own place and its own meaning in that particular place. If any one word or clause were to be reordered the meaning of the whole would be fundamentally changed.

Figure 5.1 *Initiation*

Subject:	ii
Date:	26/11/00 17:02:42 GMT Standard Time
From:	Kathleen Montgomery3
To:	Chips6159@aol.com
hey this kathleen. martin I have some very good news last week I got a new baeg	

Kathleen’s choice of opening word establishes an informal feel to the message. The term ‘hey’ might imply the greeting used predominantly in American culture and largely transmitted into the home via television entertainment. Alternatively it may be a spelling of ‘hi’, a common English colloquialism used in informal greeting. In any case, it has been selected in preference to a more formal salutation such as ‘Hello’ and manifestly avoids the use of ‘Dear’ as in traditional letter writing. Otherwise ‘hey’ might be a means of gaining attention, a less formal alternative to ‘excuse me’. Whatever its provenance, this word was deliberately selected because of its casual connotations. This is highly significant with regard to the social nature of the exchange. Use of the term ‘hey’ by a child in communication with an adult is predicated on an existing interpersonal relationship. It would not be appropriate, for example, in a message to a teacher. Bearing the meanings of familiarity, it works as a

renewal of a valued family tie. Kathleen's message implicitly carries indicators of social practices within the extended family. The relationship between the child and her uncle shaped their language and its graphic representation in such a way that the text became implicitly suffused with indicators of what their relationship was. The social shaped her choice of words, and the message represented the social. This seemingly trivial word is therefore heavy with meaning. It realizes the social and the social realizes it.

The writer's and prospective receiver's physical invisibility to each other at this moment in time appears to have made it necessary for Kathleen to reveal who she is. Her self-naming ensured that there was no doubt about her identity as messenger. Omission of the verb in the phrase 'this kathleen', rather than 'this is kathleen', could have been a slip. In typing 'this', Kathleen could have forgotten to repeat the two final letters. The verb might have been mistakenly overlooked in the excitement of the moment or the sheer speed of creating and sending. Such a forward-looking and forward-moving pace might signify something about attitudes to 'correctness' in email writing. Whereas formal school-based writing might carry expectations of habits in retrospective checking for accuracy, email users might take a different view of precision. Email text for personal interchange might carry culturally different sufficiencies from other written forms. On the other hand, disappearance of the verb might suggest traces of speech. In speaking the phrase 'this is kathleen', 'is' would not normally be articulated separately but elided, with a vocalization between the two 's' sounds ('this's'). In converting the spoken version into a written form, the omission is a logical transduction.

A similar phenomenon was apparent in an email subject caption created by an 8-year-old child. Creating a subject caption demands particular cognitive work. The writer must decide on a concise title which encapsulates the main thrust of the message's import succinctly. Laurel summarized the content of her message to her grandmother in the highly evocative single textual unit 'Christmascoming'. In a similar manner to 'this kathleen', the present indicative of 'to be' would not be distinctly separated in its spoken form but elided into the 's' of Christmas, hence not 'Christmas is coming'

but 'Christmas's coming'. What is particularly interesting is that Laurel showed the absence of a temporal gap in speech by removing the spatial gap in its lettered form, 'Christmascoming'. This condensation was not a mistake. It was a representation of the phrase as said and heard, and shaped by Laurel to be a single textual unit, something akin to the syntactical units written without spacing by eighth century scribes (see Chapter 2, pp.50-51). This apparently realized her aims for aptness and concision. In terms of curriculum sufficiency, 'this kathleen', like 'Christmascoming', is 'incorrect'. In the context of this interpersonal email exchange it is a crucial sign. In bearing the characteristics of speech it establishes register. Implicitly, it informs the reader that this is informal chat realized through visual letters in space rather than audible sounds in time.

After her self-identification, Kathleen named the person with whom she was communicating. Placed in first position in the clause, Martin's name acts, in terms of functional grammar, as Theme (Halliday, 1994, pp.30-36). Its function appears to have been to gain her uncle's attention, ensuring that he was taking heed in advance of her important announcement. Qualification of the nominal 'news' through the premodifying descriptor 'very good' alerts the reader to Kathleen's affective response to the happening. The whole clause 'I have some very good news' is concurrently a statement of fact and a building of a sense of anticipation. It tells the reader that there exists as yet unrevealed information but does not hint at what that information might be, apart from that it is good. This sense of expectancy is then resolved in the final clause. Whilst the placing of 'last week' in thematic position in the conjoined clause endows the timing of the occurrence with importance, the most noteworthy information linguistically is saved not only for the end of the clause but is also positioned at the conclusion of the message as a whole. Locating the unknown after the known at the end of a syntactic construction is a common feature of English linguistic usage (Halliday, 1989, p.55). In this way, Kathleen skilfully builds suspense; she greets, identifies herself and announces information of momentous import, withholding her surprise right until the last word. The punch of her message is left until the very end.

Writing systems engender conformity, partly for convenience and partly for standardization, as well as educational, political and 'high culture' discourse which strives to maintain the purity of the written form. However, in a language where historical assimilation, adaptation and borrowing have rendered English 'messy and indeterminate' (Halliday, 1989, p.24) children have to learn complex spelling rules as well as their irregularities and exceptions. Conventional English spelling is neither always phonetically logical nor rule-conforming. Young writers are frequently confronted by the uncertainty of the unknown, the untried or the unusual. When they come across a word whose spelling is new, they can either seek help or apply the rules they have made meaning of. 'Baeg' is Kathleen's best effort at the unfamiliar using the spelling resources currently at her disposal. It is not an arbitrary invention but a sensible application of the rules of English spelling and an endeavour to be precise.

Communicative exchanges are made up of meaning-making and meaning-remaking. Halliday's (1989, p.8) 'natural human tendency to want to mean' is not only about the human impulse to transmit meanings but also the satisfaction of another person understanding and responding to them. Symbolic acts require representation that is sufficiently clear to be accessible for interpretation by others. Deviation from convention can give rise to misunderstanding where particular meaning was intended. Snags at either the site of transmission or the site of reception are potentially hazardous and could create a communicational dilemma. In composing her message Kathleen imbued her text with a multiplicity of signs which were intended to afford maximal transparency. Yet, whilst she had control over the process of production, Kathleen had little control over the context of reception. On receipt her uncle was clearly placed in a position of some uncertainty. The surprise of 'baeg' to a convention-saturated reader carries uncertainty in how to interpret it. Despite the richness of meaning communicated in the email, the word which carried fundamental informational content and provided the key to understanding the whole was an unconventional spelling and therefore proved difficult to decipher. There was a snag between meaning-making and meaning-remaking. What is a 'baeg'? Martin's recourse was to make the most sensible interpretation based on his knowledge about

English spelling conventions and his niece personally. Settling on what was a seemingly apt interpretation, he made the assumption that the word was a misspelling of ‘bag’.

‘Adulthood’ is evident in the style of Martin’s reply sent three days later on a Wednesday (Figure 5.2). The message is made up of a declarative, a question and a signature, with conventionally correct spelling and punctuation, and informal grammar. The declarative expresses shared pleasure. Repetition of ‘got a new bag’ is indicative of geographical and temporal distance. Had this been synchronous, replication of these words would have been a superfluity and therefore omitted. A more likely response in online chat would have been something like ‘So glad to hear it’. Exclusion of the Actor / Subject ‘I am’ or ‘I’m’ in the first sentence eliminates the subjectivity of the writer yet Martin’s desire to sustain and develop the exchange is implicit in the question ‘What kind is it and what colour?’

Figure 5.2 Martin’s first reply

Subject:	(No subject)
Date:	29/11/00 01:07:03 GMT Standard Time
From:	Chips6159@aol.com
To:	Kathleen Montgomery3
So glad to hear you got a new bag. What kind is it and what colour?	
Uncle Martin	

Kathleen replied just over seven hours later. It is uncertain whether the three-day delay in Martin’s reply further exacerbated her somewhat curt response. It was reported to me orally by her mother that frustrated, Kathleen asked her how to spell ‘survival’ and ‘badge’. This was the first her parents knew about the exchange.

Kathleen was economical in her choice of words. Her response is short and concise – ‘survival 1 badge kathleen’ (Figure 5.3). The grammatical constructions of the adult reply (one sentence and one question) did not prompt a ‘sentenced’, ‘correct English’ response. Kathleen actually responded to her uncle’s question ‘What kind is it?’ but clearly considered its colour immaterial. She selected out what was essential – the *critical nominals* – the first group bearing the informational content of the message and the second serving as a signature. There is no verb. The message’s brevity communicates the affective, Kathleen’s irritation in all probability being directed more at the breakdown in communication than as personal blame. She did not make any direct reference to the misunderstanding, nor did she provide more expansive detail. Nevertheless, she did correct her uncle’s reading, making it quite clear that a ‘baeg’ was not a bag but a badge. Its descriptor, ‘survival 1’, is based on the assumed cultural known that this refers to swimming and the first level in a series. It is likely that Kathleen’s use of ‘1’ rather than ‘one’ replicated the graphic representation on the badge itself. Her succinctness implies that she considered further explanation unnecessary. The readily understandable was presumed and explanation was omitted.

Figure 5.3 Kathleen’s response

Subject:	(No subject)
Date:	29/11/00 08:21:37 GMT Standard Time
From:	Kathleen Montgomery3
To:	Chips6159@aol.com
survival 1 badge kathleen	

Asynchronous interpersonal electronic communication is a joint enterprise. It is a shared process between participants where content is built through a mutual construction of meaning. Even as the writer infuses the text with intended meanings,

it is expected that interpretation will be permeated with largely matched meanings. There is an anticipation of relatively unimpaired reception. Yet, despite Kathleen's intended transparency, there was a misunderstanding where a particular understanding was intended. The spelling of 'baeg' had an impact on the semiosis of the whole. Here is an example of a child reaping the consequences of what adults might denote a 'spelling mistake'. The experience of misunderstanding in what was, to the child, a serious situation, prompted an indignant response. Yet the unconventional spelling represents a learning opportunity of particular significance as the interchange provided a salient illustration of the consequence of a misapprehension of an intended meaning. It had repercussions for both parties, each being emotionally affected by the *faux pas*. The power of this learning is in its consequence in a situation of personal importance. Here is an example of a child realizing the impact of a 'spelling mistake' on the transmission and reception of meaning, a foiled attempt at accuracy and an insight into communicational sufficiency. Feedback did not come in the form of a correction as in school where attention is drawn to the 'mistake' in a very direct way. It was implicitly yet powerfully given in the content of the reply which patently illustrated the communicational snag. It was then the child who herself made the 'correction' based on her interpretation of the situation, presumably through reflection on what had happened and why (the consequences of 'incorrect' spelling), and resolution (in the seeking of adult help and a corrective reply). This would reduce or remove the risk of any further misapprehension. Kathleen observed the effects of an unconventional usage in her message and experienced how the misunderstanding of one word can have an impact on the semiosis of the whole. This was meaningful and powerful situated learning.

The initial communicative act was predated by Kathleen's desire to make contact with her uncle. She decided whom to contact, the overall focus, the mode and the medium. As the initiator of the sequence Kathleen embarked on the exchange in a position of power. An indicator of her social role, her original message did not directly request a reply although it was implicitly expected. On the other hand, both of her uncle's replies more overtly sought a response through his use of direct

questions. This demonstrates adult status. Nevertheless, the misunderstanding also brought about something of a reversal in power relations where the child as the maker of the misapprehension assumed power as the adult showed subservience. Kathleen's decision to discontinue the exchange by not responding to the second reply is a striking indicator of her power.

Figure 5.4 Martin's second reply

Subject:	(No subject)
Date:	30/11/00 00:27:10 GMT Standard Time
From:	Chips6159@aol.com
To:	Kathleen Montgomery3
<p>CONGRATULATIONS ON YOUR SWIMMING SELF-SURVIVAL BADGE!!!! I WAS 11 BEFORE I GOT MINE. HOW OLD ARE YOU NOW? HOW FAR CAN YOU SWIM? AND WHAT IS YOUR FAVOURITE STROKE? LOVE UNCLE MARTIN</p>	

Spacing and punctuation

Linguistic analysis is undeniably fundamental to understanding the semantics of writing. However, other semiotic resources contribute to meaning in significant ways. The linguistic is no doubt foregrounded in Kathleen's message. Holding on to the lexicogrammatical analysis above but considering it in combination with other signs opens up extended opportunities for analysis and reveals meaning-rich features of graphic representational design. Computer-generated text seemingly reduces the semiotic potentialities afforded by handwriting. It regularizes the uniformity of letters and brings precision to spacing between letters, words and lines. It also offers presentational options such as font, size, colour, emboldening and underlining. Kathleen did not choose to avail herself of these possibilities. Nevertheless, in her first message (Figure 5.1, p.127) she did make use of three keyboard functions other

than letters: the shift key or caps lock, the space bar and the full stop. Traces of using the delete key are necessarily lost in electronic texts.

Firstly, Kathleen made signs through letter case. Lexicographically the Actor and Subject, here combined in the first person singular, make Kathleen the main focus of the message. This linguistic foregrounding is further emphasized by Kathleen's singular allocation of a capital letter for 'I' (not 'i' and at a time prior to automatic capitalization in email). This distinguishes it from the words around it. Granted this is conventional in 'correct' grammar. Yet 'kathleen' and 'martin' are not allocated initial capital letters. This has a very particular visual effect. It renders the names unexceptional in relation to the words around them. It may be that Kathleen considered their linguistic positioning in the clause to give them sufficient prominence, deeming it unnecessary to, in effect, repeat in another way what had already been done in one way. A more conventional use of capital letters would give the text a more formal feel (Figure 5.5). It would also give a different visual emphasis. 'I' would then be in competition with the names, the greeting and the time indicator and would therefore receive less prominence.

Figure 5.5 Imposed capital letters, punctuation marks and spacing

Hey! This Kathleen. Martin, I have some very good news. Last week I got a new baeg.
--

The pressing of the shift key or caps lock to make the capital 'I' was agentive. It was a deliberate decision and a deliberate action. Kathleen's choice not to make capital letters elsewhere in the message was also agentive. But what about spacing? Spacing between the words of the email is varied and represents no, one, two and three taps of the space bar (Figure 5.1, p.127). The triple spacing following the introductory word represents a desire to make a bigger gap than one tap of the space bar. Why did Kathleen want to do this? The larger space creates a visual effect. It separates 'hey' from the succeeding text. Already given linguistic primacy as the first word in the message, its positioning at some distance from the subsequent self-identification 'this

kathleen' and indeed the bulk of the message semiotically frames it off. The greeting appears separately from that which comes next. This emphasizing of informality establishes the context in which her news is to be received. Kathleen's word choice works with her spatial positioning to convey salience in her greeting. The orchestrated semiotic (the combined linguistic and visual as spacing) foregrounds the social relationship between Kathleen and her uncle.

The triple spacing between 'hey' and 'this' is succeeded by double spacing between 'kathleen' and 'martin'. Graphically, this separates 'this kathleen' from the preceding and succeeding words. It has the effect of framing this phrase from behind and in front. If the variation in spacing is equalized by imposing single spacing between each word and if the full stop is also removed the result is that the named subject ceases to stand out (Figure 5.6). Kathleen's self-identification then becomes visually indecipherable from the regularity of the surrounding words. Kathleen further emphasized the double space by her singular insertion of a punctuation mark. Together with the words that come before and after, the full stop and the double space form a 'new section' boundary. They mark the end of the greeting and self-identification and the start of the email's ideational content. Kathleen used spacing as a means of showing her textual organization.

Figure 5.6 Imposed single spacing and removed punctuation

hey this kathleen martin i have some very good news last week i got a new baeg

With one exception, there is no variation in Kathleen's single spacing between words in the remainder of the message. It is as though she chunked together the ideational content as one textual unit. The spelling of 'baeg' was apparently a creative moment which required some considered reflection. The double spacing between 'new' and 'baeg' may represent a brief moment of hesitation or indeed a relatively prolonged period of careful thought before committing letters to the screen. Alternatively, Kathleen may have considered a double space important before inscribing the

message's key word. Whatever, the actual outcome was that the word 'baeg' was moved into its own space.

The speech-like shaping of Kathleen's messages implies the possibility of a blurring in traditional distinctions between spoken and written forms. Early on in my analysis, I hypothesized that what are designated prosodics by linguists (for example, intonation, rhythm, phrasing) whilst absent from the orthographical form of email might be added in reading aloud or in one's head. Applying possible intonation patterns following Michael Halliday's (1989, pp.54-55) 'information units' and Wallace Chafe's (1982, p.37) 'idea units', I experimented, in retrospect somewhat fancifully, with the effects of emphasis and pitch. I imposed syllabic, rhythmic and intonational patterning by breaking the text down into feet, exploring how different words might be emphasized if the message were spoken and how this coincided with my lexicogrammatical analysis.

Although I subsequently abandoned the elaborate development of these ideas, this undertaking proved important because it began to open up the possibility of other aspects of meaning that might be present in the text beyond the linguistic. Interpreted as speech-like, the spatial gaps in the message might be a metaphor for the temporal pausing of speech. In conversation, silence can be phatically loaded in an expectation of response either in words (Tannen, 1982) or not-words (for example, nodding, facial expression or gesture). There may be intimations of fleeting moments of anticipation as the reader awaits what is to be articulated next: self-identification or the main body of the message (a question, a reprimand, a surprise, a joke?). Due to the asynchronous nature of email writing, the writer is required to fill this gap with ongoing graphic characters. Kathleen's message could be a remaking of mindfully enacted speech realized graphically. If so, the visual could imply the temporal.

Martin's second reply is written entirely in capital letters (Figure 5.4). This is visually significant. It appears to imply embarrassment or apology. Self-deprecation ('I WAS 11 BEFORE I GOT MINE') and the signing off ('LOVE UNCLE MARTIN') implicitly communicate linguistically that no offence was meant. Similarly, the four

exclamation marks at the end of the first clause offering his congratulations semiotically express great delight. This, along with the inclusion of three questions, implies a desire to sustain the interchange. As Kathleen chose not to reply its effects are lost.

Kathleen made signs in three distinct but interrelated ways: firstly, in her choice and ordering of words in relation to one another linguistically; secondly, in punctuation as capital and lower case letters and punctuation marks; and thirdly, in her spacing between words. The potentialities for meaning in the visuality of lettered representation begin to emerge when punctuation and the framing of words in relation to other words are examined in combination with wording. In spacing and the one occurrence of punctuation, Kathleen showed textual and semantic boundaries. She joined and related words as textual chunks through single taps of the space bar but made double and triple spacing to create visual frames that distinguished semantic blocks (greeting, self-identification and news) within the message. An orchestrator of the semiotic resources of graphic representation, Kathleen succeeded in integrating complexly interrelated signs. This co-construction of meaning is fundamental to the semiosis of her graphic design. Her linguistic and presentational / organizational signs are mutually supportive and combinationally significant.

Remaking the semiotic resources of writing

Choice

In a protected online environment for 7- to 11-year-olds 'stickies' resemble 'post-its' in shape and representational size. A popular resource, children use them to send notes to one another. The amount of text stickies hold is limited although it is possible to continue on the virtual 'back'. What is particularly interesting is how children in this community had developed ways of communicating via stickies. Their design is quite different from that of writing in curriculum work. The children remade writing in very particular ways in this environment.

Like Kathleen's emails, sticky messages tended to be brief. Of the 27 on 10-year-old Bethany's home page, the shortest was 'cool site'. This was quite acceptable in the environment. Length was not an indicator of quality or a measure of acceptability. Comments and thanks were commonplace in stickies, as were questions or helpful hints about technical skills. Children used them to make contact with people they did not know (for example, 'hi! my names ellie!'). They also chatted online with their friends (for example, 'Hi vic I just seen your bro!'), made plans (for example, 'If I am not allowed to sleep at your house...') and 'whispered' intelligences (for example, 'Pippa Crowson is online'). Length is itself a semiotic indicator. It implies that the content is concise and pithy and that the message contains a singular or limited range of topic material. Exclusion of description and explanation is also a sign of the children's social relationships. More expansive detail would be deemed informationally and socially inappropriate in sticky exchange.

Words and wording

Widespread ownership of mobile phones, a relatively recent phenomenon, has brought with it culturally shaped and socially mediated transformations in lettered graphic representation. Text messaging is unlike 'standard' writing both lexically and grammatically. Indeed, it might be argued that 'texting' is a different mode of graphic communication, one that has become established with astounding speed and that is likely to continue to develop. Traces of 'texting' were evident in the children's stickies. Like written Hebrew, the children omitted vowels in a kind of shorthand and made letter-swaps (for example, 'Visit mine plz') and shortened words (for example, 'pic' for 'picture'). As Bissex (1980) noted in her observations of her son's early experimentations in writing, letter names and numbers represented words and phonemes (for example, 'U can make your own pic now' and 'Could you tell me how 2 do that'). As in text messaging, this was neither a fully developed nor an entirely regularized system. Message makers had to understand the variant nature of letter and number symbols, and message receivers had to be flexible in interpreting the same symbols for varied functions and in different combinations. A different attitude to

spelling in this environment from that in schoolwork was apparent in 10-year-old Sophie's comments:

And we have like stickies [...] Josh is really bad at spelling and he spells things really bad / but it doesn't matter because we understand what he's trying to tell us / and you don't have like squiggly lines under / and like the teacher shouting at you and saying / 'Oh no / that's wrong that's wrong / you've got to stay in at playtime and learn it'.

