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Multimodality, "Reading", and "Writing" for the 21st Century

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As words fly onto the computer screen, revolve, and dissolve, image, sound, and movement enter school classrooms in "new" and significant ways, ways that reconfigure the relationship of image and word. In this paper I discuss these "new" modal configurations and explore how they impact on students' text production and reading in English schools. I look at the changing role of writing on screen, in particular how the visual character of writing and the increasingly dominant role of image unsettle and decentre the predominance of word. Through illustrative examples of ICT applications and students' interaction with these in school English and science (and games in a home context), I explore how they seem to promote image over writing. More generally, I discuss what all of this means for literacy and how readers of school age interpret multimodal texts.

Introduction

Print- and screen-based technologies make available different modes and semiotic resources in ways that shape processes of making meaning. The particular material and social affordances (Kress & van Leeuwen, 2001; van Leeuwen, 2005) of new technologies and screen, as opposed to page, have led to the reconfiguration of image and writing on screen in ways that are significant for writing and reading. In this paper I describe some of these configurations and explore the design decisions made about when and how writing, speech, and image are used to mediate meaning making. My intention throughout the paper is to challenge the educational foregrounding of the written word and to establish the need for educational research and practice to look beyond the linguistic. In the process I hope to demonstrate how useful multimodal analysis can be in the context of both school literacy and computer applications and gaming (Kress & van Leeuwen, 2001; Kress, et al., 2005; van Leeuwen, 2005).

Print-based reading and writing are and always have been multimodal. They require the interpretation and design of visual marks, space, colour, font or style, and, increasingly image, and other modes of representation and communication (Kenner, 2004). A multimodal approach enables these semiotic resources to be attended to and moves beyond seeing them as decoration.

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I bring together a variety of illustrative examples in order to explore how new technologies remediate reading practices. These examples include computer applications (Microsoft Word), CD ROMs (*Multimedia science school* [New Media Press, 2001] and *Of mice and men* [Penguin Electronics, 1996]) and games (*Kingdom hearts* [Sony, 2002] and *Ico* [Sony, 2001]). These are selected to show the range of configurations of image and word and to begin to explore how these configurations might be shaped by subject curriculum and different contexts of use.

Writing in the Multimodal Environment of the Screen

Screen-based texts are complex multimodal ensembles of image, sound, animated movement, and other modes of representation and communication. Writing is one mode in this ensemble and its meaning therefore needs to be understood in relation to the other modes it is nestled alongside. Different modes offer specific resources for meaning making, and the ways in which modes contribute to people's meaning making vary. The representation of a concept (e.g. "cells" or "particles") is realized by the resources of writing in ways which differ from the resources of image, i.e. different criterial aspects are included and excluded from a written or visual representation.

Writing is not always the central meaning making resource in applications for use in school English and science. In some texts writing is dominant, while in others there may be little or no writing. The particular design of image and word relations in a text impacts on its potential shape of meaning. For example, a computer application can be designed to marshal all the representational and communicational "force" of image and word around a single sign; image can be used to reinforce the meaning of what is said, what is written, and so on. In turn, this relationship serves to produce or indicate coherence.

An example of this marshalling of semiotic resources across modes is offered by the PlayStation game *Ico* (Sony, 2001). *Ico* is about a young boy (Ico) who is entombed in a mysterious fortress that he and his rescued companion Yorda must escape. To this end, the two characters travel through the maze-like fortress while defeating shadowy monsters and an elusive sorceress queen. This discussion draws upon video and observational data from a pilot project designed to explore how the game as a multimodal text is realized through the player interaction (Carr & Jewitt, 2005). My discussion is based on multimodal analysis of the game and video data and observation of a game session between three children (aged 8, 15 and 17 years).

In the game *Ico* the ephemeral quality of the central character Yorda is produced through the multimodal design of the modes. This quality is realized by the shared impenetrability of Yorda's speech and its "written transcription". (I discuss this in more detail later in the paper.) It is signalled in the visually ill-defined, changing features and the leaking/blurred boundaries of her form. Her quiet voice, soft, slow ghostly gestures that hesitate and barely finish, along with floating movement, add to this realization of the character. Each of the modes used in the realization of the

character Yorda are designed to suggest the same thing: she exists in a liminal space on the boundary between the castle that the game is situated within and the world outside of the castle, to which the player must try and escape.