Punctuation

What is also distinctive about the stickies is punctuation, or rather lack of it. One child individualized his note by mixing lower and upper case letters, writing 'Oh ma GoD Ur PaGeS R WICKEd'. Capital letters were often absent from the beginning of texts where they would traditionally be obligatory and they were not always used for names (for example, 'hi! my names ellie!'). Exclamation marks were rife, as were omissions of full stops and question marks, with no commas evident in this sample of 27 stickies. Sophie continued,

I don't like it when the teacher bosses you about and says / 'No that's not right' and stuff and / 'Oh you haven't put your capital letter in there' / or it's just a one off / or 'You haven't put a full stop here' / and 'Oh no it's all wrong it's all wrong you'll have to write it out all over again' / and I'm thinking 'Oh this is boring / uuuh!' / and then when you're on the net you don't get funny squiggly lines or the teacher shouting in your ear hole or the computer suddenly coming alive [...] when you're in class you have to make your arm ache to write things for the teacher that are never actually going to see the light of day / so it's not really going to be much worth except for learning things / but with computers you learn to type / how to type in with double hands / and also you don't have to always put in punctuation because it's sending to kids [...] they're not really going to care / they're just going to want to know what's going on I think.

The focus of Sophie's outburst was indignation at the demand not only for absolute accuracy in curriculum located punctuation but also for a 'perfect' version that did not bear traces of correction. Her reference to the community's (note the

generalization of 'you') habituated practice of not using punctuation conventionally was a deliberate distancing from the educational domain.

Sticky messaging is different in form, style and function from formal school writing. Its criteria for sufficiency differ. Writing in school is subject to conventional correctness. Reception children (age 5) are taught 'to use awareness of the grammar of a sentence' (DfEE, 1998a, p18) and by the end of Key Stage One (age 7) are taught 'to write in clear sentences using capital letters and full stops accurately' (DfEE, 1998a, p.30). What children understand a sentence to be is neither simple nor straightforward (Kress, 1982). Of interest in the stickies, as in Kathleen's emails, is that the messages were not written as sentences. Capital letters, full stops, question marks and commas were largely omitted or at any rate limited. Where they did appear, their meaning was interpersonally oriented. For example, they marked the affective and work as surprise indicators. In this online context changes to traditional punctuation were usual; it was acceptable to give names lower case beginners, to omit full stops and to signal social meanings through exclamation marks.

Computers first appeared in schools in the 1980s, around 100 years after the introduction of compulsory schooling, that is just over 20 years ago. The acceptance and integration of computers into the school curriculum has been patchy, challenges including pupil / computer ratios, the age of equipment and teacher capability (Loveless, 1995; Ofsted, 1995; Ofsted, 1996; DfEE, 1997; McFarlane, 1997; Robinson, 1997; Watson, 1997; Becta, 1999b; Becta, 1999a; Ofsted, 2003). This led to the National Grid for Learning initiative for which the Labour government committed significant funding to ensure that all schools were online by 2002 (DfEE, 1997; DfEE, 1999; DfEE, 2001; DfES, 2003). Its aim was to 'modernise education' (DfEE, 1997, p.4) and to raise educational standards in schools, particularly in literacy and numeracy. As yet there is little 'proof' that ICT is having an impact on attainment as it is currently measured. However, what is happening is that children appear to be learning in unexpected ways, particularly at home (Somekh, Lewin and Mavers, 2002; Somekh et al., 2002). Interestingly, the electronic texts I have examined above suggest that the multimodal potentialities of the computer and the

ways in which technologies are being used by relatively young children are fostering deep-seated distinctions between children's writing in their own communities of practice and 'traditional' literacy in the formal writing of school. The sociocultural shaping of electronic text is changing what writing is, expanding its forms and functionality. Using the computer to communicate becomes at least a divergence from traditional perceptions of standards, and at worst a threat to the 'purity' of writing (Halliday, 1989, p.30) and to traditional notions of literacy. My own view is that different representational practices are an inevitable consequence of daily life and that they offer extended potentialities for meaning-making.

Meaning was constructed, exchanged and interpreted as part of a social process. The children's community where the stickies were generated was culturally shaped through the social interactions of its members within it. Monitored by adult moderators, the environment had rules devised to ensure safe and respectful exchange. The presentation of the site as a whole and the examples set by the moderators' content were implicit indicators of what the environment was, the sorts of contributions that were acceptable and how members should behave. Nevertheless, within this framing and these parameters, children were able to construct their own identities, decide on the content and register of their contributions and thereby co-construct what the community was. The individual had agency but individual identity was shaped by the work of the community, its aims and its working practices. Thus, there was a constant interplay between what the community was about and how people operated within it, both the individual and the group as a whole. Lettered graphic interactions were largely through sticky messages where habituated practices had partially established conventions. The children's abbreviations were not purely graphic substitutes for other graphic symbols. In their sign-making on stickies, the children constructed a particular social environment through their shaping of writing. What messaging was shaped. This shaped the character of interactions. This had implications for social relationships. There was therefore an inextricable relationship between the shaping of writing, the shaping of social relationships and the shaping of the community. The social was realized as graphic text – but not just realized, also handled, interpreted, shaped and remade.

Halliday (1989, p.3) suggests that symbolic acts are acts of meaning which only work if someone sees and responds. Although in both the email and the sticky messages the reader was not physically present at the moment of text formulation and production and the writer was not present when the text was received and read, there is a sense in which the imagined producer and recipient had a disembodied presence, that the reader was hypothetically present to the maker just as the virtual presence of the maker was active in the act of reading. Social relations were initially imagined and represented rather than enacted because the producers were absent from the place where the actual communicative transaction was completed. Yet the exchange also became a concrete event. This is a curious but entirely ordinary mix of the virtual and the actual. The other's distant but authentic presence and anticipated exchange gave a powerful sense of two-way communication. The ways in which the children in this environment composed their texts suggest mindful anticipation of the exchange of meaning. How texts are made to look and how they are looked at are both aspects of the maker's thinking in the process of design. A prediction of the sign-remaking of the reader takes place at some level. This anticipation of the sign-remaker's interpretation is the very opposite of Piaget's egocentrism. Producing and reading signs might have been separate but, paradoxically, communication entailed semiotic processes where design, production and interpretation were inextricably linked. Although the message might only become a 'fulfilled' communication when read and interpreted by the recipient, the traces of meaning in these children's online messages suggest that the communication was a foreseen exchange from its very inception.

Intramodal transformation

The Paddington Bear worksheet inscription 'because' underneath 'I chose' specifies the need to explain in words (Figure 4.1, p.89). So why did Rachel and Daniel write from the board 'It shines when a light is shone on it' whilst Katie wrote 'it shines when a light shone on it'? Educationally, this might be judged in terms of what I have called 'sufficiency' – one is deemed to be a 'correct' reproduction and the other 'wrong'. For me, Katie's exclusion of 'is' is intensely meaningful. It represents something pivotal for how she thought about the phenomenon. Her use of the active

rather than the passive voice suggests interpretative sign-making in the process of writing from the board. Katie conveyed the action of the experiment (note the past tense of ‘when a light shone on it’) and her knowing derived from this experience (‘it shines’) as shown in her image. This is not copying but transformation – an intramodal transformation. It is a sign of a scientific conclusion based on her experimental findings. An interpretation of her experience, her words carry the scientific ‘truth’ of the experiment as she perceived it.

Figure 5.7 ‘Copying’ as intramodal transformation

a) Rachel

1. We looked in the box when there was no dark.

b) Daniel

1 we looked in the box when there was no light.

c) Katie

1. We looked in the box when there was some light.

That remaking is a case of transformation and not ‘copying’ is evident in another scientific report entitled ‘Can objects be seen in the dark?’ which was completed exactly two weeks earlier. Again, following class discussion, the children were required to ‘copy’ a jointly constructed report from the board. In recording the first point in a set of three procedures, each of the three children’s versions is different. Rachel wrote, ‘We looked in the box when there was no dark’; Daniel wrote, ‘we looked in the box when there was no light’; and Katie wrote, ‘We looked in the box when there was some light’ (Figure 5.7). If this is ‘copying’, should these be seen as ‘mistakes’? In educational terms, maybe yes, since the aim was reproduction.

However, the texts provide insights into the processes of ‘copying’, about which Porte (1995, p.145) describes our lack of knowledge as ‘alarming’. These variations in wording suggest interpretative work. The children each made their own meaning. This is evidence of thinking minds at work as they transformed the words before them in relation to their interpretation of their experimental experience. Which is ‘correct’ is not the issue. What the different versions show is that semiotic processes were at work. Each was a transformation of what had been written on the board and each gives clues about the children’s perceptions of what they did and observed, and what they understood by this. The changes to wording are external traces of internal sign-making; they are interpretations.

Semiotic resources in an intermodal transformation⁷

Words and wording

Speech and writing share the same underlying linguistic system yet they are quite distinct. Writing is not speech written down nor is speech writing read aloud; they are different ways of signifying, they ‘mean’ in different ways and they fulfil quite different roles (Halliday, 1989). Each has distinct lexical and grammatical characteristics, organizations and structures. A distinctive feature of speech is its proliferation of intricately and elaborately interwoven grammatical items (function words) in contrast with the more closely packed lexical density (content words) of writing (Chafe, 1982, pp.39-40; Halliday, 1989, pp.63-63, pp.72-73, pp.79-80). Melodic ‘idea units’ (Chafe, 1982, p.37) or ‘information units’ (Halliday, 1989, pp.54-55) are chained as coordinated, conjoined and adjoined clauses in speech whereas mature writing is characterized by sentences which are bounded by full stops (Kress, 1982).

What is unusual about Hannah’s submission is that she undertook a full transcription of the interview. At 13 pages long, this was no mean feat. Listening and writing must

⁷ An earlier draft of this section has been presented at a conference: Mavers, D. (2002) *Remaking Meaning: Multimodal Sign Making in a Child’s Interview Transcription*. British Educational Research Association (BERA) Annual Conference, Exeter, UK (September 2002).

have taken considerable time and careful concentration. Astonishingly, in her transcription Hannah neither abridged nor summarized the interview interchange which lasted for seven minutes 22 seconds. With the exception of some complexly interwoven hesitations, restarts and simultaneous talk, cross-referencing with the audio recording shows her text to be an extraordinarily accurate verbatim transcription of the interview. This is remarkable in itself and demonstrates Hannah's meticulous attention to detail. In her commitment to capturing the 'fullness' of the interview accurately, its 'truth', she painstakingly transcribed what was said word for word, never substituting articulated vocabulary with alternatives. True to lexis, words remain the constant.

Hannah portrayed the structure of the girls' informal talk in a way that made its spoken characteristics absolutely explicit to the reader. She did not alter, simplify or refine syntax. Rather, she transcribed each utterance faithfully. Throughout, and strikingly, Hannah neither omitted the frequent falterings and restarts nor did she modify them to make them writing-like, just as she retained the frequent occurrences of conjoining with 'and'. Considering the challenges and complexities of accurate transcription this is quite astounding, for example, 'thought it was a great that that didn't really, that wasn't interacting um said' (Figure 5.8). The hesitation 'um' occurs 55 times, that is about once every 22 words. In approximately half of these instances Hannah located it absolutely correctly, even making painstaking adjustments as in her opening words 'is um just to find out ~~um~~ whether um'. This implies that she took the import of these hesitation indicators to be of sufficient significance to warrant inclusion, exclusion and precise positioning. In this way she captured the falterings, self-corrections and repetitions typical of speech. These have situated meanings, for example uncertainty, thinking time, teasing, a hint of frustration and a sense of suspense.

On the first page of her transcription Hannah wrote 'has bell gone'. The definite article is omitted. This captures the virtual disappearance of 'the' firstly in the speed of speech production and secondly as it precedes the crucial nominal ('bell') which receives intonational and intensitive emphasis at the peak of the phrase. Similar to the

contractions in 'this kathleen' and 'Christmascoming' (see pp.128-129 above) this is not a mistake but a remaking. Hannah's graphic representation of the lexis and syntax of speech symbolizes the social context in which the interchange took place. It provides information crucial to the reader's understanding of the girls' social situation, the informality of the setting and familiarity of the girls' relationship. Intermodal transformation, the graphic remaking of one form of representation into another, goes beyond the solely linguistic to the social semiotic.

Figure 5.8 Recording the complexities of speech⁸

the person that wasn't having a talk
thought it was a great that that
didn't really, that wasn't interacting
um said hey you should do this it's
a one in a life time chance so she
went over there instead of her and he
actually asked her to go over- it
would be good if I could remember
which one is which and and um- I
do remember which one is which but
nevermind- and and and um he
hasn't actually that person they found
out in the end and then the other sister
was sister like me, he! he! Went over
there and and and- yeah but
interviewee:

⁸ I received a photocopy of Hannah's transcription rather than the original. In this process, the beginning of the line to the left of each page was lost.

There are only rare falterings in Hannah's writing. Just 19 generally zigzag deletions and four overlays from a total of 1,205 words (just under 2%) indicate what she deemed to be errors. A number of these are perceived slips in spelling (for example, 'eefect-affect', 'differendt'). Other amendments suggest revisions made as part of the complex process of transcription. Hannah's careful attention to the identity of the speaker and meticulous attention to detail are evident in Figure 5.9. Here, she reallocated 'but he wasn't' to the other participant and removed the words 'Hey hey', presumably considering them inaccurate. Amendments were therefore to do with accuracy in the mechanics of writing (spelling precision), efforts to represent exactly what was said (transcription precision) and endeavours to be true to the experience (event precision). Hannah's corrections demonstrate how seriously she undertook her work and her attention to detail in striving to produce an accurate account.

Figure 5.9 Amendments

this person um um was pretending
 to to be really famous person. but he wasn't
 interviewee.
 but he wasn't!
 interviewer:
 Hey hey shut up! She went over to his
 house m um h...

Hannah also transcribed non-verbal vocalizations such as laughter. What might be interpreted from the graphic account as boisterousness is actually in sharp contrast with the subtlety of the interchange on the audio recording. This disjunction epitomizes the challenges of remaking the orality / auralness of sound into the visibility of marks on a page. Laughter and laughter-related sounds took many different forms on the audio recording (for example, giggling, an outburst and intake of breath, nasal emission of air, suppressed chortling, whooping and vocalized guffawing). Each had

its own sounds and situated meaning. As there are no standardized conventions for dealing with this Hannah used the same written form 'ha ha' to indicate different instantiations of laughter and laughter-like sounds. Each has a different meaning intentionality in the context of the exchange, for example to convey amusement, hilarity, embarrassment and uncertainty. Just once, 'ha ha', strongly intoned, denoted deduction, as in 'aha' (ə-hä). The one occurrence of 'he! he!' (hē hē) was distinctive in its falling intonation pattern and expressed pride in being a twin like a character in a favourite television programme. The reader is obliged to construe these meanings through context.

Making written words look different from what might be anticipated signals the unexpected. In remaking spoken words into written words, Hannah presented lexis on the page as speech-like rather than writing-like. Her repeated writing of 'coz', rather than 'because' (which never occurs), happens eight times. There is just one variation in the single occurrence of 'coarse'. Similarly, all 22 instances of 'yes' are consistently written as 'yeah'. Furthermore, Hannah used 48 elisions including 11 occurrences of 'it's', six of 'don't' and six of 'they're'. On one occasion, she shortened 'that's' to 'Thas'. These lettered forms capture the clipped pronunciation of speech, warning the reader that this is something different from formal written text.

Punctuation

The multimodality of the face-to-face event was the originally realized representation of meaning. This held the definitive 'fullness' of the exchange. As an audio recording the event became something else. It was a modal narrowing. The aural selectivity of the audio recording then became the primary source for transducing meaning into writing as transcript. The full range of signs of the original source which became the 'cut-down' version of the audio recording had to somehow be realized in the potentialities of graphic representation. In many ways the written form is inadequate to the needs of the transcriber. Intonation patterns, phrasing, pace, intensity and pausing are powerful semiotic indicators that allow certain things to go unsaid. As writing precludes the sounds and rhythms of speech Hannah had to represent them in

a different way. She endeavoured to produce as precise an account of the interview as she could in this multimodal composite. Her transcription is (mainly) a record of dialogue in a graphic form. It is not so much writing as a graphic remaking of talk.

Words as speech and words as writing have different material forms. These materialities are not additions but realizations. The semantics of spoken words combine with culturally and regionally specific sounds and rhythmic patterns to communicate meaning. Language as speech is articulated in the tonicity of voice, the modulations of intonation, the crescendos and diminuendos of intensity, variations of rhythm, differences in tempo, and the effects of sound and no sound in pausing. The sounds and rhythms of speech are absent from writing, only reappearing if there is a performance at some level such as reading aloud or in one's head. So how did Hannah remake the semiotic resources of the sounds and rhythms of speech with the semiotic resources of writing?

Interestingly, Hannah appears to have both retained and abandoned curriculum-like punctuation. On the one hand, she used punctuation marks conventionally. Yet she also seems to have bracketed her knowing about conventional rules in order to remake their meanings for the very particular needs of her interview transcription. Hannah knew that the 'correct' way to write a question is to use a capital letter at the beginning and a question mark at the end. This is what she did in writing out her questions prior to interviewing. Yet in her transcription she wrote 'has bell gone' without a capital letter or question mark, and indeed with 'incorrect' grammar. Hannah drew on existing signifiers but remade their signifieds for the very specific purposes of her transcription. In this way the punctuation sign system became something different. Her aims were apparently to do with semiosis beyond the linguistic. Deviation from what the reader would normally expect in writing is powerful sign-making. Dissimilar to school-like writing, scarcity of capital letters shows implicitly that the conversation was not 'sentenced' but a collection of clauses (Figure 5.8). Full stops are notable by their absence. As omission of capital letters and full stops disrupts what the reader would normally expect in written text, this gives a sense of the rhythms of speech and signals successions of connected phrases.

This was no accident. These signs convey the continuous nature of the girls' interchange, both the unbroken talk of one individual and the interweaving of the dyad.

Ambiguities and inconsistencies (which are by no means restricted to children) are features of the actual complexities of Hannah's thinking becoming visible in her text. On two occasions, her inclusion of full stops conveys similar meanings to her omission of full stops. Hannah's threefold strategy in both cases was identical. Firstly, the full stop marks the position of an interruption; secondly, the interposing interjection begins with a capital letter and ends with a full stop; and thirdly, the continuation proceeds with a lower case beginner. For example,

She went over to his house no um her sister, went um over to his house coz they weren't aloud um so well I I can't remember which one it was but um.
interviewee:

One of them.

interviewer:

so the one

Hannah seems to have been aiming to show the rapid swapping between speakers in the fast moving pace of the exchange. The 'sentenced' interjection gives it wholeness as the other participant's contribution. The lower case beginning for the speaker's subsequent words suggests continuation.

Hannah made twelve commas in her 1,205 word transcription. One comma to approximately each 100 words is not a lot. When they do appear, these marks perform very specific functions that are not always the same. In teaching children how to use commas and full stops, teachers often advise children to think about where they would take a breath in the spoken form (Hall, 1998a, p.8). Halliday (1989, pp.37-39) suggests that the pausing in speech rarely coincides with grammatical boundaries. Two of Hannah's twelve commas imply pausing. In three cases, however, her commas mark repetition (for example, 'if it affects their, if it affects their um sats results'), conceptual recasting (for example, 'Um I don't think they're right coz um um I know someone, I know a few people that have been affected') and

hesitation (for example, ‘I thought, I thought that you’d yeah um yeah o.k um’). She also used a comma to show speech-like subordinated clauses and addenda (for example, ‘Do you think children should be aloud into chatrooms in case of danger, under the age of 15?’). This is transformation in sign-making – a particular signified is combined with an existing signifier to make a particular situated sign.

Hannah’s exclamation marks show distinctive cadences of auditory significance in the interview talk. They are visual indicators of the other-modal – the sounds of oral communication. Exclamation marks signal an intensification of intonation (for example, ‘he! he!’ as deduction), melodiousness (for example, ‘sister sister!’ as singing) and non-verbal communication (for example, ‘ha! ha!’ as laughter). These can only be hinted at in the transcription and must be recreated at some level or at least recognized by the reader in the act of reading. The exclamation marks convey light-hearted control (for example, ‘Hey you can’t sing the theme song!’), lively altercation (for example, ‘yeah they do!’), surprise (for example, ‘but he wasn’t!’), jovial disagreement (for example, ‘shutup!’), frustration (for example, ‘get on with it!’), resigned agreement (for example, ‘no!’) and friendly banter (for example, ‘And and so!’). As greater specificity of meaning is not possible in the written form, the reader cannot be absolutely certain about the precise signified. S/he must decide on the most likely interpretation based on surrounding contextual information and the linguistic tenor of the writing. Indications of the lively nature of this peer interchange are communicated through this sign-making. The exclamation marks implicitly communicate something about the more overarching semiosis of the interview by capturing the informality of the interchange.

As with her use of full stops and commas Hannah gave the dash different functions, such as showing continuation, concurrent talk and melodic information units, as well as clausal asides, afterthoughts or addenda (see, for example, Figure 5.8) and parenthesized explanation (for example, ‘and-yes egg –nick name –and they’). Elsewhere in her transcription Hannah’s dashes perform a very particular semiotic function akin to stage directions in a play script. Non-verbal information such as throat clearing (for example, ‘- coughs – umm yeah I do’) and bodily actions (for

example, ‘- nods head -’) are sandwiched between dashes. On two occasions, a single dash following a verb pre-warns the reader that the succeeding words are sung or chanted rather than spoken (for example, ‘sings – Inch high priveat eye yeah’). This signals that the reader should be mindful of tunefulness. The sounds and rhythms of speech, always implied by the transcriber, must be recreated at some level.

Interpersonally oriented, they are vital to the reader’s understanding of what happened in modes beyond language-as-speech.

Hannah’s intermodal transformation from the sounds of an audio recording to words on a page was situated in her broader research experience. The event itself was not just speech; it was a face-to-face exchange. Furthermore, the interview was situated at a particular time and in a particular location where other concurrent happenings were going on (this was during the school day). Whilst she made transcription of words her primary consideration, Hannah also had to make decisions about acting or not acting upon sounds other than the girls’ voices. Of particular interest is her decision to mark with dashes the only occurrences in her transcription of ‘sound events’. About 50 seconds into the interview the opening of a door (‘- door opens -’) was a happening that apparently interrupted the flow of her explanation about what would happen to the interview data (Figure 5.10a). Clearly audible on the audio recording, the sound is concurrent with halting, measured speech towards the end of the clause as Hannah’s attention was seemingly diverted (‘this will be sent off (*pause*) to (*pause*) a (*pause*)’). There is no indication in the text of who the door opener is and there are no clues on the audio recording apart from indistinct background noises. Absence of any spoken exchange between the girls and this other person may indicate someone with greater power, possibly a teacher. The dashes in the transcription inform the reader that the words positioned between them should be read and interpreted differently from the words that precede and follow, that is not as recorded speech but as contextual information. On the third page of the transcript, and approximately one minute 48 seconds after the sound of the door opening, Hannah recorded the closing of the door in a similar way (Figure 5.10b). The high-pitched sound of creaking hinges is just audible on the audio recording.

Figure 5.10 Dashes

a) Door opens

~.
ra ha and and um my job is to intervi-
w you and and then this will be sent
- door opens - to
interviewer:
as bell gone
ntermin.

b) Door closes

interviewee:
OK then I'll begin when, when I find my
questions.
- door closes -
O.K
interviewer:
O.K din dente in den dehh!
ntermin.

Interestingly, on the recording in between the sounds made by the door, is the loud crash of, presumably, the opened door slamming which Hannah did not note in her written transcription. Why did she record the barely audible and omit the blatant? Indeed, why did she record the opening and closing of the door at all? The door events carry significance of importance to the reader's understanding of the interview situation. Hannah selected out what she considered pertinent contextual information. She judged the slamming door incidental (the door happened to make a loud noise as it closed) but irrelevant to the social occasion (it did not signify a person entering or leaving). Similarly, she excluded actional sounds such as paper rustling and tapping that are audible on the cassette. Presumably, for her, these did not have significance

for the interview situation. Hannah's selectivity in her logging of contextual information appears to be pertinent to the social context as she perceived it and as she chose to purvey it. The intrusion seems to have had consequences for the privacy of the girls' exchange. As the hinges cease to creak, the door is apparently closed and the 'intruder' seemingly exits, the character of the exchange is transformed. It immediately sparks off a more relaxed, jovial and frank exchange between the girls. This is heralded by the respondent's rendition of a fanfare in Hannah's invented lexis 'din denle in den dehn!' (Figure 5.10b). These seemingly insignificant asides, marked by dashes, imply broader social meanings.

Layout

Hannah's transcription is written in ink, probably black biro (I received a photocopy not the original) on unlined white A4 paper. The joined, rounded handwriting is evenly spaced and largely aligned on the horizontal although with a slight dip to the right of each line. The thickness of line suggests a similar pen pressure throughout. Regular and unvaried, the writing's consistent substance, colour, size and style indicate that Hannah chose not to make signs through the semiotic potentialities of text presentation. This uniformity apparently realized her perception of an acceptable recording style for the task.

Throughout, Hannah designated the speakers 'interviewer' (30 occurrences) and 'interviewee' (31 occurrences) but inversely in conventional terms (the opposite of standard usage). The words 'interviewer' and 'interviewee' are not subheadings; they are role identifiers that demarcate the girls' social roles in this interview situation. As such, they are also identity indicators that inform the reader who the speaker is – Hannah the interviewer and transcriber or her friend, the interviewee. In the face-to-face interaction of the interview there was clearly no need to announce who each speaker was prior to each utterance. Identity has to be dealt with differently on the page. The combination of role identifier and colon make it clear that these textual units are not the same kind of words as the succeeding text. They announce that what follows are the spoken words of that individual, 'from here, this is uttered by...'

These are who said what; those are what people said. This layout alerts the reader to words for different purposes: identification and dialogic content. The reader should expect difference (that questions will be asked by the interviewer and replies will be given by the respondent).

The potentialities of the space of the page also offered other opportunities for meaning-making. Hannah marked and left unmarked. Always positioned to the extreme left of a fresh 'line' and consistently with lower case initial letters in all but three cases each occurrence of the role identifier is followed by a colon (for example, Figure 5.11). The remainder of the (conceptual) 'line' is always left blank, resulting in areas of unmarked space. This layout is consistently maintained throughout the text. A conventional arrangement, it is like other submissions from Hannah's class and apparently a best fit to the task in hand. Layout provides vital generic information. At a glance, it informs the reader what the report is not (for example, a story) and what it is similar to (a play).

The speaker's words are written underneath the role identifiers as a block (for example, Figure 5.11). White space is a means of marking boundaries. In the mind maps examined in the previous chapter, the children positioned 'families' of like items together and left unmarked space around them to demarcate groupings. Here, the blocks of text framed by white space mark off different chunks of spoken words. They show speech boundaries. The proportion of covered space is significant. Whereas larger blocks of writing present extended individual contributions (as in Figure 5.8), shorter bursts show rapid turn taking (as in Figure 5.11). Thus, the spatial is an indicator of the temporal and the social. The unmarked space of the graphic account shows transfers between speakers and thereby implicitly shows the reader something about how the girls constructed meaning in this interview situation. At a glance, dense text signifies individual exposition. In contrast, areas of white space to the right of the page are signs of rapid, alternating exchange. In the latter, speaker identification is rendered less immediately obvious. This is significant with regard to the girls' co-construction of meaning. It shows how their short, interwoven contributions jointly composed meaning-making. The spatial layout of the account

therefore carries figurative meanings. Semiotically, space becomes significant in whether it is covered or uncovered. The marked and unmarked space of the page is a metaphor for the social relationship between the girls in this situated interview experience. It represents their roles and their joint construction of meaning. The layout of the transcription goes beyond the solely linguistic to the social semiotic.

The role identifiers and white space also work as place finders. They provide reading paths. The reader can enter at any of these discrete blocks of text headed by the role identifier and know who is speaking. Whilst Hannah's transcription abides by the temporal linearity of the original spoken exchange, the spatiality of the page gives the reader a choice of different entry points and therefore gives the reader control over the order of reading. Making sense of groups of words remains linear but the reader may dip in and out according to his or her interests. Furthermore, the sequential position of the page in relation to others (at the beginning, middle or end) is also a location indicator. The spatial corresponds to the temporal. However, in becoming spatial, that which was originally articulated temporally may become of variable sequentiality depending on the particular reading.

Spoken words are linear. Transcription of one person's talk is tricky enough. This is complicated when there are swift exchanges between two people. However, simultaneous speech is another problem entirely. Perhaps the most complex example of rapid swapping between speakers and concurrent talk is about half way through the interview when the girls were discussing a slightly risqué ethical issue. Deciphering who said what and in what order presumably required backtracking and re-listening. One dilemma was how to represent temporal concurrency in the spatiality of the page. Hannah had already chosen a layout that worked and clearly decided to persist with it. Two versions of this extract are presented in Figure 5.11, the child's and my own. Mine is a different kind of transcription but it is in the same multimodal composite as Hannah's. It demonstrates how she dealt with the challenges of remaking the complexities of rapid exchange and simultaneity in a temporal multimode into the spatiality of writing. Two strategies are apparent. Firstly, from the complex of concurrently spoken words, Hannah picked out that which she considered

critical. Secondly, she skilfully captured the co-construction of meaning through an interweaving of words. She maintained the linearity of continuous writing but made frequent swaps between speakers, each making short, sometimes unfinished interjections and interruptions. This conveys joint meaning-making as the girls explored the subject. It includes clarification and explanation, hesitation and agreement, assertion and counter-suggestion. The girls supported one another as they reach an agreed position on this difficult ethical question.

Figure 5.11 *Simultaneity*

a) *Hannah's transcription*

interviewee:
 -tell um / what do you mean like like
 hat
 interviewer
 -tell like body fattening.
 interviewer
 like um in Lara Croft her boobies stick
 out a bit! ha! ha!
 interviewee
 yeah they do!
 interviewer
 her boobies ok I'll well I think
 interviewee
 yeah really coz do you think it's fair
 really coz?
 interviewer
 think maybe in Lara Croft her boobies
 do stick out a bit but um

b) *My transcription*

Interviewer:	Respondent:
like	
fattening	what do you mean like that?
well	
like	like (<i>loudly</i>)
body fattening	like the (<i>pause</i>) like in Lara (<i>pause</i>) L Lara Croft her boobies stick out a bit (<i>inhalation</i>) her boobies
yeah they	
do	her boobies
okay	
do you	well I
think it's fair really 'cos I think maybe in Lara Croft	

Discussion

For me, Kathleen's email, the sticky messages and Hannah's transcription raised a fundamental question: what is writing? Culturally, academically and educationally the traditional response would probably be 'language'. Undeniably the linguistic is foregrounded. However, writing is more than an abstract system of lexical, syntactic and semantic rules. It is graphic symbols presented on some sort of inscriptional surface. Writing cannot therefore exist apart from its materiality and visibility. So what are the semiotic resources of writing? On the basis of the evidence above, and

provisionally, I would like to suggest that writing includes the semiotic resources of lexis, materiality, punctuation and layout.

- 1) The problem for Hannah in her intermodal reshaping was that the modal capacities for sign-making did not match. That which was articulated in one mode did not easily 'translate' into another. Of course, this is why different modes are so crucial. They enable different things or different aspects of the same thing to be communicated. As Hannah tried to transduce the signs of the exchange from one mode to another, she ran into problems precisely for this very reason. To manage this, she faithfully and meticulously re-presented lexis and complex syntactical structures, including repetitions, falterings, hesitations and restatements with matched sequentiality so that the linguistic content of the graphic account was largely identical to the spoken version. The linguistic was modally dominant, as were the words chosen by children for their email and sticky messages. The *lexicogrammar* of writing is its fundamental semiotic resource. In an endeavour to separate out the semiotic resources of writing for analytical and theoretical purposes, a 'stripped' version of lexis, as with drawing in the previous chapter, means temporarily bracketing its appearance as materiality and visibility on a graphic surface. For the purposes of this study, I propose that *language-as-writing* is understood as a linguistic construct.
- 2) All signs are materially realized. The electronic messages originally appeared as light on computer screens. For the purposes of this thesis they have been re-presented in a different *materiality*, namely as ink on paper. Hannah's transcription was made from ink applied by a biro to white A4 paper. This was not her only option. She might have chosen pencil and lined paper or a word processor. Her selection of substance and surface signifies what she deemed appropriate for the task in hand according to contextual constraints. All mark-making choices are semiotically significant. Where apparently unremarkable, it is not that substance and surface are meaningless but that they make signs that convey the commonplace or the conventionally apt.

- 3) Some features of speech are not readily realizable on the page. This forces the transcriber to find ways of expressing such phenomena as aptly as graphic representation will allow. *Punctuation* became a vital semiotic resource in the intermodal reshaping of transcription. Remaking every intonational inflection would have made Hannah's work unmanageable. Marking of the less remarkable would also have cluttered the transcription, making interpretation overly complex. She therefore selected out what she considered worthy of marking, the *critical meanings* made in the sounds and rhythms of speech. Hannah simultaneously analysed as she transcribed. She marked that which she considered salient. This entailed making decisions about what was important in the multimodality of the original situation and remaking this in a 'new' graphic mode as accurately as she could. Hannah's account is a record of semiotic choices made at key points in her transcription. Her sign-making provides traces of her theorization. Hannah's criteria for precision changed from moment to moment according to her interests and the immediate demands of the transcription as she perceived them. Based on her knowledge of the English writing system, she gave familiar signifiers different signifieds. Not only did she include six different punctuation signs but she also multiplied their meanings. Quite different from an everyday experience of writing this meant suspending some aspects of curriculum literacy learning and reconceiving punctuation for a new purpose. Hannah remade marks to deal with the challenging demands of transcription. In giving familiar signifiers unexpected signifieds, she purveyed the 'un-writing-likeness' of speech. As a result, the meaning of graphic marks varied. A mark might imply something in one position and something else somewhere else. Sometimes a different mark might be chosen for a similar function. This was creatively transformative work.

The sticky-makers similarly remade punctuation for social purposes.

Capitalization was notable by its absence in places where it would normally be expected in formal writing (for example, names and beginnings). This might be partly to do with the speed of composition – pressing the shift key or caps lock slows down the untrained typist. However, the children did use capital letters when it suited them and they did have to press the shift key to make exclamation

marks. Why were they prepared to make the effort in some instances but not in others? It seems to me that there are two interrelated reasons. *Textually*, exclamation marks and capital letters provide emphasis. A form of accentuation, they drew attention. Scarcity of traditional punctuation was also a sign of the informality of the children's *social* exchange. The sentence, crucial to formal writing, was largely redundant in this child-only environment. Exclamation marks carried the affective and attitudinal. They were signs of friendship, friendliness and befriending. In combination with linguistic choice, the semiotic resources of punctuation were made to sustain a particular social culture and its social practices.

- 4) The *spacing* in Kathleen's first email was significant. The effect of varying the number of times she tapped the space bar was bigger gaps in some places than in others. Significantly, within a text interspersed by those larger spacings, there was always consistent single spacing. The visual effect was a framing of particular textual features: a greeting, self-identification and her news. In conjunction with her wording, Kathleen's spacing was significant *textually*. It showed boundaries through separation and framed the criterial visually. This was a means of helping the reader to make sense of the message's composition and the function of its parts.

Any mark on a graphic surface must be placed somewhere. In the case of Kathleen's email and the stickies, the children were obliged to conform to the constraints of the medium in the sense that their texts began from where the cursor was programmed to appear. The linearity of writing resulted in a sequential ordering of words. Hannah, on the other hand, used blank sheets of paper and a biro. This provided the potential for making marks wherever she chose. Yet she did not avail herself of these possibilities. Why not? Hannah selected what she considered to be the most appropriate *layout* for her transcription. She consistently placed role identifiers on one line followed by a colon and the words uttered by the speaker underneath. Like the genres studied in school literacy lessons (for example, stories, poetry or plays) this might be conventionalized but

it was nevertheless her choice. That layout had significance for the meanings she wished to make.

Regarding writing only as linguistic cannot be sustained in a semiotic approach to understanding graphic representation. Whilst language is undeniably foregrounded, the material appearance of writing, how it is organized on the graphic surface and other marks that are added are part of the stuff of meaning. My analysis suggests that children's writing is made and read multimodally, that writing is a multimodal composite. From the semiotic resources available to them, these children selected out the most apt means for making signs according to the particular communicational need. Not all that is available might be used. The potentialities of substance were restrained in Hannah's transcription but she drew heavily on the semiotic potentialities of punctuation. With astounding creativity and apparent ease, Kathleen integrated signs in a seamlessly interwoven but understated whole. The semiotic resources in her first email were combined in such a way that the meanings of one mode interconnected with the meanings of another or others (for example, triple spacing, the words 'this kathleen' without capitalization, a full stop and double spacing). This transformation of writing according to children's own concerns and interests goes beyond the linguistic. In order to understand children's semiosis in different lettered forms more deeply, it seems to me that attention must be given to the full range of signs present in their texts. To disregard signs other than the linguistic as meaningless is to miss the text's 'fullness'.

CHAPTER 6

THE SEMIOTIC RESOURCES OF MULTIMODAL COMPOUNDS

In this chapter I explore what happens when writing and image appear co-presently in children's graphic texts as multimodal compounds. I ask the questions: *what are the semiotic resources of children's multimodal compounds, how do they carry meaning and how do they interrelate?* Language-as-writing, drawing-as-image, presentation (including colour, materiality, size and accentuation), layout (including spacing and positioning) and punctuation (including diagrammatic arrows and lines as well as linguistic punctuation marks) have so far emerged as key semiotic resources in graphic representational design. A question that arises is what happens to writing and image when they appear co-presently. I explore the interrelationships between modes within multimodal compounds by referring back to mind mapping and curriculum science texts explored in Chapter 4, as well as introducing further curriculum work, a child's website and a message created at home.

In the previous two chapters I explored how semiotic resources worked together within writing and drawing separately. Here, the interrelationships between language-as-writing and drawing-as-image as well as the interrelationships between the multimodal composites of writing and image take centre stage. What happens when writing and image are co-present? Do the semiotic resources of multimodal composites perform similar or different functions when they appear in multimodal compounds, how and why? How does functional load shift within and between texts? How do the presentation and layout of writing relate to the presentation and layout of drawing? What implications does this have for 'reading'? The affordances and limitations of different modes and their functional specializations become an important theme. This entails examination of that which is distinct and that which is shared, as well as investigation of how the signs of one mode 'cross-modulate'

(Lemke, 1998, p.92) with the signs of another. These are challenging questions that I can only begin to address in this study.

The semiotic resources of ‘lexis’, presentation and layout in multimodal compounds

‘Lexical’ co-fixing

Following the instruction that drawing should be the primary mode of communication, image carries the principal functional load in Oliver’s ‘Computers in My World’ map (Figure 4.3, p.93). Written labelling is (largely) a secondary and alternative means of identification. Oliver chose to write labels next to his nodes. Each of his subordinates is named with a noun with the exception of ‘surf the net’ which, an apt label for his drawing, moves from identification to action. His bracketed explanation ‘with chip in’ justifies why it is legitimate to include an electric car in the map. The other nodes are apparently self-substantiated. Actually, Oliver’s map would still be meaningful if the labelling were to be removed, or indeed the images. Both work as identifiers. It could therefore be argued that writing and drawing do similar work in his map.

Nevertheless, the functional specializations of writing and drawing allow different signs to be made. This has implications for the meanings that could be made by the maker and the potentialities for the interpreter’s meaning-remaking. Written labels as nouns are specific yet they require the reader to fill them with meaning. How a word conjures up a mindful remaking is dependent on the interpreter’s knowing in relation to the specific context. That which is imagined as the signified of a word-signifier such as ‘remote control car’ or ‘PlayStation’ might be a matter of an internal visualization (a particular toy I am familiar with), a recall of experience (for example, use of this electronic resource), a classification (for example, a type of game – even if I do not know what it looks like or how it is operated), an association (for example, like something seen in an advertisement) or functionality (for example, how a piece of equipment works). Doubtless, there are many others. Image also requires the interpreter to fill the marks on the page with meaning, to apply knowledge and

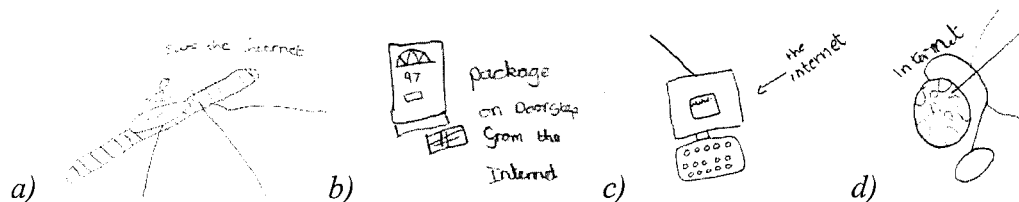
experience, but in a different way. Oliver's remote control car shows a very specific toy. Its sturdy shape, big wheels, pronounced bumper and absence of rear seats suggests that this rugged design is apt for toughness rather than speed. Implicitly it implies challenging manoeuvres, rough terrain and risk of collision. This might be very different from a reader's imagined remote controlled car triggered by words only. There is a sense in which openness is constrained. The 'reader' is positioned by the sign. In supplying what an object looks like, some things are established and further intimations are invited.

Electronic games are an integral part of children's culture but Oliver was making his map for unknown adult researchers. Labels provide nominalization but might be insufficient for some grown-ups to understand what items are and the differences between them. Oliver's expertise comes to the fore as he shows their similarities and differences through drawing in a way that would not be possible with words. Criterial form and criterial attributes depict shape (the overall 'look' of the resource), controls (with intimations of action and ways of operating), extras (such as the card in the Super Nintendo) and functionality (the figures on the gameboy screen suggest action). The drawings in Oliver's mind map enabled him to show what items of technological equipment look like, to foreground specific key features and to hint at their functionality according to the task focus. It is not that only writing 'anchors' (Barthes, 1977, p.40) because drawing does too. Writing and drawing both co-fix meaning but in different ways, the one doing what the other cannot.

In the full class set of mind maps on the topic of 'Computers in My World' there is an interesting phenomenon where references to the Internet carry varying shades of meaning. This is important because it exemplifies key affordances of drawing and writing and how they complement one another in meaning-making. In the context of the mind map, Simone's label 'surf the Internet' (Figure 6.1a – her full mind map is shown in Figure 4.5a, p.97) informs the (perhaps less knowledgeable) 'reader' that the drawing should not be interpreted literally as a windsurfer surfing the waves but as an amusing metaphorical representation of an aspect of 'Computers in My World'. The writing locates the visual pun in relation to the map's theme. This node's focus is

on human agency, what people do online. The image of a parcel left at the front door and labelled 'package on Doorstep from the Internet' (Figure 6.1b) implies opportunities available on the web. It is about purpose – here, shopping and the outcome of an online transaction. The wording supplies information that might be or might not be immediately apparent, namely that the rectangle with the hash-like lines is a parcel and that it is 'from the Internet'. As with Oliver's remote control car, the general becomes particularized: the image shows a particularly shaped package at a particular door with a particular number. Figure 6.1c is taken from Kelly's map (Figure 4.10a, p.112). The 'www.' inscribed inside the monitor is a familiar sign. It represents an entity. The symbol suggests independently existing content (note the prefixing of 'internet' with 'the' in contrast with Figure 6.1d) rather than people accessing or manipulating content. Two children in this class represented the Internet as a globe (Figure 6.1d). The node is here labelled 'Internet' not 'the internet'. Rather than an entity, this might represent the spinning globe which appears when the computer is online or it might carry notions of informational scope or communicational connectivity as world-wide.