At other times, image and writing attend to entirely different aspects of meaning in a text. Here I want to turn to some of the "new" configurations of image and writing brought about by the potentials (affordances) of new technologies. In particular, I want to ask how these configurations impact on meaning making, reading, and writing. This discussion needs to be read in the knowledge that sites of display are always socially shaped and located: the "new" always connects with, slips and slides over, the "old" (Levinson, 1999; Manovich, 2002). The ways in which modes of representation and communication appear on the screen are therefore still connected with the page, present and past. Similarly, the page is increasingly shaped and remade by the notion of screen. There are screens that look page-like and pages that look screen-like (e.g. Dorling Kingsley books). Until recently the dominance of image over word was a feature of texts designed for young children. Now, image overshadows word in a variety of texts, on screen and off screen: there are more images on screen and images are increasingly given a designed prominence over written elements.

The prominence of image is typical of many school science applications, such as *Multimedia science school* (New Media Press, 2004) (Figure 1). These examples are drawn from my research on multimodality, learning, and the use of new technologies in school science, mathematics, and English (Jewitt, 2003, 2005). Here I focus on a video recording and observation of the CD ROM *Multimedia science school* in use in a Year 7 London secondary school classroom.

Where writing does feature on screen, a common function is to name and label elements. In *Multimedia science school*, for example, the design of image and writing on screen serves to create two distinct areas of the screen: a "frame" and a central "screen within the screen" (see Figure 1). Multimodal semiotic analysis of the screen design shows that the "frame" attends to the scientific classification and labelling of the scientific phenomenon to be explored. There are a series of "buttons" displayed on the frame. Each "button" has a written "label" on it that relates to the topic areas covered by the CD ROM (e.g. states of matter). These act as written "captions" for what is visually displayed in the central "screen within the screen". The "screen within the screen" on the CD ROM is a multimodal space without any writing at all and it shows the empirical world that is to be investigated. It mediates and provides the evidence that "fills in" the scientific concepts (e.g. "states of matter") labelled by the "frame". In other words, the configuration of writing and image in the CD ROM modally marks these two distinct aspects of school science, i.e. scientific theory and the empirical world. The "frame" relies mainly on writing, layout, and composition. The "screen within a screen" relies on image, colour, and movement.

It is not only in school science that image dominates the screen. This is also true of applications used in the English classroom, although, as I will show, the way in which the relationship between word and image is configured is rather different.[1]

Figure 1. Screen shot of the CD ROM Multimedia Science School

The relationship of image and writing in the CD ROM *Of mice and men* illustrates several features of the changing relationship between image and writing (Jewitt, 2002). Image takes up more than half the screen in over three-quarters of the "pages" in the CD ROM novel. This serves to decentre writing. Writing is displayed on the screen framed within a white block; this "block" is "placed over" an image that "fills the screen" (Figure 2). The full text of the novel *Of mice and men* is reproduced on the CD ROM, but the way it is distributed across the screen as opposed to the page differs. The amount of writing per screen is greatly reduced when compared with the page of the novel (so a page consists of three or four paragraphs, whereas each CD ROM screen consists of one paragraph). This "restructuring" "breaks up" the narrative and disconnects ideas that previously ran across one page to fragment the narrative across screens.

The design of writing on screen is connected with the epistemological demands and requirements of a subject area. In school English writing on screen represents the concepts of the curriculum, although in most cases an alternative reading of these concepts is made available through image, movement, and other modes. In school mathematics and science writing appears to be primarily used to name the canonical curriculum entities within the specialized language of the subject.