Figure 6.1 Representations of the Internet



The drawing and writing together in these four examples represent the Internet in different ways: as human action, its functionality, as an entity and its 'globality'. The word 'Internet' alone would not have done this. Drawing compelled children to show a specific aspect of the Internet. That showing obliged meaning-making in a way that is different from words. It exacted definition. This does not exclude each child's knowing about other characteristics but it signifies the foregrounding of a particular idea at a particular moment in time (Marton and Booth, 1997, p.123). Drawing is a rich source for gaining insights into children's thinking for this very reason. The labels in these mind maps are not redundant. Without them there is a potential hazard

of them being wrongly construed (for example, the package might have been an item of computer equipment and the globe might have implied that technology is located all over the world). Wording orients how the images should be understood. Drawing and writing work together complementarily to co-construct meaning. They co-fix.

On 16 occasions Amy's labels identify the node as a whole, for example 'Fax machine', 'Work files' or 'Primary computer room' (Figure 4.4, p.95). Specifically pointing out what she calls the 'on and off button' of the monitor and the 'Enter button' on the computer keyboard draws attention to features of equipment she apparently especially wished to be noticed. Elsewhere, her writing moves beyond identification. Amy's 'hand held' label is descriptive in that it defines the size of a laptop. 'Finding the time', 'People use the world wide web', 'People use computers' and 'People can E-mail' move to action and functionality (what people do with electronic resources) and 'The E-mail sended' is an outcome of this. In contrast with these generalizations, the content of the email messages ('Hi Mary How are you doing' and 'Hi Amy I'm fine') and the school's website address suggest either her own personal experience or else application of her knowledge to her own experience. Her phrase 'offices need computers' both informs the reader about location and makes an evaluative observation. Thus, whilst Amy's labelling largely performs the function of confirming identification, it moves towards aspects of communication that are well suited to its particular functional specializations. This is not replication. As image and writing work together to co-construct meaning they each take on related but complementary functions.

Nowhere does the writing in Rosie's map (Figure 4.8, p.105) label nodes. She responded to the instruction 'It would help us if you could write two or three words on the lines to help us understand why you think things are linked'. As a consequence, her drawings show who, what and how and her writing explains why. The phrases on each of her six links are evaluative: 'I like learning', 'giving you ideas', 'Being in gridclub is FuN', 'help you to comucicat', 'helps you with your work' and 'Interesting'. These are not conceptual propositions as in Novak and Gowin's (1984) concept maps but they are judgmental observations that link relevant

images. Speech bubbles containing the comments ‘I like learning because gridclub makes it fun’, ‘We are friends’ (twice) and ‘fineshed’ provide information that is not so readily communicated through drawing.

In a central position Rosie drew a head crowned with a glowing light bulb. This is a transformation of the dog image that launches the communication area of the online environment she is representing. Like the ‘integrated’ nodes shown in Figure 4.5 (p.97) this is not a drawing of something that could be seen in actuality. It is a metaphor for Rosie’s perception of the benefits of belonging to the club. To make it apt to her communicational needs, Rosie integrated words within her image. She wrote ‘Bright idea’ inside the light bulb and ‘I’m to [too/so?] full of ideas’ in the outlined brain. Words and drawing each do what they do best and, in doing so, co-construct meaning in a way that would be perhaps more complex and certainly more extended in drawing or writing alone. Drawing-as-representation and writing-as-representation each retain their own meanings. If all the words in Rosie’s map were to be removed it would still have meaning, as would her writing set out as bullet points. However, the interplays between them expanded meaning potentiality. They enabled her to construct a synthesized representation of what children do in the club, how they do it and why. Drawing and writing work together to co-construct meaning in a *semiotic partnership*.

*Functional specialization*⁹

Choice and manipulation of animated images and word art and the programming of moving text differentiate the affordances of the computer from those of paper. Unlike the fixity of the inscribed page, the graphic potentiality of the screen enables the maker to incorporate images that are given particular meaning by their movement and to create writing that is not restricted to one form or one place. At the top centre of Bethany’s home page was a small, unidentifiable shape. Growing outwards, three-dimensional shapes emerged and gradually transformed into capital letters, black

⁹ An earlier draft of this section has been presented at a conference: Mavers, D. (2003) *A Child Online*. British Educational Research Association (BERA) Annual Conference, Edinburgh, UK (September 2003).

outlined and coloured in shades of blue. The letters snaked and coiled, gradually unfolding into the word 'WELCOME'. Whilst there was an occasion when its appearance was made up of standard text in that it was evenly proportioned and spaced, its form constantly changed. At one point the 'O' became foregrounded in size and the remaining letters were stacked behind to form a lozenge shape. This then collapsed and the jumble of letters again twisted and took on new forms. It was an incessant reconfiguration of the visuality of writing.

Underneath, Bethany had programmed '~welcome to my web page~' in plain black text to scroll across the screen from right to left. The '~' embellishments stylized her design and gave it symmetry. Animation of this writing required html programming. In a focus group one child said, 'If you manage to do it right you can put pictures on or moving words that go through the screen then disappear and then they come back on again.' To achieve this affect, Bethany would have had to program '<MARQUEE>~welcome to my web page~'. The 'look' of the text was clearly of sufficient importance to warrant the challenge of how, where and why to program inverted commas, greater than and lesser than symbols, capital letters and most probably a new spelling. Why was this so important? It seems to be about distinctiveness. Moving written text has salience. It draws the eye. Bethany's intentionality was apparently to attract the reader's attention. The interwoven semantics and semiotics of the transforming 'WELCOME' and the scrolling '~welcome to my web page~' worked combinationally. As a first contact with visitors to her page they co-constructed the meanings she wished to make. Socially oriented towards others in the community they were salient signs of greeting and friendship. Perhaps they were also signs whose 'lexical' and visual attraction was intended to entice visitors to explore her pages further.

The image-based section of Bethany's home page dominated in size. Centrally positioned was a relatively large, animated fairy identical to those she had also wallpapered as a desktop background. Equidistant to either side of the fairy and significantly smaller were two digital photographs of Claire, the one to the left labelled 'my friend' and the one to the right 'my best friend'. Underneath and in a

central position was a relatively large video clip of a windsurfer, the blue of the sea working as a colour theme across the page (a mode?). Below and centrally aligned was a cartoon figure clasping a bunch of blue flowers, its face (approximately 75% of the image) displaying a broad smile. Animated, the figure jumped up and down. Image predominated. Absence of any written labelling of or explanation for the images was significant. The visitor had to make meaning of them as a collection. Bethany's chosen pictures were a sharing of things precious to her: maybe fantasy, magic or delicacy through the fairy, friendship in her digital photographs of Claire, possibly action and adventure in the windsurfer, and friendly contact with others in the cartoon character. The images were therefore to do with identity, that is how Bethany wished herself to be perceived by visitors to her page. She appropriated images and word art and remade their meaning through the ways she combined them to construct a coherent text-level meaning – the synthesized home page.

The upper and lower sections of Bethany's page were word-based. Beneath her welcome signs, and to the left of the screen, Bethany had created three hyperlinks: 'Quizzzzz', 'Do you like my website?' and 'onClick>alert'<{Oh! You!}>'. As with the 'Christmascoming' email subject caption (Chapter 5, pp.128-129) these snappy titles seem to have been designed to entice her visitors. Herein lies the cleverness of her spelling of the former and the word choice, exclamation marks and embellishments of the latter. Distinctiveness attracts. A link to a 30-word article entitled 'My Best Friend' appeared at the foot of the page. Here, Bethany wrote about her best friend Claire, giving her age and birthday and stating that she is 25 days older than her, facts appropriate to words rather than image. Her more extended written text was not immediately visible, unlike her images. The visitor could choose whether or not to pursue additional linguistic information which, on the basis of knowing about modal affordance, was likely to hold what the images did not.

Another of Bethany's web pages entitled 'faces' focused on her favourite football star. It consisted almost entirely of downloaded digital photographs. The page was headed with a curved, thin line of coloured balls cascading downwards. Subtly animated, single balls rolled from side to side, bounced or made circular movements.

Below and to the top left was a line drawing of the footballer encircled by a red frame which rather resembled a road sign. To its right was a head and shoulders photograph of the star wearing a hat and to the right of this a smaller head-only image of him wearing glasses. Underneath and positioned to the left, the largest image on the page depicted the footballer in action on the pitch (full length, frontal, jogging) and, separated by a large area of white space in the centre of the page, a photograph to the right showed him in a different strip standing to attention. Below and centred one above the other were two images of the star with his children, above an animated line drawing of a three-dimensional spinning heart. The images seem to capture different facets of the star's life (his job as a footballer – foregrounded in being the largest image, his leisure time, with his family), to represent different sides to his character (smiling, serious, proud, determined, protective) and to show different appearances (football kit, leisurewear, glasses). The heart was symbolic of Bethany's response to these features. Apparently self-explanatory, none of the images were labelled. Bethany appears to have considered them sufficient in themselves to establish the meanings she wished to make. At the foot of the page a link to an article Bethany had written about the star was entitled 'All about X'. This gave the latest news about the player's role in his league and national team, injury details and news about his personal life. Again, Bethany made the modes of image, writing, presentation and layout work for her, each doing what it does best. She exploited the potentialities of modal capacities.

The opportunity to choose animated images and words from existing banks of online resources, and to experiment with and amend their size and positioning, along with the programming of moving text, differentiate the affordances of the computer from the potentialities of the page. Screen-based texts have the capacity for moving away from the static to something else. Unlike the fixity of the inscribed page, the electronic medium enables the maker to produce writing that is not restricted to one place and images that are given new meanings by how they move. From what children said in focus groups, moving text and image are linked with fun, humour, motivation and engagement. The actional attracts attention and interest. The way in which Bethany designed her web pages anticipated 'reading'. On the one hand, her

design implied preferred 'reading' paths. Positioned at the top of her home page, the transforming 'welcome' sign and the scrolling '~welcome to my web page~' text drew the eye in an intended direction. On the other hand, open 'reading' paths were a feature of her page design. The spatiality of the screen enabled certain textual items to be seen simultaneously. This gave the 'reader' the freedom to make decisions about which features to attend to more closely and in which order to 'read'.

For me, Bethany's animated 'WELCOME' sign is a metaphor for online representational design. Its construction / deconstruction in a sense embodies what Bethany was doing in her making and remaking of writing and image. In her choice, shaping and combining she transformed semiotic resources, according to her particular representational needs. This is very different from making texts in the classroom for curriculum purposes. In this child-only electronic environment image-only screens and remaking writing (for example, 'Quizzzzz' and 'onClick'alert'<{Oh! You!}>') were legitimate and perhaps expected. Graphic texts cannot be divorced from the purposes for which they are made. The objective and the audience shape the sign. Leisure-related, Bethany's three web pages were themed collections. They shared what was important to her and implicitly represented aspects of her online persona in this virtual environment. Her images and words were selected specifically for a peer audience. In this children's environment, meaning was constructed, exchanged and interpreted within a particular social context and in accordance with particular social practices.

Like the web pages made by other members of the club, Bethany had uploaded no drawings or electronically painted pictures of her own. Her pages consisted entirely of ready-made images imported from other sites and a digital camera. This is important. Drawing seems to be the premise of the page or other facets of computer activity. Web pages are a site for choosing, transferring and placing existing images. An affordance of the online environment and its resources is that, granted skilled capability, this can be done relatively quickly and easily. The meaningfulness of Bethany's web pages was in the images she chose, their size and where she chose to place them. In the curriculum and mind map drawings (Chapter 4) meaning was

communicated through how children constructed the criterial form and attributes of their drawings, how they presented them and how they positioned them on the page. Drawings have to be made from scratch, mark by mark. Herein lies a broad distinction between screen-based images and page-based drawings. Sign-making as selecting, presenting and arranging ready-made images, and sign-making as composing from scratch are both transformations. Both take time, thought and effort. Each has a very specific purpose. Searching for and manipulating ready-made images and composing drawings are very different kinds of meaning-making – but they both make meaning.

In my analysis of the video of Bethany ‘reading’ her web pages I discovered that the speed of her scrolling, the duration of time periods for which different elements of the text were displayed, the positioning and movement of the cursor, along with her head position and eye movement were significant. These ‘attendance indicators’ suggested different ‘reading’ strategies motivated by Bethany’s interests at that particular moment in time. *High speed scrolling* implied disregarding that which was currently not needed or not relevant. The rate at which Bethany scrolled past the images she had placed and the content she had written on her ‘welcome’ page – a fraction of a second, so quick as to be immeasurable with a stopwatch – showed that this was not the immediate focus of her attention. Almost certainly, this was dependent on that which was seen being that which was expected. A more *leisurely scrolling* suggested scanning for change or for something of particular interest. Bethany scrolled less rapidly (approximately 1.5 seconds) down the 27 sticky messages that had previously been sent to her by other children. A *measured scrolling* speed implied more detailed attendance. Bethany spent 11 seconds looking down a page she had entitled ‘notes’ at a fairly regular rate. This page consisted of eight postcard-like texts in a vertical alignment and of a roughly even size. Each combined background colours and effects, image and between two and 19 words in different configurations with a focus on relationships (for example, ‘The only way to have a friend is to be one’).

Pausing was evidence of more sustained and intensive attention. In some instances, this was relatively brief. Frame-by-frame viewing of the video recording showed

Bethany's head orientation and her line of vision as she paused to read two sticky messages for just under one second each. Precisely what she attended to is unclear. Stickies comprise a main message in a plain black font, the name of the sender presented as a hyperlink (blue, underlined lettering), date / time details at the bottom and various icons along the top. Bearing in mind the duration of her attention, it seems likely that this was a selective reading, presumably the message and the identity of the messenger. In contrast, the capitalized message 'THANKS FOR STICKY' was the focus of the girls' attention for about six seconds in total. The most recent message, sent at 5:12 in the evening four days previously, it may have been newly received and therefore of particular interest. On another occasion the girls' concentrated looking for over four seconds at the hyperlink text 'Make a smilie' suggested a moment of decision-making. Bethany actually chose not to pursue this link. She did, however, click on a link 'All About X' (her favourite footballer). Her head position and movement and the consistently steady, linear left / right motion of the arrow on the screen indicated that, over a 13-second period, she read the entire text from beginning to end. Pausing following high speed scrolling signalled more sustained attendance as a consequence of Bethany's immediate interest. She stopped to peruse or re-examine the known and to investigate the appearance of the new.

Overall, Bethany's six minutes seems to have been a review, a checking of what was familiar and an inspection for anything new or untoward. She passed through, scanned and overviewed her pages, and examined elements of particular interest more closely. This was not a 'traditional' reading like the linearity of narrative. It was a selective picking out for examination that which was of interest at that particular moment in time. This not only suggests a mix of linear and non-linear ways of 'reading' but also indicates that scanning and closer attention to the text are dependent on the individual's perception of modal affordance. What is implicit in this video clip is how Bethany moved between writing and image. In an online environment, as makers or 'readers', children must make decisions about whether writing or image is likely to carry the information they seek or that interests them. Using culturally and experientially shaped 'possibility thinking' (Craft, 2000, p.3) they make choices about the most probable modal information carrier based on which

source is conventionally most likely to bear what they wish to communicate or find out. This has implications for how multimodal 'reading' and making might be understood.

Just as academics skip between title, abstract, subheading, tables, equations and citations (Lemke, 1998, pp.95-96), expert child 'readers' select features of websites according to their immediate interests (Mavers, 2002). In electronic environments moving information, such as advertising, telephone numbers, website addresses and messages, scrolls across the screen, here one moment and gone the next. Children must respond by making decisions about what is important and therefore where to direct their attention. Web pages invite different points of entry, so that 'reading' becomes ordering according to individual interest (Kress, 2003, pp.137-138).

Electronic environments operate in ways both like and unlike print. Hyperlinks give choice of where to go next and therefore of what comes next. Searching for information within the relatively fixed and confined environments of books where unknown or unseen information remains somewhere materially present even if not immediately visible is a very different experience from the screen. Here, the existence of the unknown or unseen becomes materially present. Navigating websites, like seeking information in electronic encyclopaedias and playing electronic games, is a paradox of certainty and uncertainty. Pursuing links can be predictable or may lead to the unexpected. For web surfers or strategy game players this is not surprising, accustomed as they are to planned strategies being of indeterminate outcome. Children as electronic information explorers learn to be flexible in their navigation routes and to accept uncertainty as an inevitable aspect of their online journeying. Perhaps this is not so very different from print-based information seeking. Children must make decisions about what to pursue. With that choice comes both expectancy and risk.

Shifting functionality

In order to complete curriculum worksheets accurately children must make meaning of their multimodal configurations. Throughout the year and across topic areas, a range of modal combinations was evident in the mathematical worksheets completed by Rachel, Daniel and Katie. The majority of these structured graphic tasks, both teacher-prepared and commercially produced, contained numbers, symbols, words, images, tables, graphs and pictures. Each fresh worksheet held the surprise of new configurations. This provided variety. However, it also required that the children were able to recognize the wide functionality of different kinds of 'lexical' content and to interpret variations in presentation and organization.

To complete the mathematics worksheets successfully the children had to make meaning of the different functions of alphabetical (as well as numerical) writing. This was not only to do with making sense of the purpose of the task but also entailed making decisions about what was or was not important to successful completion of that task. Within the 124 mathematics worksheets in Daniel's folder (some single, some double sided) written words might be titles, subtitles, instructions, questions, notes, comments, labels or explanations. The presentation of writing was sometimes critical to understanding its relevance and importance. Small print might be information for teachers or publisher detail. The children had to realize that this could be ignored. Some words were underlined or enclosed in frames which gave them salience – but the children had to understand why. On 12 occasions in Daniel's mathematics worksheets (approximately 10%), words were presented in speech bubbles. This was often instructional and informed the completer about the aim of the exercise (for example, 'Write 10 kg more' or 'Write these numbers in figures'). Elsewhere, writing in speech bubbles gave procedural advice (for example, 'Use the number track to help you' or 'Watch how the numbers go up in twos!'). On one occasion, a mathematical concept was explained ('It's about 4 cm long. It measures 4 cm to the nearest centimetre'). Addressing the worksheet completer with greetings (for example, 'Hi!') and encouragers (for example, 'Good luck!') gave the worksheets a personal feel. In their reading of the words in speech bubbles, children therefore had to make decisions about their functionality. Writing might tell, explain,

advise or support. Each new worksheet was therefore not only a mathematical exercise but also entailed making meaning of the varied functions of writing in the school-based subject area of mathematics.

Pictures appeared in approximately half of this set of Year 2 mathematics worksheets. They, too, had a number of functions that had to be freshly deciphered in each new sheet and again the children had to make decisions about their situated purpose. Some images in the sample were intrinsic to tasks. For example, calculating the value of coins, telling the time or identifying shapes could only be achieved by looking at representations of money, clock faces and objects. Images were also a resource for applying mathematical knowledge (for example, counting pairs of socks or sweets in jars of ten). Marking and drawing images was a means of demonstrating conceptual understanding (for example, drawing the missing half in symmetry and showing a quarter of the snakes in fraction work) and were to do with mathematical skills such as labelling, sorting, identifying and calculating. Other images illustrated what the task was about, for example action images of children in a worksheet where the activity entailed counting how many skips, hops and written words could be done in one minute. In some instances, images were an attempt to situate mathematical processes in meaningful contexts. For example, the completer was instructed to identify the numbers heard by an 'elephone', a 'technologized' elephant with an aerial on its head, dials on its body, a microphone trunk, a wire-like tail and a digital display with a three digit number in the centre of its body. Elsewhere the children were required to note the weights carried in wheelbarrows. Sometimes the choice of image was more arbitrary but worked as a motivator, for example shading in the same colour the bags with the same 'answer' (for example, '82', '80 + 2' and '8 tens + 2'). On other occasions the images were apparently coincidental to the mathematical theme; they varied the presentation of exercises. For example, three bats with numbers inscribed on their bodies seemingly had nothing to do with an investigation to make as many three-digit numbers as possible but provided an attractive presentation. Finally, like the words in speech bubbles, images could be encouragers or motivators (for example, cartoon-like caterpillars in amusing poses). This huge diversity makes for variety but it also makes interpretative demands.

Modes were presented both discretely (for example, as separate blocks of writing, numbers or images) and in combination. One sheet in the sample tested children's ability to interpret a pictogram. That the graph showed the number of bikes owned in each class was explained in writing. To the right of this text was a rectangular frame in which was written 'æ = 2 bikes'. If not read and understood, successful completion of the worksheet was not possible. The children had to realize that this was not an illustration but vital information.

Furthermore, the positioning of textual constituents in the mathematics worksheets carried meaning. Variations in page layout were numerous. Often, a linear top to bottom and left to right orientation structured a conceptually progressive path. Some worksheets presented 'types' of mathematical problems in blocks. These were distinguished by patterning (for example, a series like '8 + 4 = □') and by presentation as a block surrounded by white space. This layout does not necessarily compel a particular 'reading' path or order of completion and children might enter at any point according to their interests. In my teaching experience I noticed children picking out and completing sums they knew the answers to first. This suggests scanning within and between textual chunks. Whilst conventional presentational devices might guide the 'reader's' attention, the content and order of 'reading' is subject to individual attention and interest.

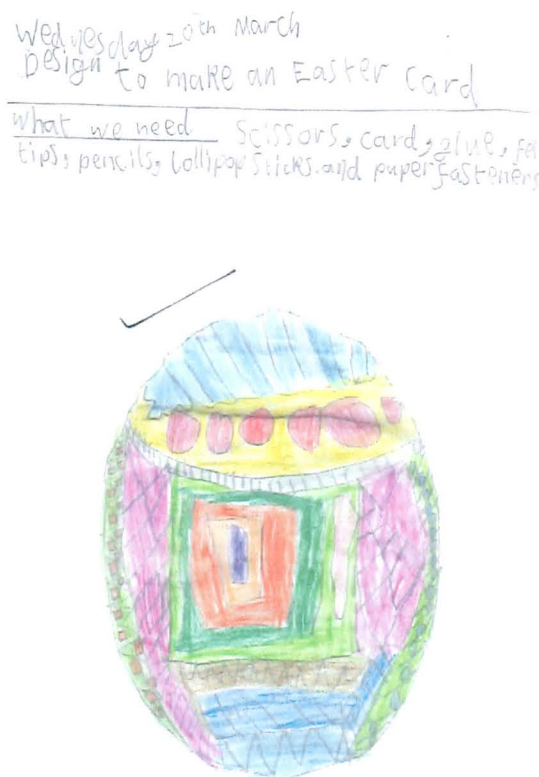
Speed of and sufficiency in worksheet completion is not only about mathematical capability but also an ability to interpret and make judgments about the signs of the representational design of the page. With each new sheet the children had to make sense not only of 'lexical' content (in writing as numbers or words, or image) but also different modal combinations, presentational devices and configurations in the spatial layout of the worksheets. How children made meaning of pre-inscribed graphic marks was critical to how they interpreted, understood and approached activities. This indicates that children's understanding of the purpose of mathematical exercises is not only to do with mathematical concepts but also involves other graphic knowing. They must have knowledge about and understanding of the changing roles of textual

components and the implications of presentation and page layout. Flexibility in interpreting compound multimodal texts is significant in and for children's thinking.

Modal integration

A blank page is a quite different semiotic resource from a worksheet. Clearly, its main distinguishing feature is that it is un-inscribed prior to the child's mark-making. Nevertheless, there are powerful rules that govern children's use of the space of the page. Conventions shape children's generic designs early on. Nursery-aged children shaped the visuality of graphic texts according to whether they were producing a story or a recipe (Kenner, 2000c, p.256, p.259). How the graphic task is prescribed in curriculum work frames how children conceptualize the page, and how they compose and configure meanings in the space of the graphic surface. There may be greater or lesser opportunity for independence and agency.

Figure 6.2 'Design to make an Easter card' (Owen)



As part of his design and technology curriculum work, Owen (a member of Megan's class) composed a graphic account prior to practical work. His 'Design to make an Easter card' (Figure 6.2) is a multimodal compound in that it includes writing and drawing. Owen's text is important for three reasons. Firstly, it gives clues about the functional specializations of inscriptional modes. Secondly, it is a site for analysing how shared and distinct composite modal semiotic resources interrelate in a multimodal compound. Thirdly, it is an example of how the

modes of multimodal compounds construct 'reading' paths.

There is one text but there are several modes and these modes have different functionality according to their specializations. None is dispensable in the semiotic harmony of the page. Image does what writing cannot and writing does what image cannot. The result is a synthesized connectedness where meanings interrelate. Owen's drawing is a preview of what the Easter egg on the card will look like. He shows its shape, assorted colours and intricate partially symmetrical patterning. His language-as-writing consists of three components. The date, shown here as words and an ordinal number, is not conventionally apt to drawing. The title explains the purpose of the graphic text, thereby giving particular meaning to the image; this is a design for an Easter card, not a patterned oval shape and not the card itself. The list of resources needed in the process of production consists of scissors, card, glue, felt tips, pencils, lollipop sticks and fasteners. The ordering of Owen's words may relate to the order of production in the sense that cutting the card precedes decoration and construction. There is no explanation of how the card will be constructed.

Owen's writing is understood in its 'fullness' that is as writing-as-representation. This goes beyond wording to include other semiotic resources. These combine in the multimodal composite of writing. It is unclear whether the line ruled across the page is an underlining of the title or a textual divider. The effect is a separation of the date and title from the writing below. Owen's underlining of the subheading 'what we need' along with a space of approximately two centimetres prior to his inventory marks it as something different from that which succeeds it. Highly pronounced and carefully constructed commas separate the listed items which stretch across the remainder of the 'line' and the entire width of that below.

The semiotic resource of space appears within the multimodal composites of writing and drawing and in their co-presence as a multimodal compound. Within Owen's writing-as-text there is spatial separation between words and lines. His writing constructs a band that all but meets the framing of three sides of the sheet. In contrast, his drawing is centred and occupies an area clearly framed by relatively large areas of white space. This disconnection may imply a separation of the process from the product. The two modal composites are kept separate but the compound shares the

same graphic area. Clustering of the writing shows that it belongs together as a block. The large proportion of space around the drawing provides framing which gives it salience. Spatially co-present, the modes of language-as-writing and drawing-as-image are put into a semiotic relationship.

Owen's writing, clustered at the top of the page, takes up a relatively small proportion of the graphic area (less than 25%). Following a linear (English) 'reading' path, words come first sequentially but size-wise the image predominates. Its attractive, elaborate and multicoloured decoration invites the 'reader' to pause and enjoy the intricacy of his design which must have taken considerable concentration and time to compose. Colour and patterning give it salience, as does its central positioning and framing with white space. This draws the eye. Owen's modal arrangement sets up an inherent tension within the text. Whilst attention might be attracted to the image the writing heads the page. Both are thereby given prominence and there is a sense in which they work against one another visually. There is a vying for attention. Consequently, there is unpredictability in the 'reader's' interest and the order of 'reading'. It could be that a brief overview of the whole or a cursory glance at a specific textual item works as a means of place-holding. Initial interpretations might be kept in peripheral view or mindfully bracketed prior to more intensive examination of particular textual constituents. The 'reader' orients him/herself in what to attend to first according to culturally informed graphic knowing about the relative affordances of writing and drawing.

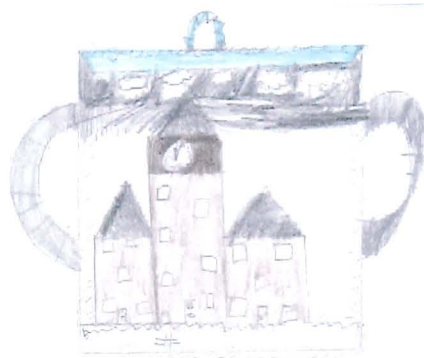
Three months later, as part of another design and technology task, 7-year-old Jessica designed (Figure 6.3a) and then made a bag which was later exhibited in a wall display. Four days afterwards she composed a report (Figure 6.3b). Graphic representers are not generally thought of as designers. Producing a piece of work in response to teacher instruction might be viewed as codified textual construction following existing formulae and set rules. I prefer to see Jessica's written account as agentive design. Design is an imposition of order on the multimodality of representation (Kress, 2003, p.60). In multimodal compounds, that which is to be communicated must be distributed within and across modes. So what does each mode

do within its multimodal composite and as the multimodal composites of writing and drawing interrelate in a multimodal compound?

Figure 6.3 'My Bag' (Jessica)

a) The design

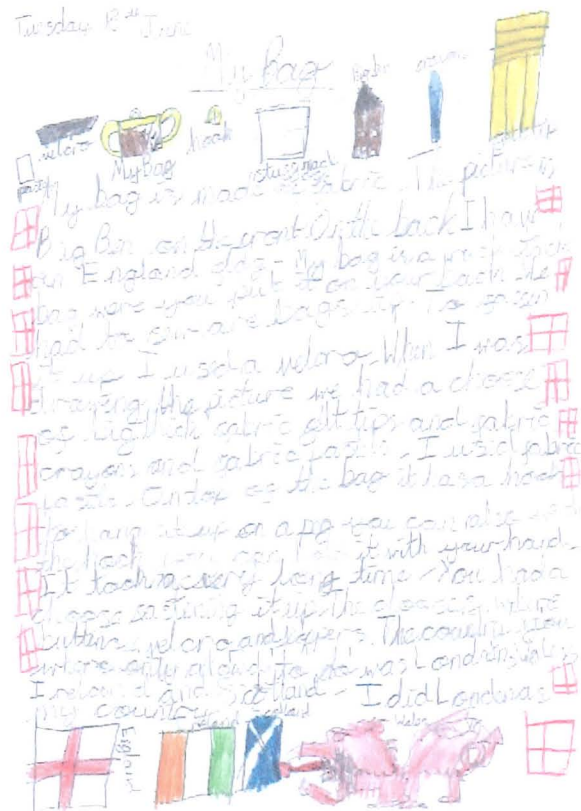
i) The front



ii) The back



b) The report



Jessica's writing is dominant in her 'My Bag' report (Figure 6.3b). It appears as a date, a title, labelling and a continuous account. The date locates the activity just prior to the 2002 summer celebrations for the Queen's Golden Jubilee. Her title is concise and apt. Labelling identifies what her drawings are. Sometimes this prevents uncertainty, such as 'pastels' to name a pencil outlined rectangle or an erased and remade square labelled 'stuff made of'. Elsewhere, Jessica's labels demonstrate her knowledge to her teacher, as in her naming of the flags of the United Kingdom. Her written account which appears as a textual block and takes up the majority of the page performs a number of functions. It reports on the product and the process. Largely descriptive, it also includes two explanations, a judgment and a reference to rules. These do not appear sequentially but are interwoven in her text. Jessica's

writing establishes the bag's type and explains how it is carried ('My bag is a ruck stack bag were you put it on your back [...] On top of the bag it has a hook to hang it up on a peg you can also with the hook you can hold it with your hand'), states the decisions she made ('I did London as my country') and identifies the images that adorn her rucksack ('The picture is Big Ben on the front. On the back I have an England flag'). She provides an inventory of the materials and resources from which her bag was made ('My bag is made of fabric' and 'To fassen it up I used a Velcro') and possible choices ('when I was drawing the picture we had a choose of big thick fabric felt tips and fabric crayons and fabric pastels – I used fabric pastels' and 'You had a choose fastening it up – the chooses where buttons Velcro and poppers'). The account describes the process of production ('We had to sew are bags up') and an evaluative opinion about it ('It took a very long time'). Jessica also mentions class rules ('The country you where only alowd to do was London, Wales, Ireland and Scotland').

Drawings frame Jessica's continuous written account on all four sides. Whereas her writing tells, the criterial form and criterial attributes of her drawings and their colouring show. Between her title and preceding her written account are coloured drawings labelled 'pastel', 'velcro', 'My Bag', 'hook', 'stuff made of', 'crayons' and 'felt tips'. The resources used in the process of production in some cases include the range of possible choices as in her depiction of pastels, crayons and felt tips but in others provide exemplars such as the fabric and blue crayon which invite the 'reader' to imagine others. She also shows her finished bag and her Big Ben motif. Jessica may have deemed more detailed criterial attributes unnecessary here as this was done four days earlier in her bag design (Figure 6.3a). As in Amy's mind map, there was apparently no need to repeat the known which appeared on the preceding pages of her exercise book. Multiple St George's flags adorn each vertical side of the page. This repetition emphasizes her choice of country. Accurate patterning and colouring of the flags of the United Kingdom from which she could choose are featured along the bottom of the page, including a careful drawing of the Welsh dragon.

The presentation of Jessica's writing conforms to the educational domain within which and for which it was produced. Enlarged, title cased, underlined and centred, her title is apt to this genre, as is her account which appears as regular, continuous text. Her punctuation, restricted to the composite mode of writing-as-text, follows the conventions expected in curriculum work. Capital letters always follow full stops (which, incidentally, often appear as dashes rather than dots) and she uses capitals for names (for example, 'Big Ben' and the countries of the United Kingdom) and for the personal pronoun. Her drawings are regularly spaced. Their proximity to her writing may suggest a close interconnection between the modes of language-as-writing and drawing-as-image in her meaning-making. Within one graphic text Jessica brought together different modes, interweaving them in a harmonized synthesis. Her choice of presentation and layout are significant in their very ordinariness. Semiotically apt to a piece of curriculum work, they are signs of the social practices of the classroom.

Just as Jessica selected fabric, velcro and pastels to shape her bag, in her report she selected and shaped graphic semiotic resources. As bag designer Jessica (prospectively) planned the apt, the functional, the structural and the aesthetic (note the details in Figure 6.3a such as stitching, fastenings, supple fabric, image design and choice of colour). She considered specifications for construction, and appropriate tools and materials. The design principles for her report are similar. Jessica attended to function (the text's purpose), the means (which 'bits' were needed – drawing and writing as appropriate modes of representation), the interpersonal (who it was for), structure (how to put parts together in combination), visibility (what it would look like) and medium (consideration of surface, substance and tool). This was framed by external and inherent constraints and affordances (the resources available, the task, educational expectations and the social context), shaped by her own interest and interpretation, and always oriented towards the apt.

Design of a graphic composition is not random or accidental but deliberate and purposeful, and always situatedly responsive. Jessica analysed the particular representational occasion. Based on her understanding of it, she made choices about the most appropriate means of representing particular meanings according to that

which was to be represented, the subject area, the teacher for whom the representation was intended, the representational resources available, and the context. These complexities are extraordinary in their very ordinariness. Children ‘show deliberation, planning, design as a quite normal, expected, and unexceptional state of mind’ (Kress, 1997, p.34).

Design in graphic composition is both material and mindful, visible yet unseen, analysable but elusive. The graphic product is a tangible and semi-permanent source for understanding representational design. It represents the final semiotic settling of the designer. In the composition of the material graphic text, design features as the choice, shaping and combination of semiotic resources deployed according to representational need. The words that are written or the pictures that are drawn and how they are presented and set out in relation to one another are vital clues to the individual’s conceptualization of design. Deletions of marks, as in erased writing evident around Jessica’s title and towards the end of her account, are also signs. Each mark or removal of marks is the outcome of the process of design, representing the final decision of the communicator about fitness for purpose. That which appears graphically may not show all aspects of decision-making that were considered and discarded, for example alternative possibilities for wording or image composition. The material design of the graphic text can only provide clues about the mindful processes of design. The signs made on the page are those things ultimately deemed apt for the particular representational event.

Design apparently consists of decisions made both prior to and in the process of production. The text might bear traces of the complex inner sign-making that led to it, for example ideas that were considered and discarded or decisions that later proved unsuitable. On the other hand, the unified whole of the product may camouflage the drama of internal negotiations, challenges and decisions in the process of design. Text-level choices must be made before getting started. The layout of the ‘Computers in My World’ maps, whether as spider diagrams (Figure 4.10a, p.112), non-hierarchical compositions (Figure 4.10b, p.112) or classificatory structures (Figure 4.4, p.95) would suggest that it was planned before embarking on map-making. This

entailed making decisions about where to start, and possibly such features as size and positioning, in advance. Absence of erasing in the mind maps suggests that the children adhered to their predetermined structuring. Which items were to be included and where were then inserted into this mindfully designed structure. Other decisions were seemingly ongoing. Whilst Rosie generally drew her images first and then added words either within nodes or on links, overall there was a constant switching between writing and drawing as she made the map as a whole (Figure 4.8, p.105). This suggests an ongoing decision-making process as she chose an apt mode for the meanings she wished to make. The process of design was apparently both pre-ordained and continued throughout. As a consequence of making and engaging with the emerging text, the graphic designer evaluates the effect and the effectiveness of signs and modifies what comes next accordingly. To a greater or lesser extent, the process of design is therefore one of constant adjustment. There is some sort of dynamic interaction between internal and external sign-making.

Framing as a semiotic resource

Tabular framing

Graphic representation in science is often compoundly multimodal in that knowledge is reported through alphabetical and numerical writing and image. The ideational is also set out in different formats such as continuous writing, graphs, tables, diagrams and so on. In order to demonstrate their knowledge, children must make sense of the specialized graphic conventions of science. The tables shown in Figure 6.4 were completed without teacher instruction or assistance at a fortnight's interval and glued into the children's science workbooks as part of their topic on light. At a glance these tables look similar. Actually, they are completed and 'read' quite differently. The children had to interpret what the format of different tables might mean and record their scientific knowledge accordingly.

The first of these examples was completed after the children and their teacher together studied a similar chart in a science book. It comprises four columns labelled 'From electricity', 'From batteries', 'From fire' and 'From the sun and the moon'





















The semiotic resources of multimodal compounds

which function as category headings (Figure 6.4a). The table is actually a tabular list. Vertical lines working as framing devices separate each column. Whilst there are similarities between the items selected by Rachel, Daniel and Katie, differences in criterial form and criterial attributes as well as the order in which they are presented show individual transformation as they each made meaning according to their interests and their interpretation of the scientific framing. Rachel completed her table in a vertically oriented order. The spatiality of the page allows the ‘reader’ to enter at any point within the list according to his or her interests.

Figure 6.4 Tables

a) Tabular list (Rachel)




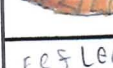

Sources of Light

From electricity	From batteries	From fire	From the sun and the moon
			
			
			
			
			
			
			
			
			
			
			
			
			

Natural or artificial? ✓

The sun and moon are Natural sources of light. Electricity, fire and batteries make artificial light. ✓ Well done.

b) Tabular report (Daniel)

Object	Do you think it is a source of light?	Use the black box and test if it is a source of light.
 torch	Yes	yes
 watch	No	No
 tinsel	yes	No
 card	yes	No
 reflector	yes	No

I found out that shiny objects are not sources of light.

Drawing horizontal as well as vertical lines makes a table into something else. It constructs rows as well as columns and splits the frame into cells. In Figure 6.4b the column labels ‘Object’, ‘Do you think it is a source of light?’ and ‘Use the black box and test if it is a source of light’ were pre-inscribed but the children were required to enter the row labels. As well as itemizing the objects subject to examination (as images and words), the children were required to provide predictions and

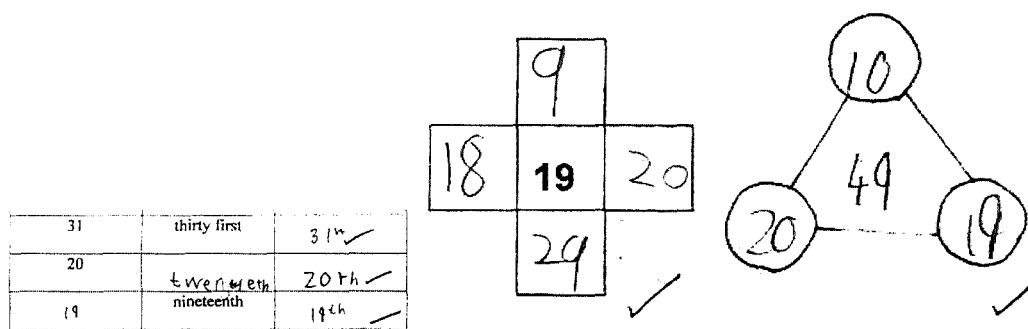
experimental findings. Filling in the table, which the children undertook alone, demanded a systematic approach. None of children completed it randomly. Daniel entered his predictions and data with absolute honesty. His table can be ‘read’ in three different ways. Vertically it is a tabular list where ‘semantically homogeneous’ data are comparable and contrastable (Lemke, 1998, p.99). It shows the range of objects used in the experiment and the spread of yes / no alternatives. Horizontally the table is a narrative: choosing an object, predicting whether it is a light source and noting the experimental outcome. This can only be understood when the entries are interpreted in relation to the column headings. Once memorized and understood these can become conceptual referents. Lemke calls this an ‘implied grammar’ (ibid, p.96) and suggests that there is a recoverable linguistic sentence although mindful remaking of meaning might be only partially linguistically remade. Semantically ‘heterogeneous’, this information is interdependent and combinable (ibid, p.99). Thirdly, it is also possible to ‘dip in’. It is not necessarily intended that this scientific table be read in a specific sequence. This requires the reader to relate the data in the cell to the row and column labelling (the object identifier and either the prediction or outcome). Expert readers are able to do this with ease. The yes / no meanings are therefore dual criterial. The data belong together both vertically and horizontally but in different ways.

Being able to complete these tables required knowledge of the semiosis of lines. These 6-year-olds had to understand the functionality of vertical and horizontal framing and that line configurations bring about different meanings. In these two science activities the children had to know or learn that lines within a tabular structure are a means of textual structuring. The lines of the table both separate off textual constituents and show interrelationships between them. Representing scientific data therefore requires an understanding of how lines can be used as informational structuring devices. Understanding graphic conventions is pivotal for being able to demonstrate subject knowledge. Representing scientific facts requires knowledge of how to use structures that are conventional to the discipline. It is part of the representational ‘habitus’ of being a scientist.

In other subjects of the curriculum lines appeared in different configurations and had functionality both shared with and different from science. In mathematics, numbers might appear in similar tables such as that shown in Figure 6.5a or in structures that look quite different as in Figure 6.5b and 6.5c. These examples demonstrate the flexibility that is required in interpreting the semiosis of lines. Always the framing implies some sort of interrelationship, established either vertically, horizontally or obliquely. The erasing in ‘Adding three numbers’ (Figure 6.5c) is testament to the challenges of the understanding different configurations. Whilst the ‘answer’ might be the same as ‘ $\square + \square = \square$ ’, the alternative layout makes particular interpretative demands with regard to the semiosis of lines. Again, mathematical learning entails understanding variance in graphic representational design (see pp.176-179 above). The child must decipher the situated meaning of relationships constructed through the framing of lines in order to complete the task successfully.