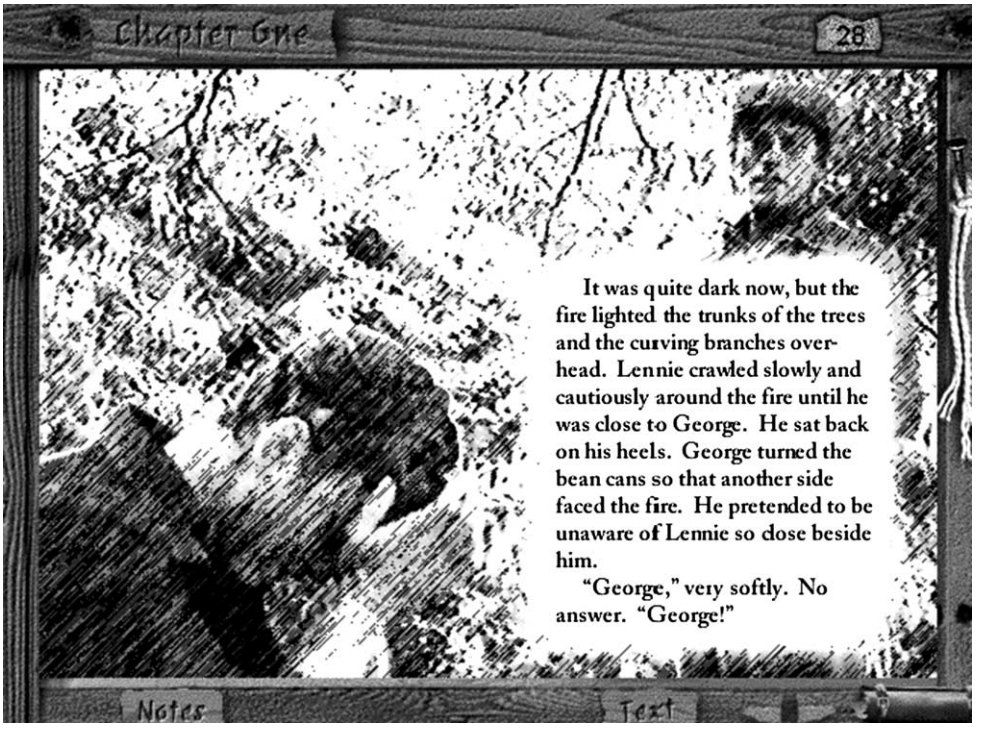

Figure 2. Screen from the CD ROM *Of mice and men*

Writing appears to serve a similar labelling function in computer/PlayStation games. While the multimodal action rolls on, writing is used to name a character or indicate its status, specify a narrative point, or identify a decision. For example, the decision of when and what to represent in writing and/or speech can shape game character and narrative. Writing and speech can be used to give voice and expression to some characters in a game and not others. Watching my daughter (aged 8) and her friends play PlayStation games, I noticed and became interested in how they move through games by using the characters' access to speech as a multimodal clue to their potential to help solve the puzzles and tasks in the game. A character's access to language indicates (was read as a part of) their game value, i.e. their value in achieving the object of the game, to collect resources to move through to the next level of the game. A multimodal semiotic analysis of the game *Kingdom hearts* (Sony, 2002) shows that some characters have the potential to speak, some respond by written text bubbles when approached by the player/avatar, and others have no language potential at all. The characters that have the most modes of communication are the key to game success.

The design of writing and speech can also subtly shape the identity of a game character. In the game *Ico* (2001), introduced earlier in this paper, the configuration of speech and writing within the multimodal game serves to reference the social

function of language as a marker of identity, belonging, and difference. This reference is central to the game narrative and the task of solving the game puzzle and realising its goal, to escape the castle. The "language" spoken by Ico is a kind of global Esperanto, an ungrammatical combination of elements of Japanese, French, and German. Ico's speech is at the same time both universal and inaccessible. His speech is translated into subtitles that run across the bottom strip of the game cut sequences. Yorda's speech, like Ico's, is made up of bits of reworkings of various existing languages, but is "fictional". Her spoken words are translated into a "fictional" pictorial written language. The written language is made up of curling letters that stand somewhere between a Japanese script and Arabic. In other words, neither Yorda's speech nor its written translation is accessible to the player.

The relationship of writing and speech in this game seems to almost defy its essential purpose, to communicate. And yet these incomprehensible languages still mean. In the case of Yorda, writing and speech are pure form. They indicate something of her character by the inaccessibility of her talk. Speech and writing are used to represent Yorda's identity as other-worldly and different. By representing Yorda's "language" as one that can be spoken and written, the game design constructs Yorda as human-like, literate, and sociable. What Yorda "says" cannot be known, but the quiet, soft, and lyrical tone of voice with which she utters her non-understandable statements is an audio sign of her harmless, kind nature (van Leeuwen, 1999). The written script that stands for her words offers a visual echo of the pictorial signs carved on the tomb in which Ico is initially imprisoned. In this way, the written script of the subtitles marks Yorda's connection to the castle. Speech marks her difference from Ico. Writing marks her belonging to the castle; language marks her identity.

The way that writing and speech are used in the game *Ico* is also a part of the construction of the relationship between the characters Yorda and Ico. Watching the two characters speak and listen to one another, it is clear that Ico cannot understand Yorda's language. (It is unclear whether or not Yorda can understand what Ico says.) The young people we observed playing the game are (like Ico) left to visually interpret the meanings that Yorda struggles to make in gesture, movement, posture, and audibly via her voice. Their interpretation and response to her differs in relation to their game experience and notion of game, which in turn is dependent on the context of play (Carr & Jewitt, 2005). In contrast, the player is offered access to Ico's language, via the written subtitles. The designer's decisions about when and how to use writing and speech mediates the flow of the narrative as a multimodal sequence. Ico's desperate call of Yorda's name is the only talk against the backdrop of action. Ico and Yorda's speech strips away what is said, the content of language, and instead offers the sound, the material form of speech. The material visual form of writing can be highlighted in a similar way. This strips away the content of what is written, like Yorda's fictional written language. This stripping away of the content of writing is what I turn to discuss now: the visualization of word.