Figure 6.5 Semiosis of line in mathematics (Daniel)

a) Cardinals and ordinals b) Ones and tens c) Adding three numbers

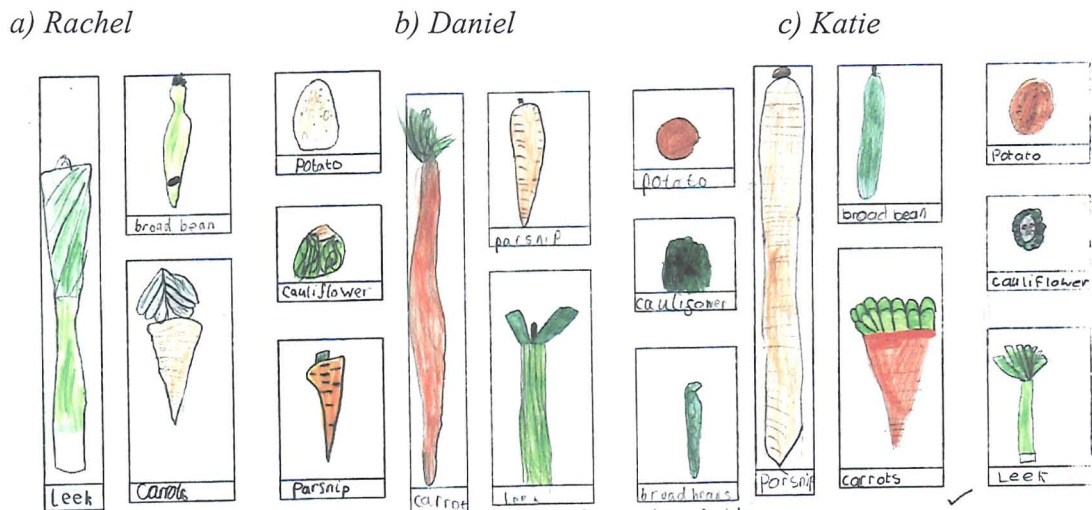


Modal framing

Elsewhere, the framing of lines can have quite different functionality. The worksheet entitled ‘Crops on the Farm’ (Figure 6.6) had six pre-inscribed and originally empty boxes: a tall thin rectangle, three wider rectangles (two of which were virtually identical), and two almost-square shapes of virtually the same size. A partitioned section at the foot of each consistently measured just under one centimetre in height. Pre-inscribed, these framings defined where marks could and could not be made. This structure carries predetermined and embedded modal expectations readily understood

by the children. The frames implicitly but unequivocally specify either writing or drawing. They also suggest a relationship between them.

Figure 6.6 'Crops on the Farm'



The space of the writing frames carries implicit meaning. Firstly, a limited writing space is a sign that this area is not intended for a sentence but rather for labelling. Secondly, the equal height of the one centimetre base partitions contrasts with the varied dimensions of the larger areas above. The completer infers that the images can be dissimilarly sized whereas words must be regularized. Thirdly, the frame division is an indication that the attached written text be cohesively related to the conjoined image.

There was restricted choice in what to draw where. One image was expected in each image space. Without exception the children centred their drawings (Daniel and Rachel also centred their writing). The worksheet also carried expectations about which drawing should be done where. In order to complete the 'Crops on the Farm' worksheet Rachel, Daniel and Katie worked from six 'real' vegetables which they were able to observe and handle: a broad bean, a carrot, a cauliflower, a leek, a parsnip and a potato. The children had to accommodate their perceptual, conceptual and experiential knowing about vegetables to the image spaces provided in the worksheet.

The predetermined framing presupposed three features of prospective image components: shape, size and orientation. The shapes of the frames anticipated drawing so that, to some extent, what could be drawn in each was partially suggested. They predicted the proportional characteristics of the prospective representation. A tall, thin space presupposes a tall, thin vegetable. The almost-square frames suggest the more-rounded, less-elongated shapes of the cauliflower and potato. The children's decisions about where to position each of the vegetables show that they understood this implicit message. The size of the frames may have proved more problematic. The 'real' cauliflower was larger than the potato yet their predetermined locations were the same size. As a result the children may have decided that actually the relative size of the space in this worksheet was immaterial. Any roundish vegetable could go in any squareish space and any tall, thin vegetable could go in any of the rectangular spaces. An outcome is that the tall thin vegetables are differently positioned by each child. What the children appear to have done to represent the 'truth' of their appearance was to retain each vegetable's proportions relative to itself. Lastly, the preset orientation is interesting. Vegetables in the supermarket or the kitchen normally lie on a surface in a horizontal position. We would not normally talk about a *tall* thin vegetable but a *long* thin vegetable. The perpendicularity imposed by the worksheet perhaps suggests their growing orientation as crops on the farm (as in the title) rather than as everyday food for buying, preparing and eating. This marks the images as educational, scientifically oriented representations. On the other hand, where there was choice (in the almost square frames) there is variety in the children's plane of representation. Katie and Daniel showed the cauliflower from a top view whereas Rachel depicted hers from the side.

The signs the children made in completing this worksheet resonate with ideas explored in Chapter 4. Whilst there was restricted choice in what to draw and where, there was scope for agency in how the children depicted the six vegetables. Similarities and differences are signs of the children's individual observations and interests. Daniel seems to have endeavoured to show what the particular carrot looked like (Figure 6.6b). His drawing captures the flowing unevenness of the vegetable and the delicate feathery texture of its leaves (note how his colouring over and beyond the

pencilled lines portray a hazy indistinctness rather like his tinsel representation in Figure 4.2b, p.90). Similar but not identical, those drawn by the girls are more iconic. Katie's triangular profile and rows of upwardly oriented tongue-shaped leaves are almost cartoon-like (Figure 6.6c). Perhaps in recognition of the provision of actual vegetables and educational expectations, Rachel decided to modify her carrot shape (Figure 6.6a). She erased most of her left-hand outline and pencilled over it in an uneven line. Its less uniform appearance, along with lightly inscribed uneven lines to suggest surface aberrations, is a more 'realistic' representation. Even within the tight prescription of a worksheet, these children represented their individual interests within their compositions.

As well as the children's individual observations, interests and interpretations, the images provide traces of their scientific conceptions and their knowledge of the potentialities of drawing. Katie's bean pod is represented as seen – a largely elliptical shape shaded green and with a short stalk at the top. Rachel coloured lightly and loosely inside her irregular outline in pale green and yellow. This implies a sense of partial transparency. Towards the base of the pod she added a darkly coloured brown oval shape to represent a broad bean. Rachel's image is diagrammatic. Rather like his tinsel drawing (Figure 4.2b, p.90), in pencil Daniel drew five bean shapes within his elliptical outline. He then coloured the whole image green with no variation of shading. At first sight, this might appear odd. Why draw the beans so carefully and then colour over them? Intriguingly, what he seems to have done is to cleverly combine the pictorial and the diagrammatic – this is what a broad bean actually looks like but hidden under its green exterior are the beans themselves. In this way, Daniel made a hybrid image that carries both the perceptual and the conceptual, the pictorial and the diagrammatic, that which Georges-Henri Luquet calls 'visual realism' and 'intellectual realism' (see Chapter 2, p.56).

Framing of surface

In the mathematics worksheets, the scientific tables and the crops worksheet, lines worked as framing devices that set up an interrelationship between textual items.

They were a means of framing that showed what belonged together or what should be seen as disconnected. An empty page or screen is devoid of represented framing as pencilled lines. However, an inscriptional surface area is a bounded space framed by its own edges. Whilst that framing might remain fixed, it is also potentially subject to extension, recasting and alteration. Continuation on the reverse of a piece of paper or attaching additional sheets is a means of extending a frame. This is what Hannah did in her interview transcription. Scrolling down the computer screen is a reframing of what can be seen. This is what Bethany did as she ‘read’ her web pages. Adjustments can be made through modification of the graphic frame. Kerry’s crafting of a heart shape was a remaking of frame (Figure 6.7). The question is: why did Kerry cut out the heart shape? Why was a represented frame in the form of a heart inscribed on a rectangular sheet of paper not deemed apt? Cutting out shapes brings them off the page. In this case, it was not just the removal of extraneous space that was significant (see Kress, 1997, pp.24-29) but the particular shaping as a heart. Kerry’s crafting of its flowing contours was crucial to the meanings she wished to communicate.

Figure 6.7 *Kerry’s heart message*



For her very particular purposes, Kerry chose to orient the rectangular sheet in a portrait alignment. This is in itself a sign of her mindful premeditated design. Pencil lines detectable at various points around the periphery (see especially the top curves) suggest that Kerry drew the heart shape prior to cutting it out. The precision of her cutting implies a desire for accuracy. The cardboard arrow is threaded through two parallel slits strengthened with sticky tape. Placed rather than firmly affixed, it has some movement. (Creasing of the paper and a tear repaired with sticky tape are testament to the challenges of such a demanding task.) These were all deliberate design decisions. Specialized by being crafted into a

'thing' with the potential for movement rather than an image on a page, Kerry's heart became a semiotic object rather than a represented textual item. This makes it something very different from Owen's Easter card design (Figure 6.2). The heart shape is itself a sign. It carries conventional and readily recognized meanings, here conveying the affective in an extended family relationship.

The heart shape and the arrow differ in appearance in that the rounded curves of the heart's outline contrast with the straight lines and pointed tip of the arrow. They also differ with regard to materiality. The heart is made out of tractor-feed computer paper. Unrefined, this is flimsier than standard A4 paper. The side Kerry selected as the front is plain and of a creamy white hue. The reverse is printed with pale green lines of approximately one centimetre width edged with a darker green. This contrasts with the sturdiness of the heavy, brown card cut from a discarded cardboard box. These different textures and weights give the object complementary material properties, one relatively fragile and easily torn and the other tough and difficult to cut. This was an important design decision. Kerry might have used only paper. This would have been much easier to deal with but would not have given the final product the same rigidity. The robustness of the finished object makes it into something that can be handled and viewed in a different way from representation on a sheet of paper. Kerry made ordinary, everyday materials into something special to convey the ordinary, everyday affective which is always special.

Kerry then took this shape and used it as the milieu for graphic decoration and words that amplified her 'object message'. Her choice of felt tips, rarely used in school, marks off the personal from the educational. The pink, purple, red, blue, turquoise and green work together harmoniously. Exclusion of black or grey is notable. Extended to the arrow and thereby providing text-level continuity, the darkness of the card gives these colours greater density. Kerry's symmetrical abstract decoration on a vertical plane works with the heart's outline shape. The purple rays and green zigzags carry a sense of energy and intensity of feeling. The words 'I love you' add linguistic force, along with the conventionalized 'xxx' to represent kisses. This is further extended on the reverse by the repeated message 'I love you'. Kerry also drew a heart

in turquoise coloured pencil on the reverse and a barely discernible heart pierced by an arrow in dark green felt tip on the arrowhead. These interplays between shape, pattern, colour and words are a motivated, coherent orchestration of meaning. A similar phenomenon is evident in a 32,000-year-old carved statuette of a mammal from Vogelherd in southern Germany on which is carved an arc of crosses (Leakey, 1981, p.137) and the cult scenes etched on a silver Viking cauldron (Magnusson and Forman, 1976, p.106). My point is not that the representations of ancient peoples are child-like. On the contrary, they represent refined representational cultures. Rather, Kerry's heart sits in a longstanding tradition. For both Kerry and the ancient peoples, the crafting of the object works with the application of symbolic marks, the one intensifying the meanings of the other.

What implications does medium have for a theory of multimodality? Owen's text (Figure 6.2) was produced in a school exercise book made up of blank white A4 pages. Reshaping of the outline frame was not an option because it was not apt to the immediate task in hand. (Incidentally, Megan did adjust the potentialities of the A4 page in her exercise book by turning it to a landscape orientation for her picture of 'The Story of Pentecost' in Figure 4.12a, p.116). Herein lies a fundamental difference between the Owen's Easter card design and Kerry's heart message. Owen made signs *on* the inscriptional surface. The page was the receiver of his mark-making. Medium is a *sign receiver* and a *sign carrier*. In contrast, Kerry chose and shaped junk materials to make her heart. She made signs *with* them as well as *on* them. Her choice of which resources to use for which constituent was shaped by her technological knowing about their contrasting material properties and therefore how they might be used effectively. However, her choice was also made to suit her representational design purposes. It made possible certain semiotic affordances. She agentively shaped the materials according to their properties and the communicative meanings she wished to make. This was a transformation of the original framed boundaries of the paper and card into new framings. Kerry also amplified and particularized the meanings she wished to make through mark-making on the heart object. There is therefore some sort of double articulation in the heart message. On the one hand, the heart and arrow are object signifiers that, with their affective meanings, make a sign.

Yet the card and computer paper are also a medium for inscription. They carry Kerry's graphic sign-making. This suggests an inherent ambiguity where surface (and substance) can simultaneously be medium and materiality. For analytical purposes this is a crucial distinction. In practice it is about effective meaning-making.

Discussion

Sign-making is always some sort of semiotic compromise. It can only be a partial expression of an individual's ideas, beliefs, thoughts and feelings. The meaning-maker strives to make the most effective possible signs with the resources at his or her disposal and yet is constrained because, despite the robustness of shared meaning (the 'social mind'), there is a constant endeavour to communicate particular, situated meanings effectively. Sign-making is an internally negotiated, culturally informed settling on what is perceived as apt. There is a sense in which semiosis is always simultaneously meaning-rich yet partial.

A key feature emerging from my study of multimodal composites and compounds is a concurrency of partiality and fullness. The affordances of writing and drawing include their particular functional specializations but also their limitations. They each do certain things well, other things less well and some things not at all well. Each can play only a partial role in the full spectrum of graphic representational possibilities. On the other hand, each graphic text is an example of represented 'fullness'. All that the text represents is the final semiotic settling of the sign-maker on what is deemed apt. Whilst the entirety of the representational event encompasses the preparation and lead-up, graphic making and each 're-reading', the product itself holds its own represented 'fullness' in a multiplicity of signs. I do not lay claim to discovery of that 'fullness', but I do endeavour to push at the boundaries of understanding how children make meaning with a range of semiotic resources.

- 1) I take the position that it is when different composite modes are co-present that *compound multimodality* comes into being. Locating together linguistic and image-based textual constituents in the shared space of the graphic surface puts

them into a relationship with one another. This interrelationship between composite modes within the same graphic text expands meaning potential not only in the sense that each is able to do what it does best according to its functional specialization but also in the interplay of meaning between them. This opens up a world of meaning. Writing and image work together complementarily in compound multimodal texts (also see Lewis, 2001) according to their functional specializations. There is a joint construction of meaning where interacting signs interrelate to create a more or less coherent and cohesive whole. Modes interweave in a complex orchestration of multimodal semiosis, something akin to Lemke's (1998, p.92) notion of 'multiplying' meaning. This does not happen according to a set formula. Functional load shifts from text to text. The product of multimodal organization is an interaction between the signs of the same and different semiotic modes working together more or less successfully in a more or less synthesized whole.

- 2) *Organization* is an imposition of order apparent at different levels of text. Organization happens as part of the processes of modal choice and shaping. The sign-maker must decide in which mode particular meanings will be realized and must mindfully organize whether that which is to be communicated will appear as writing, drawing, presentation, layout or punctuation. Signs must then shaped and organized within the mode. In the linearity of writing, this entails making decisions about what goes together, what came before and what will come next linguistically as word ordering, clause, sentence and paragraph. In layout, children must decide which textual items will be positioned where. Modal choice entails recall, analysis and transformation of the modal signifiers available within the individual's repertoire of semiotic resources.
- 3) Prior to inscription, a blank, unlined page is unstructured. The making of a graphic mark anywhere on a sheet of paper is the beginning of *layout*. Whilst there are tight cultural regulations on how written texts are set out within particular genres (for example, poetry as against prose or a report compared with a letter), less stringent rules about how compound multimodal texts might be

arranged allow the potential for innumerable designs. Electronic resources for making web pages expect layout as a fundamental feature of what they are. Text boxes must be made before writing can be entered and they are readily repositioned, as are imported images. This is different from email or sticky messages where written text appears automatically at the top left of the graphic frame. Web design carries a presupposition of variations in layout as a fundamental semiotic resource.

- 4) The semiotic resources of mode and medium are bound closely together in graphic sign-making but they can be separated for analytical purposes. The semiotic resources of mode are materially articulated whereas medium is materiality carrying or carrying the potential for symbolic realization. The marks made through the medium of the pencil become the material signifiers that are connected with signifieds to make signs. Mode and medium are therefore inevitably and complexly interrelated. They are separate, yet neither can exist without the other. What can be represented is dependent on medium. Choice of medium can have consequences for which modes become available. The modes of writing and drawing are shared across the page and the screen but the medium changes how things can be done (such as making spaces), and sometimes also what can be done (for example, enlarging of existing textual items). Other modes are medium-specific. Automatically moving image and animated writing are only available electronically. Medium therefore changes what graphic texts are and what they can do. Recognizing the different potentialities and limitations of paper and the computer entails analysis of their individual and relative affordances.

Mode is significant for what can be communicated. Language-as-writing and drawing-as-image do different and complementary work. It is not that one is superior to the other but that each offers different potentialities for sign-making. Together, they co-construct meaning. Neither is peripheral, neither can be discounted in the children's representation of their knowledge. However, semiotic resources go beyond these. Space is a resource shared between composite and compound modes and the layout of textual items within the space of the graphic surface puts language-as-

writing and drawing-as-image into a relationship with one another. This is significant for meaning.

Historically, experiences of new technologies are forming new perceptions of what can be done graphically. They are also changing representational practices. Bethany's web pages imply deep-seated distinctions between children's graphic texts in their own communities of practice and 'traditional' literacy in the formal writing of school. This suggests 'an enormous fund of specialized knowledge' (Smith, 1984, p.1). Children have always been able to make signs with a range of semiotic resources but the emergence and widespread appropriation of new technologies are extending their range and scope. How the expanding potentialities of graphic resources brought about by recent technological developments are being appropriated and remade suggests that children are highly adept at making and 'reading' a range of diverse texts for different purposes in both formal and informal settings. Just as skilful orality in adult story-telling does not detract from high level literacy capability (Tannen, 1982) experimentation with different compositions is an enrichment rather than a detraction from traditional, formal literacy. Image-only web pages and remaking writing in stickies are not detrimental to other forms of graphic representation but 'can genuinely expand existing repertoires' (Moss, 2001, p.110). The expanding representational opportunities of a range of graphic experiences shape expanding multimodal dispositions.

CHAPTER 7

IMPLICATIONS

So, how can children's graphic representation be understood as multimodal design? In my final chapter I draw out key implications from the detail of my analysis. Firstly, in returning to my research question, I identify what I have found to constitute the *semiotic resources* of modes of graphic representation, how they carry meaning and how they interrelate. Shared and different form and functionality are phenomena that have pervaded my thinking throughout. Picking up this theme raised in my introduction and running through my analysis, I discuss the particular specializations of writing and drawing and their partiality, and shared and particularized modes evident in graphic texts irrespective of whether they are drawing or writing. New hypotheses for theory are interwoven into this discussion. Secondly, in the light of my interpretation, I consider implications for multimodal theory more generally. Going beyond the graphic, I hypothesize that *semiotic principles* across modes of communication might operate at a deeper level of semiosis. This implies the notion of multimodal dispositions. These ideas are by no means dogmatic statements of or claims to 'truth' but are rather a contribution to the field for further discussion. Finally, on the basis of what children are doing representationally in an ever-expanding graphic world, I suggest that reconceptualizing graphic representation as multimodal design has pedagogical and research implications.

Implications for graphic representation as multimodal design

Understanding children's graphic representation as multimodal design has been by no means straightforward. Fundamental issues in multimodal theory remain unsettled. What is mode and what is multimode? Are all graphic texts multimodal or just some? The children drew on separate semiotic resources to make signs in their writing and drawing but did they draw on different modes? An essential question is whether presentation (as colour, animation, 'style' and materiality), layout and punctuation

can be thought of as separate modes or whether they are part of the independent, self-contained modes of writing and drawing. Having proceeded with the notion of multimodal composites and multimodal compounds in my analysis, at this concluding stage of my study I briefly pause to reflect on whether this was prudent and whether it is justifiable. In endeavouring to find a secure position on this question I returned again and again to the children's texts. Their representational practices are the 'stuff' that give rise to the development of theory. The children constructed what graphic representation was as they transformed it in their everyday social practices, their 'textual habitat' (Unsworth, 2001, p.7). The theory must fit the evidence. Nevertheless, the move from interpretation and analysis to theory – that which I thought of as a 'theoretical leap' – was not without considerable deliberation and lingering uncertainty.

Layout was a crucial semiotic resource in the 'Computers in My World' mind maps because it did what individual drawings alone could not. As a separate resource from a 'stripped' notion of drawing and one that could put images into a relationship with one another to convey her classifying conceptualization, for Amy, this appears to have been a distinct mode. The presentational features of size recurred in the maps. Enlarged superordinates (which a number of children described as 'the main thing') gave central computer images a title role. Hannah remade punctuation for the specific requirements of her transcription and for the sticky messengers punctuation was one way in which they sustained the social practices of their online environment as distinct from curriculum writing. Whilst intimately interrelated, the implication is a distinction between language-as-writing and drawing-as-image from the semiotic resources of presentation, layout and punctuation. Within the children's texts, the latter also had different functionality from wording or individual images. Presentational features, layout and punctuation were made to carry meanings that words and the lines of drawings could not (or did not) and they enabled meanings to be made in ways that would not be possible, or perhaps not so easy, without them. There were also regularities in how meaning was made with them. If these regularities can constitute modes, then they worked as independent modes.

So what about less explicit instantiations? Was layout a mode for Kathleen (Figure 5.1, p.127)? Taking into account Kress and van Leeuwen's suggestion that the same text can be modal for one person and multimodal for another (Chapter 2, pp.45-46) it is feasible that Kathleen considered her email to be 'just writing' whereas my analysis as a semiotician sees it as a multimodal composite. From an analytical point of view, thinking of writing as multimodal is a way of broadening out how it is understood beyond the linguistic. Reconceptualizing writing and drawing as multimodal composites also opens up possibilities for understanding how they are different and that which they share. Difference and commonality are key themes as I next explore what the modes of graphic representation might be, how they make meaning and how they interrelate.

That which is different

Drawing and writing look different and they do different things. What precisely are the forms and functions of drawing and writing that make them different? Actually, this apparently straightforward question proves remarkably challenging and I do not claim to have any definitive 'answers'. What follows merely scratches the surface. Drawing-as-image and language-as-writing are distinct modes of representation. Each has mode-specific 'lexis'. That 'lexis' is essentially different. Words are made up of groupings of letters and there are fairly definite rules about how both letters and words can be combined. Written words are culturally developed signifier-resources which are abstracted in such a way that certain marks stand for something else. The range of signifieds which might be combined with signifiers is always infinite because of the situatedness of sign-making. Nevertheless, the difference between signifiers (difference was an important theoretical observation in Saussure's work) historically locates their potential meanings in a largely bounded, but never fixed or finite, semiotic ball-court. 'Badge' locates broad meaning within different semiotic parameters from 'bag' (Chapter 5, pp.130-133).

All signifiers must be filled with meaning in the process of sign-making and sign re-making. Kress (2003, p.38) argues that words as sounds or as marks on a page must

be 'filled with content'. Of course, drawing signifiers must also be filled with meaning but they are essentially different from words. Like writing, image is an abstraction but, unlike writing, it can construct visual equivalence. In transforming three-dimensional objects into marks on a graphic surface, the lines of drawing enabled the classroom scientists to show the criterial form of tinsel (Figure 4.1, p.89) and the map-makers to show the criterial attributes of items of electronic games equipment (Figure 4.3, p.93 and Figure 4.4, p.95). This gave visual detail which guided sign-remaking on a fairly definite trajectory.

Drawing is powerful where it depicts people, places and events but less effective in other circumstances. 'Pippa Crowson is online' and 'cool site' (Chapter 5, p.139) were apt to writing not drawing. Different aspects of knowing were communicated through different modes as each undertook different representational work. It is not that the 'lexis' of writing or drawing is superior or inferior, that one holds a greater propensity for 'truth' than the other, but that each is different in that it offers semiotic resources that can carry particular signifieds.

That either language-as-writing or drawing-as-image alone is sufficient to carry definitive fullness of meaning is a fallacy. The lexicogrammar of writing is unquestionably a highly developed and refined representational resource. Its dominance in the representational repertoire is perhaps justified. However, in a situation where the communicator wished to show what someone or something looked like in actuality (for example, a new baby) or diagrammatically (for example, the workings of the internal combustion engine) it would be inadequate. Each mode is *partial*. It enables particular things to be communicated in particular ways but it is only one component of the full repertoire of graphic representation. Whilst certain modes are an effective means of communicating certain meanings, any one single mode is insufficient to capture the full range of that which might be represented graphically. There are always gains and losses.

It is not necessarily that words and drawing are not able to share the functionality of that which is represented but that they do it in different ways. Both provide scope for

identification, description, analysis, explanation, comparison, persuasion or argumentation but, realized differently, their semiotic resources enable different information to be represented. The mind map images and labels both identified; the former depicted and the latter named. It was not a case of replication. Showing and telling worked together to co-construct meaning (see, for example, Figure 4.1, p.89, Figure 6.2, p.179, Figure 6.3, p.182 and Figure 6.4b, p.187). Bethany's web page collections of images were one means of displaying and sharing identity but writing was another (Chapter 6, pp.169-170).

A consequence of any representational graphic design is that certain semiotic resources are made to perform certain functions. Sometimes one mode clearly carries the greater functional load, as in the images rather than the labelling of the 'Computers in My World' mind maps (Figure 4.3, p.93 and Figure 4.4, p.95). Sometimes there is a vying for attention as in Owen's Easter card design (Figure 6.2, p.179). Functional load shifts from text to text. How and why particular signs are made with particular modal 'lexis' is always situated. Whilst drawing-as-image or language-as-writing might be foregrounded in certain texts, in a more general conceptualization of graphic representation it is not a matter of modal superiority or dominance but of difference and aptness, and consequently of choice, shaping and combination according to need.

Linearity is entirely absent from pictures. Whilst a left to right 'reading' directionality might be preferred in Megan's 'Story of Pentecost' picture (Figure 4.12a, p.116) and a 'reading' path from the more to the less detailed in Abigail's picture of an email exchange event (Figure 4.7, p.103), the order of 'reading' is largely subject to the interest of the 'reader'. Continuous text such as written narrative is more insistently linear than drawing. The sequential ordering of words strongly positions the reader. It imposes certain meanings (Halliday, 1994) and is oriented towards causality (Kress, 2003, pp.3-4, p.57). This sequentiality is a significant difference from pictorial drawing. Nevertheless, writing is not definitively linear. The spatiality of writing means that it can be read both in a linear and a non-linear way. The reader has the freedom to dip in and out according to his or her interest because the graphic marks

of writing appear simultaneously. The spatiality of the page or screen enables the reader to enter and leave according to his or her own interest. S/he can choose to read sections in any order but within those sections chunks of writing are expected to be read sequentially. Any deviation from the linearity of the whole is a deliberate remaking different from the writer's intentionality.

Other aspects of linearity / non-linearity go beyond 'lexis' to the modal properties of multimodal composites (and compounds). One reason why the image-based mind maps proved to be such a powerful genre for representing how children thought about 'Computers in My World' was their diagrammatic format. These provided traces of how children were thinking about items in relation to the task focus. Presentation and spatial arrangement gave the map-makers scope for showing interrelationships between images. Groupings, juxtaposition and distance, along with presentational resources such as equal or dissimilar size, enabled the children to show classifications (Figures 4.3, p.93 and Figure 4.4, p.95) and relative personal importance (Figure 4.10b, p.112). This non-linearity was tempered by the linearity of links which guided the order of 'reading' to a greater or lesser extent. In websites and information texts (Chapter 6, pp.168-175) the reader is expected to move between discrete blocks of written text according to his or her interest. This is a characteristic of layout.

That which is shared

Being *graphic* is what is shared between writing and image. They both comprise signs on a surface. This allows them to be brought together, to co-exist, to interrelate and to co-function. That which essentially unifies writing and image is their spatiality. This distinguishes graphic modes from temporal modes. Speech is time-based. As only one word can be articulated by any one individual at any one time, that which is spoken must be sequentially ordered. Extended to face-to-face communication, gesture and movement happen in space but are also governed by time. Writing and image, on the other hand, are spatial. Semi-permanent, textual items appear simultaneously as marks on a graphic surface. Temporality comes into play as a graphic text is made (produced) or remade ('read'). The order in which the

'reader' 'reads' happens in time. That which is attended to first is dependent on how the text has been composed (for example, accentuation or positioning), what the 'lexis' is (wording or image constitution) and the interests of the 'reader'. The spatiality of graphic representation as against the temporality of speech and other features of face-to-face communication have implications for how signs are perceived and interpreted.

Beyond language-as-writing and drawing-as-image, my analysis suggests that other graphic representational resources (modes) contribute to meaning in not insignificant ways. Some of these semiotic resources are common to both writing and drawing whereas others are writing- or drawing-specific. As they work within and across these multimodal composites, sometimes they have identical form and sometimes they have different and particularized expressions. I examine this hypothesis by considering in turn the representational modes of presentation, layout and punctuation as *common and particularized modes across graphic representation*.

a) Presentation

For analytical purposes, the semiotic resources of presentation and those of language-as-writing or drawing-as-image can be disarticulated. Bethany's scrolling words '~welcome to my web page~' (Chapter 6, p.169) would remain even if the animation were to be removed. The words and the movement fulfilled different functions: as ideational content and textual salience respectively. For analytical purposes, presentational features can be disarticulated from one another as well as from 'lexis'. Megan's representation of the Holy Spirit was made up of the 'lexis' of overlaid circular strokes (criterial form), but also colour and materiality (Figure 4.12a, p.116). Each signifier carried a different signified: line its wind-like nature, colour its fire-like nature and substance its ethereality. These were integrated to co-construct meaning.

How presentation might be conceptualized has proved challenging. Is presentation a mode or would it be more apt think about presentational modes? If there are different presentational modes, what are their semiotic resources and what are their functions?

On the basis of my analysis, I would like to suggest that it might be preferable to conceptualize colour, materiality, 'style' and animation as modes in their own right. This enables the inquirer to think about their semiotic resources as belonging together as distinct 'families'.

Kress and van Leeuwen (2002) argue that *colour* is a mode. They define its semiotic resources as value, saturation, purity, modulation, differentiation and hue (ibid, pp.355-358). These differences may be clear to specialists but may be less apparent to the non-specialist. Nevertheless, the examples in this study show children making choices between hues, shades and intensity for very particular purposes. Daniel's grey and yellow 'scribble' showed the sun's light reflecting on the moon's rocky surface (Figure 4.11c, p.114). The shared colouring of the Holy Spirit, Jesus and God (Figure 4.12a, p.116) was a way of showing a complex theological idea that the lines of drawing could not. This would imply that presentation is 'grammatical' (if 'grammar' is a fundamental characteristic of mode as Kress and van Leeuwen suggest) because it is operationalized interrelationally within individual representations and across the full text. My own recent research into 6-year-old children making computer animations shows how they attended to directionality, speed, regularity, sequence and effects. These seem to be some of the semiotic resources of the mode of *animation*. Doubtless there are others (for a multimodal study of animated texts see Burn and Parker, 2003a; Burn and Parker, 2003b). *Materiality* is closely aligned with medium. Nevertheless, substance applied to surface makes signs that can be significant ideationally as in Megan's waxy veneer to signify ethereality as a characteristic of the Holy Spirit (Figure 4.12a, p.116). Hypothetically, the semiotic resources of materiality as mode include finish (shine, dullness), depth (opacity, transparency), texture (rough, smooth, indented), tactility (tacky, non-sticky). More research would be needed to explore this further.

The question is where the remaining heterogeneous cluster of semiotic resources belong. Size, boldening, italicizing, underlining and font are all standard typographic features available in standard word processing packages. In this context they are known as '*style*'. Their functionality is bound up with their visuality

(Goodman, 1996) which can carry ideational meanings as well as textual accentuation. Some of these apply to drawing but some do not. Whilst the evidence of previous chapters shows that these semiotic resources appear frequently in children's graphic texts, further research is needed into how they might be conceptualized theoretically.

Some of the semiotic resources of presentation and their functionality are shared across drawing and writing. Amy enlarged her central node and Rosie enlarged the word 'FuN'; Rachel emboldened her tinsel representation through overlaid strokes and Megan outlined her title; Oliver encircled his central node and Owen underlined his subheading; Bethany made her words '~welcome to my web page~' scroll across the screen and she selected an image of a spinning heart. The semiotic resources of animation, colour, 'style' and materiality are not composite mode-specific; they are evident in writing and drawing alike. Nevertheless, some aspects of presentation are medium-free whilst others are medium-specific. Colour, along with such resources as enlargement, emboldening and underlining or line repetition can appear irrespective of medium. On the other hand, changes to materiality are not possible on the screen and animation cannot be programmed as an automatic feature of the page.

b) Layout

Without exception, space was a semiotic resource evident in all of the children's texts. The space of the page or screen is the site of the appearance of the graphic. Kathleen made equal and different sized spaces between words within her email (Figure 5.1, p.127). Hannah made regular spaces between her words but she wrote role identifiers and each fresh incidence of talk on a new line (for example, Figure 5.11, p.158). Within the linearity of writing, white space is shaped by the regularity of letters, words and lines. This is automatic in electronic texts but has to be composed in handwriting. Interestingly, although consistency in the size and proportions of letters and spacing between words and letters is a teaching objective for 7- to 8-year-olds, line spacing is not mentioned in the National Literacy Strategy (DfEE, 1998a, p.33). Space can be more varied in drawing or in multimodal compounds. Oliver set apart his electronic games grouping by surrounding them with

white space (Figure 4.3, p.93). Owen made spaces between lines, between subheading and list, and around his drawing (Figure 6.2, p.179). Evident in both writing and drawing, white space is a shared semiotic resource.

In a multimodal approach to graphic representation, a fundamental issue is whether spacing in image can be thought about in a similar way to that in writing. The question is: what is space and what does it do? What are its forms and functions? Is space-as-signifier the same or different depending on whether it appears within writing-as-text or drawing-as-text? What space is remains constant irrespective of modal composite in that is not-marking as against marking. White space looks the same in writing and drawing in that it is absence of marks but it can appear in varying shapes, sizes and proportions. Space does not alter how words or drawing appear (unlike presentation) nor does it entail the addition of marks beyond 'lexis' (unlike punctuation). Space is a *signifier-resource* that belongs to the mode of *layout*.

On the basis of my analysis, it would appear that space has shared functionality irrespective of composite mode. I would like to suggest that space has two functions, namely framing between textual items and arrangement within the space of the graphic surface, and both are to do with semiotic interrelationships. The *framing* of space separates textual items, whether individual words, groups of words or images. The amount of space between textual items gives clues about how their interrelationships should be understood. More space constructs greater distance and suggests separation whereas juxtaposition implies that items should be seen as more closely related. *Arrangement* is where textual items are placed within the graphic surface and where they are placed in relation to other textual items. In more open design contexts such as web pages, blocks of writing and images are treated in a similar way, namely as textual items available for display in alternative configurations. Appearance at the left, right, top or bottom of the graphic frame opens up multiple possibilities for directional meaning-making. Positioning can also provide scope for non-linear interrelationships, as in the mind maps where nodes were located on a diagonal as well as a horizontal or vertical plane. Spatial framing and

arrangement are both to do with space and they are inextricably related but they are not the same thing.

In my analysis, the *semiosis of space* was significant for meaning. Its precise and situated significance was inextricably interwoven with the semantics and semiotics of the 'lexis' of writing and image. As a result of their experience of a vast range of graphic texts children conceptualize the spatial potentialities of the page and screen in many different ways. Arrangement of the mind map nodes as superordinates and classifications made a significant contribution to ideational content, that is *what* was said through *how* it was said. In conjunction with 'lexis', white space can provide clues about perceptions of the social, as in Hannah's interview transcription. Layout is not without meaning. It can carry signs crucial to understanding children's knowledge and understanding as the ideational, attitudinal, affective, social and so on portrayed through the signs of text.

c) Punctuation

Whilst intimately associated with writing, punctuation is nevertheless different from wording. It comprises a particular group of marks, a clearly defined 'lexis' that is not part of the letters of the alphabet. Linguistic punctuation consists of two different graphic manifestations. Firstly, it is marks separate from alphabetical lettering. These take different forms (dots, curved and straight lines of different lengths and in different orientations) and appear in different combinations (dots can appear alone as full stops, paired in a vertical alignment as colons and placed below a straight vertical line to make exclamation marks). Secondly, punctuation makes changes to lettered representation in capitalization. Upper case letters are sometimes enlarged versions of lower case letters, sometimes a quite new shape, sometimes a combination of the two, and, with the exception of 'Q', always unvaryingly devoid of descenders. In formal writing, these two aspects of punctuation work together. Capital letters succeed full stops to signal sentence boundaries. In informal contexts, particularly electronic texts, they may not.

In the examples given in Chapter 5 children used punctuation marks and capitalization – and lack of them – multifunctionally and multisemiotically. Firstly, as a framing device, punctuation marks constructed relationships between words and groups of words such as grammatical constructions, textual organization and blocks of meaning. As with white space, this showed framing and boundaries, separations and associations. These signs gave clues about how the children were thinking about relationships within and between parts of the text. Secondly, punctuation marks specified what the text was doing. In line with convention, the mark ‘.’ showed a statement whereas ‘?’ denoted a question and ‘!’ indicated an exclamation. Thirdly, hypothetically in the electronic messaging and certainly in the transcription, punctuation marks carried elocutionary functionality in implying the sounds and rhythms of speech and with them the effective, the affective and the attitudinal.

The children remade the meanings of punctuation for interpersonal, ideational and social reasons. Language-as-writing remains an essential feature of writing but the semiotic resources of punctuation work with wording to offer expanded meaning-making potentiality to the writer and additional signs to the reader. Writing can exist independently of punctuation marks but punctuation marks do not usually occur without the co-presence of wording. For the most part, they are inscribed only in conjunction with writing. There are exceptions to this. Question marks, exclamation marks and occasionally speech marks sometimes appear independently, for example in advertisements or comic strips.

Some punctuation is unique to writing. There are no equivalents to capital letters or full stops in drawing. However, the lines and arrows of the mind maps were a form of punctuation. They indicated relationships between textual items. Without labelling it was not always possible to construe the precise meaning intentionality of the map-maker, but links implied that electronic resources should be thought about as joined, connected or associated in some way. Whilst specific punctuation resources such as full stops and commas might not be shared between written and image-based diagrammatic texts, punctuation as a common semiotic resource (a mode) is. Furthermore, it is restricted to the graphic. Punctuation marks cannot exist in

temporal modes, although sometimes speech marks are remade gesturally to denote the ostensible.

d) Semiotic partnership

The semiotic resources of presentation, layout and punctuation work together interdependently in subtle combinations to make synthesized meaning ensembles in what I have chosen to call a *semiotic partnership*. Oliver's encircling of his central node, along with the image's enlarged sizing, framing with white space, central positioning and exiting point for major grouping links made it stand out as the map's title (Figure 4.3, p.93). The functionality behind this semiotic partnership was to do with showing emphasis and non-emphasis, and thereby relative importance. This accentuation gave meaning both to the central node and to its subordinates. By putting textual constituents into a relationship with each other Oliver drew the sign-maker's attention to different informational values. Some textual items were given prominence. Deflecting interest from components of lesser consequence was equally important in his textual design. These hierarchies of salience were a means of shaping ways of seeing, a device for positioning the sign-maker. The resources of presentation, layout and punctuation have co-functional semiotic effects within individual textual items and across the full text.

The semiotic partnership of layout, presentation and punctuation co-constructed 'reading' paths. Through combinations of these modal resources, textual items were foregrounded, midgrounded and backgrounded in such a way that they invited the 'reader' into a certain way of 'reading' and therefore a certain way of thinking (see also O'Toole, 1994, pp.244-248). 'Reading' might be more or less open-ended or more or less constrained. Sometimes greater control might be exerted as in Hannah's transcription (Chapter 5, pp.145-158); sometimes guidance was offered as in Bethany's web pages (Chapter 6, pp.168-172); sometimes the freedom of multiple-choice was given as in Tom's non-hierarchical map structure (Figure 4.10b, p.112). 'Reading' paths are composed with different combinations of semiotic resources as deemed apt by the sign-maker. They are features of writing-as-text and drawing-as-

text discretely as multimodal composites and in combination as multimodal compounds.

Semiotic connectedness and coherence

Each text in this study was characterized by an intent to mean. The children provided ‘lexical’ precision, textual precision, semantic precision, semiotic precision, social precision, ideational precision and more besides as they skilfully interwove semiotic resources in their graphic representation. That which they chose to include or exclude in their texts was shaped by their specific interest in and interpretation of phenomena, and always oriented towards the apt according to the representational need as they perceived it. Taking care with regard to which signs they made and how, they worked seriously to make their texts transparently ‘readable’ and to afford the utmost comprehensibility. The way in which they achieved this was through careful choice, shaping and combination of semiotic resources as graphic multimodal design.

Meaning resides in many graphic places. The children made signs at different levels of text. Always, semiotic resources interrelated in a complex and multifaceted interweaving. This multi-layering of semiotic resources was evident in three graphic sites: within individual representations, between groups of textual items and across the full text. This was evident both within multimodal composites and multimodal compounds. Firstly, there were multimodal interrelationships within individual textual items. Megan’s depiction of the Holy Spirit was a cohesive integration of the semiotic resources of drawing-as-image (line), colour and materiality (Figure 4.12a, p.116). Each made a different sign (wind, fire and ethereality) but, together, combined seamlessly in one coherent sign to construct a complex idea graphically. Bethany’s animated ‘welcome’ sign was a bringing together of lexis and movement. Its constant self-reconstruction was a metaphor for the making and remaking of social relationships in this child-only environment. Rosie combined drawing-as-image and language-as-writing in her integrated node to portray the enlightenment of a good idea (Figure 4.8, p.105). Secondly, there were interrelationships between grouped textual items. Within the composite mode of writing, meanings made in one part of

the text had implications for meanings elsewhere. Each word and phrase in Kathleen's email had meaning in relation to that which came before and after (Figure 5.1, p.127). Abigail's diagrammatic and pictorial images were understood as a group through her 'Best ways to communicate' label and surrounding white space (Figure 4.7, p.103). Thirdly, meaning was made across the full text. Amy adjusted the criterial attributes of her computer drawings in relation to other computer drawings in her mind map (Figure 4.4, p.95). Replicated detail was deemed unnecessary and its exclusion allowed for the representation of the new. Groupings of technological equipment, resources and locations of use became evident at text level (Figure 4.4, p.95). Expanded representational potentialities opened up as the multimodal composites of writing and drawing interrelated in multimodal compounds. Meanings proliferated as the signs of one multimode interacted with the signs of another. Jessica's writing described and explained whilst her images showed the criterial form and criterial attributes of items used in making her bag (Figure 6.3, p.182). In both multimodal composites and multimodal compounds meanings in one place illuminated meanings elsewhere.

On the basis of my analysis, I would like to suggest the notion of *pathways of meaning*. Pathways of meaning are textual signs which give clues about the process of design. The representational remaking of an object experienced in the world (such as the torch or tinsel) or an intermodal transformation (such as Hannah's interview transcription) are examples of pathways of meaning. In tracking sign-making from the original source to the graphic representation, it is possible to identify what has been transformed and how. Shifts in criterial attributes are another sort of pathway of meaning. They provide traces of the process of mindful design as the drawer moves from the given to the new. That which appears textually is a clue as to how the individual thought about a phenomenon in different textual contexts, and how criterial form and criterial attributes or wording were adjusted accordingly. Thirdly, text-level composition can carry clues about an individual's conceptualization such as the design of a classificatory arrangement in the mind maps. Pathways of meaning in textual design provide clues about mindful design, and thereby an individual's understanding of phenomena.

The semiotic resources of presentation, layout and punctuation were not retrospectively superimposed but were intrinsic within the process of production. This suggests that drawing on the repertoire of graphic semiotic resources available to an individual is an essential feature of the process of multimodal design. This, in turn, raises three issues. Firstly, semiotic interplays within and between modes give scope to the graphic sign-maker. The ways in which modes can be intra- and interrelationally composed provide the potential for infinite compositions of signs and relationships between them, and hence multiplicities of meaning. Secondly, children's graphic representational design has *semiotic connectedness* and *semiotic coherence*. What is surprising is that by the age of 6 or 7, the children in this study made graphic signs that represent an implicit knowing about and understanding of semiotic resources that is remarkably complex and intricate. Their graphic texts were a complex synthesis of semiotically integrated and semiotically coherent signs. This is not to say that the interrelationship of signs always works together in a unified manner. In terms of sufficiency they can also be more or less successful. Thirdly, this complexity has implications for understanding the 'fullness' of children's graphic representation. Children create a 'complex of concurrent messages' (Barthes, 1977, p.15). Graphic representation understood multimodally can open up meanings beyond the monism of the linguistic or drawing-as-image. For the analyst, separating out semiotic resources is a way of understanding threads of meaning but putting them back together and understanding the whole is equally important. These different semiotic resources at different levels of text work together in ways that can be analytically separated but that are mutually interdependent. This multimodality is fundamental to understanding the 'fullness' of children's graphic representation.

Implications for multimodal theory

Semiotic principles across modes of communication

At a deeper level semiosis might be conceptualized from a different perspective.

What started me thinking about this was the overlap between what graphic semiotic resources were doing. There was fluidity in how related meanings were being made.

Framing was appearing as punctuation, white space and enclosing lines. Accentuation might be shown through size, colour or emboldening, but also in the ordering of words or the appearance of images in different positions on the page. This seems to mark a shift from the notion of *semiotic resources as modes of graphic representation* to a notion of *semiotic principles across modes of communication*. Specific functionality appeared to underlie how the children had made meaning. For example, the need for framing prompted the mindful searching for and choice of an appropriate semiotic resource that might be a full stop, an expanded area of white space or an encircling. In thinking about graphic modes in relation to non-graphic modes, I began to see threads of meaning-making as criteriality, connectivity and salience. These surpassed particular instantiations and seemed to be located in the realm of deep-level semiosis. In order to explore this idea I first consider the relationship between speech and writing with regard to semiotic resources including and going beyond language. I then consider criteriality, connectivity and salience individually and in relation to one another in a semiotic partnership, leading to the notion of multimodal dispositions.

Words are shared by speech and writing and can be realized as spoken sounds or as graphic marks. Furthermore, the ordering of words as phrases or clausal units can be replicated in either multimode. Depending on cultural variation and register, there can be multiple and complex differences in the lexical and syntactical characteristics, structures and organizations of English speech and writing but they nevertheless share the same basic rules of an underlying linguistic system. However, the articulation of words as speech as against the inscription of words as writing has profound implications for how meanings are made. The materiality of speech is sound. Like performed as against written music, phonology includes four basic components: timbre (sound quality or tone), pitch (including intonation), rhythm (and pausing) and intensity (loudness / softness). Combined in complex configurations to create the phrasing of speech, these have been culturally developed over hundreds of years to communicate meanings powerfully and in ways that are clearly understood. This becomes evident when words are removed but intonation and rhythmic patterns remain, as in the mode of communication created for the 'Clangers' using a swanny

whistle. In speech, melodic lines, pacing and pausing, and variations in volume construct cadences that work in harmony with wording. The sounds of speech carry meanings that are organized and regularized.

These features are entirely absent from orthography. The question is whether how meanings are made has implications for what meanings can be made. Does realization as speech or writing make any difference to meaning? Can the same meanings be made in writing as in speech? The challenges encountered by Hannah in her interview transcription are a compelling reminder of the difficulties of making speech into the lettered form. Much can be achieved but much must also be construed. Furthermore, what happens when drawing is brought into the equation? Are there equivalents to the sounds of speech in drawing? Or should image be understood quite separately from language either as speech or writing?

It could be that face-to-face and graphic communication cannot be compared and therefore understood interrelationally because they are so essentially different. However, if multimodality aims to draw all modes of communication into some sort of unified and all-encompassing theory, then this is an unsatisfactory position. How mode and multimodality are defined must apply to and work for graphic representation as well as that which is represented non-graphically. It might be that difference in the specific and contrasting affordances of mode lies at the very heart of a multimodal approach. This points to a theory that not only embraces both similarity and difference but sees them as fundamental theoretical principles. I have argued that there are shared semiotic resources in graphic representation and next I would like to argue that there are shared semiotic principles too.

a) Criteriality

In my analysis, deciding on what was criterial as the perceived 'truth' of the thing, event or concept emerged as fundamental to sufficiency. 'Criteriality' is not a case of representing all that is known, remembered and thought about. In their drawings, the children were not necessarily faithful to things as they look in actuality (perceptual realism) nor were they always conceptually faithful in the sense that their

representations conveyed all that they knew (intellectual realism). In selecting the criterial, that which an individual saw, knew, thought about or experienced was interpreted and shaped through available semiotic resources towards a perceived representational or communicational need. Composing criterial form and criterial attributes in drawings and choosing criterial nouns and verbs in wording required analysis of the particular representational event, the purpose of the text and the person or people for whom it was intended, in a particular context and in accordance with the individual's interests. Furthermore, criteriality shifted intra-textually, as in Amy's drawings of computers (Figure 4.4, p.95). The known leads to the unknown but the unknown has implications for what is then chosen as criterial. That which was criterial could be the domain of language-as-writing and drawing-as-image, but it was not exclusively. 'Criteriality' was also shown through the semiotic resources of colour (for example, peach and yellow to show the fire-like qualities of Megan's Holy Spirit in Figure 4.12a, p.116 and yellow to show the reflection of the sun in Daniel's moon in Figure 4.11c, p.114), punctuation (for example, scarcity of full stops and capital letters to show continuous speech in Hannah's transcription in Figure 5.8, p.147) and layout (for example, positioning to show classifications in the mind maps in Figure 4.3, p.93 and Figure 4.4, p.95). The children selected out that which they considered criterial and chose the most apt semiotic resources from those available to represent their meanings as effectively as possible. This was always a process of transformation.

b) Connectivity

Connectivity is concerned with connection and disconnection. It is the means by which the sign-maker shows that which belongs together, that which is related and that which is separate. In graphic representation, connectivity can be shown through colour, as in Megan's matching of the hues she chose for the Holy Spirit, Jesus and God (Figures 4.12a and 4.12b, p.116). The blueness shared by Bethany's images worked as connecting device across her home page (Chapter 6, p.170). Separation and links were also shown through the framing of punctuation. Wording bounded by a full stop at one end and its requisite capital letter at the other marks off a 'chunk' as a sentence (Figure 6.3b, p.182). It implies a discrete component, a conceptual unit.

Commas, semi-colons and colons mark breaks and, in showing units, establish sub-clauses that are both separate groupings within the whole but belong to the sentence as a complete idea. Connection and disconnection are paralleled in speech by rhythmic phrasing and temporal gaps. Graphically, they can also be shown in spatial gaps. Kathleen showed the different textual sections of her email through spacing (Figure 5.1, p.127). Oliver set apart his ‘family’ of electronic games (Figure 4.3, p.93). Positioned at a distance from other textual items, and surrounded by white space, this gave them significance as a distinct grouping. Showing connection and disconnection as parts and relationships between parts is a semiotic principle realized through different semiotic resources. It can have similar and different instantiations in different modes.

c) Saliency

Saliency is to do with relative emphasis. It shows that which is of primary importance and that which is less important. Graphically, it appears as emboldening of line, contrast in and intensity of colour, substance, size and animation. Saliency in speech is constructed through intonation as rises and falls in pitch and through intensity as crescendo and decrescendo. Where the modes of presentation and layout (and punctuation) are suppressed, as in continuous print narrative, the saliency of wording within sentence construction takes over. It can be achieved by the linguistic ordering of spoken or written words or the positioning of images on a graphic surface.

Saliency is not a semiotic resource. It is a semiotic principle that can be realized through a whole range of semiotic resources. Each instantiation of saliency is newly created and is therefore situated within the particular text, but, as with criteriality and connectivity, it is shaped by historically located social and cultural practices. The relatively recent and widespread availability of electronic representational technologies enables children to experiment with graphic saliency. A host of websites, electronic games and television texts, and readily manipulable written texts and ready-made images, enable children to observe, experiment with and reflect on its effects. However subtle, saliency is always there.

d) Semiotic partnership

Shared semiotic principles are not the same as shared semiotic resources. They are underlying meaning motivations. These principles are always present in semiotic work, never mind how inconspicuous. Criteriality, connectivity and salience are analytically separable but they do not work in isolation. Collectively, together they co-construct meaning in a *semiotic partnership*. Semiotic principles are actualized in the choice, shaping and combination of particular semiotic resources. They become apparent in different modes and at different levels of text. This realization is flexible because of the shared and different functionality of modal semiotic resources. How semiotic principles are realized shifts within and between texts according to which resource best achieves the required principle at that given moment and as shaped by social practice. This is how functional load shifts. Semiotic principles have sometimes common, sometimes particularized and sometimes different instantiations within and between modes of communication.

Multimodal dispositions

This shifts the notion of design beyond the parameters of the specific material realization. A more expanded notion of representational / communicational design posits design principles as phenomena that span the full range of possible multimodal expressions. Implicitly but necessarily, this is a move towards the notion of *multimodal dispositions*. An individual can choose between different instantiations of criteriality, connectivity and salience because the same, similar or different semiotic principles can be realized through a range of semiotic resources. This choice, shaping and combination is always culturally, socially and historically located.

In graphic representational design, this has implications for *representational metafunctions*. The ideational, conceptual, affective, attitudinal, 'perspectival', experiential (amongst others) and the social are always present in the signs of text, however inconspicuous. It is not that one semiotic resource is restricted to the interpersonal, another to the ideational, another to the affective, another to the attitudinal and so on. Sign-making and signs are far more complex than this. Each

semiotic resource can be called upon to carry this information but in a different way. Kathleen chose the word 'hi' to portray her relationship with her uncle (Figure 5.1, p.127) whereas Rosie composed her figures in a particular orientation to construct a particular relationship with her 'readers' (Figure 4.8, p.105). Compositions of tinsel representations and associated wording carried the ideational (Figure 4.1, p.89) but so did organizing 'families' of electronic resources as classifications (Figure 4.4, p.95). Some textual items might carry a greater ideational or interpersonal load than others or the load might shift within and between elements within the same text. Meaning is 'cross-modulated' (Lemke, 1998, p.92).

As children meet and make a whole variety of texts in their everyday lives they gradually accumulate experience, knowledge and understanding of multiple ways in which semiotic resources make signs. From a growing reservoir they adopt, adapt, evaluate and refine how they make meaning with them. This is always a process of transformation as signs are made in response to particular ideational, interpersonal and contextual demands. As well as individual graphic texts being clues to understanding multimodality, it seems to me that there is something else beyond. Graphic communicators compose with a multimodal disposition. Whatever the text, based on the individual's perception of semiotic principles, s/he selects complementary semiotic resources from those currently at his or her disposal. This entails knowing about alternatives, analysing communicational need and representing meaning according to best fit. Those semiotic resources which are apt are chosen whilst others are held in check. This implies flexibility and adaptability in what and how children communicate. No matter what the text is, behind every graphic composition is a multimodal mind at work.

Little is known about the semiotics of internal sign-making. External sign-making gives clues about mindful processes but what goes on in the mind is notoriously difficult to access, so deep-seated as to be inaccessible as a consciousness. Hypothetically, and in disagreement with Vygotsky, mental representations induced by graphic representation may include or exclude words, never mind mindful pictures and deeper level thoughts. Internal sign-making might be something akin to

Vygotsky's notion of internal speech (Vygotsky and Luria, 1994) but expanded multimodally. He and his colleagues discovered that 'egocentric' speech diminishes with age and suggested that its structural and functional characteristics change (Vygotsky, 1986, pp.229-230). Inner speech, Vygotsky argues, is essentially different from external social speech in that it is abbreviated to predicates (ibid, pp.235-249) as 'thinking in pure meanings' (ibid, p.249) takes over. It might be that inner sign-making is not confined to the mode of its source but is both transformed multimodally and reduced to some sort of concentrated multimodal state. Such a surmise is highly speculative and can only be conjecture.

Educational and research implications

Understanding and assessing representational diversity

Children live in a diverse communicational world. Between home, school and community they are immersed in a wide range of graphic texts. In their everyday making they negotiate multiple semiotic resources and the principles behind them, as well as observing and interacting with the sign-making and sign-remaking of others. Each text children make is situated as one amongst many. In the series of seven science-based pieces of work on the theme of light the children moved between a range of genres (for example, a list, a table, a report and a wordsearch). Yet these graphic tasks were located amongst others in subjects across the curriculum as part of the normal school day, never mind sign-making at home for personal, social and leisure purposes and beyond to the community. This is a complex graphic world where one graphic thing is in many respects like another, yet quite different. With remarkable alacrity, children learn what is what. Different texts in different contexts enable children to understand their purpose and to learn about the situatedness of meaning. Understanding the range of semiotic resources with which children make signs in their graphic meaning-making is not an intention to find regularities that exist independently of social practices, an 'autonomous' model. Rather, it is an endeavour to gain some insights into their graphic representational practices in different social contexts. For this reason, 'we should be attending to the whole spectrum of communicative practices' (Street, 1998, p.3).

Children demonstrate extraordinary skill in making meaning through the affordances of drawing. If it is the case that opportunities for drawing in school are diminishing, this might implicitly suggest that current educational discourse considers representation through drawing to be inadequate to the needs of the curriculum, and that it can offer little to the representation of learning in comparison with writing and number. The same might be said of materials children produce for research. Nevertheless, children do draw for curriculum purposes. Whilst judgments about educational acceptability are made and are made accurately with regard to nationally specified levels of subject attainment, there is a danger that graphic detail remains largely unnoticed and image interpretation remains relatively unexplored. Aspects of conceptualization might consequently be missed. Children's thinking is evident in inscriptions beyond words. The detail of their images carries a wealth of meaning and can provide crucial insights into their thinking. The composite modes in which pupils are requested to communicate in the classroom shape what they can communicate and are therefore formative of their learning. Privileged attention to writing in the educational domain detracts attention from the richness of sign-making in image. I am not advocating a destabilization of the role of writing but rather the importance of attending to other forms of communication that have validity in their own place. It might be that the capacities of drawing and image more generally have yet to be explored as significant sign-making resources. Understanding the affordances of drawing can enable educationalists and researchers to make sound decisions about where it can be a powerful resource for making meaning. This has implications for initial and continuing teacher professional development, and for research training.

An important means of communicating what children know educationally, and indeed a key source for understanding their learning, is graphic representation. The multimodality of graphic texts is a fact of everyday classroom teaching and learning. Yet, for the most part, it is 'embedded' within the sometimes similar, sometimes contrasting texts of different subjects (DfEE and QCA, 1999, p.20). That embeddedness is complex. Each subject discipline has particular and shared graphic conventions. Children must learn to interpret and represent graphically the specialized knowledge of each curriculum area according to its conventions (see also

Unsworth, 1997; Gee, 2003). There is therefore a complex relationship between subject knowledge and subject representation. As they move between the different subjects of the curriculum, children must learn to 'read' and make a multiplicity of texts that have similar and different graphic designs. Their understanding of the potentialities of graphic resources shapes what they communicate and how they are able to represent their learning. This has three repercussions. Firstly, understanding how subject-specific knowledge is composed as graphic design is crucial to effective pedagogy. If teachers understand more about subject-specific graphic conventions and how children communicate their curriculum ideas graphically, they will be better able to understand and support their learning. Secondly, the ability to make particular types of graphic texts in certain ways depends upon children having experience of sign-making within specific social practices (see Gee, 2003, pp.28-31). Gee argues that it is both invalid and unethical to assess children unless they have had equivalent experiences of specific texts as part of specific social practices and embedded experiences of situated meaning. Thirdly, if learning and representation are multimodal yet assessment is restricted to the linguistic, much of what children have learned might potentially be overlooked (see also Jewitt, 2003). This has educational policy and professional development implications.

Flexibility for the present and the future

What has changed over recent years is children's access to a wider range of graphic texts and interrelationships between them as a part of the popular culture of their leisure time, for example, television programmes, electronic games, stickers, magazines, websites, information texts, collectables, clothing and food (Mackey, 1994, p.15; Buckingham and Scanlon, 2001, p.284). Computer resources are enabling different ways of making meaning graphically and different 'reading' habits, as exemplified in Chapter 6 (pp.173-17). It is not that pen and paper are no longer useful but that their place is renegotiated in the face of expanded technological potentialities. Mobile phones not only enable talk but also offer 'texting', opportunities to access information from the web, and the ability to capture and send image messages. A consequence is that children's graphic encounters are

simultaneously located in largely traditional texts and media in school whilst their home experience includes but goes beyond these to an extensive range of electronic media (Downes and Reddacliff, 1997; Beavis, 1998, pp.247-251).

It may not be that new, particularly electronic, media are causing children to read or write less or that the predominance of writing is under threat but that children in the twenty first century are experiencing a growing array of semiotic resources in different combinations. Jay Bolter and Richard Grusin (2000) argue that media remake themselves and other media in an ongoing process of 'remediation'. With regard to modes, it may be that there are continuities and discontinuities, the 'old' within the 'new', the 'new' within the 'old', and convolutions where there is actually no old and no new, and there are no 'mutually exclusive alternatives' (Buckingham, 1999, p.11). Children's graphic design dispositions are located both in the 'old' as well as the 'new'. Yet this 'new' is not the 'newness' of adults. For children, the semiotic resources of what are often termed 'new' technologies are commonplace and un-extraordinary. Moving between 'old' and 'new' technologies is a fact of life for today's children. It is just what is. They do not necessarily differentiate between 'old' and 'new' forms of communication. There is a sense in which nothing is new yet everything is new.

The rate of recent technological change is a likely indicator for what is to come. What is fairly certain is that electronic communication technologies will continue to develop at an astounding rate and that they will become increasingly affordable. Children, as children and as they become adolescents and adults, will need to sustain their flexibility to adapt to this changing communicational landscape. This implies the need for an open disposition that can adjust to change, but also criticality in being able to decide when one form of representation as against another is appropriate. Whatever the communicational future holds, people will continue to need to know how to communicate formally and informally, and how to create and make sense of graphic texts in different contexts and for different purposes. An ability to approach communication confidently, critically and inventively (DfEE, 1998a, p.3) depends on knowledge and understanding of the semiotic resources of graphic representational

design in a variety of situations. Learning the 'new basics' is not a matter of mastering 'correct' rules and procedures but navigating and embracing diversity through seeking to understand the forms and meanings of unfamiliar texts (Kalantzis, Cope and Harvey, 2003, pp.22-23). Whilst this might happen incidentally as children experience graphic communication in its many diverse forms as an everyday basis, there are also educational implications.

In order to prepare children for such a future, curriculum planners need to take account of the changing communicational landscape (see also Kress, 1995; Kress, 2000a). What will schools do about changes to formal writing in 'texting'? Will it be ignored as irrelevant to curriculum objectives or will it be seen as an aspect of cultural change that warrants attention? The graphic world at the turn of the second millennium requires that children are able to interpret visual, linguistic, aural and actional information in varying combinations effectively and critically. If children's representations are to be apt to the diversity of their current everyday lives and suitable preparation for the uncertainties of the future, they will need support in understanding how the different semiotic resources of representation work, how they are similar and different.

This is not a limiting and does not mean thwarting individual creativity and autonomy. Rather it is about giving children 'meta-multimodal' tools that will enable them to describe and analyse the texts they 'read' and make, and to think evaluatively and critically. Locating and identifying features of non-fiction texts such as headings, bullet points and captions (DfEE, 1998a, p.33, p.39) is one thing but understanding the ways in which they are composed, their functionality and how they construct meaning is another. Hypertextual links are not merely convenient connectors but rather they carry the values and assumptions of the author(s) in implicitly creating associations and constructing how discrete screens are interpreted in relation to one another (Burbules, 1998). Len Unsworth (2001; 2002) suggests that a way forward would be for teachers and children to share a metalanguage so that they can discuss the multimodality of texts (see also Zammit and Downes, 2002; Callow, 2002). This should not set down rules for 'correct' ways of understanding and making texts but

rather provide opportunities to explore, identify and explain interrelationships between textual items as located in the different discourses of different social practices (The New London Group, 2000, p.24). Such description, analysis and critical evaluation might be a way into understanding more deeply the forms and meanings of printed and web-based information texts and thereby give children the choice about how to use words and images, how to set out the page and how to use presentational devices effectively, when, why, how and where.

Epilogue

My study is neither exhaustive nor definitive, nor is it an endpoint. It represents an ongoing process of thinking as I endeavour to engage deeply with theoretical ideas in relation to my analysis of children's graphic representation, thinking that will continue beyond this thesis to the 'farther shores of possibility' (Geertz, 1973, p.21). In my ongoing research into how children make meaning graphically, I aim to explore and further develop ideas by studying the products of children's representational design in specific and different contexts, and also the processes of production as multimodal design. Questions have arisen for which I have not found ready answers and sometimes I have found that I needed to ask different questions. I have grappled with challenging ideas, some of which I discarded, some of which I retained, some of which I restored after abandoning and some of which I modified over time. No doubt, this process of shifting and settling will continue as I continue to think, engage with further reading and analyse graphic representational design located within a variety of social practices, events and domains. In this new field of research, my study has been always exhilarating, always searching, always deeply satisfying. I hope it is a small contribution towards taking theory at least one small step forward.

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The work presented in this thesis is my own.

D. E. N.

A handwritten signature in black ink, consisting of the letters 'D', 'E', and 'N' in a cursive style, followed by a long horizontal flourish.