The resources of new technologies emphasize the visual potential of writing in ways that bring forth new configurations of image and writing on screen: font, bold,

italic, colour, layout, and beyond. The visual character of written texts has always been present to calligraphers, typographers, and others, but the inclusion and recognition of the material and visual qualities of texts is more recent within linguistics (see, for example, Ormerod & Ivanic, 2002; Shortis & Jewitt, 2004).

At times the boundaries between word and image appear entirely permeable and unstable (Chaplin, 1994; Elkins, 1999). The potential of new technologies blur the boundaries between the visual and the written in ways that "recast modes" and the relationships between them. The design of kinetic typography (Lanham, 2001; Maeda, 2000) is an instance of this and one that questions what writing is and can be in the 21st century. This is a question which is further complicated by the changing notion of screen and the development of three-dimensional, flexible, and transparent screens. These changes echo and connect with visual traditions from the past when people's lack of access to writing as a means of communication meant that the parallel visual story was often embedded in ornate visual written texts. Then, as now (although for different reasons), the visual form of writing was not decoration; it was and is designed meaning.

Observing the use of the CD ROM *Of mice and men* over a series of school English lessons offers an example of how typography, as a visualization of word, contributes to the ways in which students make meaning of a text. In particular, it offers an insight into the way in which students interpreted the characters' status within the novel as CD ROM. The CD ROM gives information on each of the characters in the form of a "work roster"; a list of character names and roles. Most of the characters' names are written as a list using a font like an old typewriter (Courier-like) and are circled in red. The character names "the boss" and "Curly's wife" are "handwritten" in red ink alongside the list. The different typographic fonts used in the CD ROM mark the connections and disconnections between the characters in the story. Through the contrast of font style, colour, and spatial layout, the two characters, "the boss" and "Curly's wife", are represented as outsiders. The "handwritten" comment "botherin us" written alongside the name "Curly's wife" goes further and positions her as an intruder. The technology encoded in these two fonts mark different social distances between the viewer/reader and the people listed (as well as the list itself). The typewriter font is suggestive of a more distant (cooler) relationship than is the "handwritten" font.

How and when these two different fonts are linked in the CD ROM becomes then a matter of choice, a matter of meaning. For example, the dossier file on "Curly's wife" includes an image of an envelope addressed to "Curly's wife" at Speckled Ranch, the location of the story (Figure 3).

When the user clicks on the image on the envelope this activates a hyperlink to a letter from Steinbeck to Clare Luce (the actor who played the character in a theatre production of the book).

The envelope is produced as "handwritten" using Apple Chancery font while the letter it links to is produced as "typed" using Courier font and scroll bars. This pattern of a "handwritten" font on screen hyperlinked to a text using Courier font occurs throughout the CD ROM. This serves to produce two "distinct" kinds of

Figure 3. Screen shot of the Curly's wife dossier on the CD ROM *Of mice and men*

writing. Apple Chancery font is used to indicate something at the fictional level of the story. Courier font is used to indicate something at the factual level. The fictional narrative of the novel and the descriptions of characters emulate "handwriting" and visually mark the "presence" or "essence" of a human writer. The factual information included in the dossier and hyperlinked texts about the historical places named in the novel use Courier, a font that brings forth the imagery of a machine, the old clunky machine of a typewriter, and suggests the presence of technology as human absence.

Figure 4. Screen shot of the Curly's wife dossier on the CD ROM *Of mice and men* hyperlinked text

Typography is used here to visually express something as belonging to either the personal and potentially fictional or a formal and factual account. These different fonts give the students reading it a visual clue as to the different kinds of work they are expected to engage with. In the case of the handwritten font the work of the student is one of imaginative engagement, while the Courier font suggests that the kind of engagement needed is more distant, more to do with historical fact and evidence. In this way, the qualities of the font used are a key to the textual positioning of the reader.

At times writing on the screen becomes "fully visual". By this I mean that the "content" of the writing is "consumed" by its form. Writing becomes image when it is either too big or too small to relate to the practice of reading. The tiny scrawl of printed words retreats to a textured pattern of lines and it is redefined as a visual representation on screen. When writing moves about the screen, interacting in rhythm with other modes for example, the linguistic meaning of what is written is often illegible and transformed (Jewitt, 2002).

Some think that it is best to separate images and writing in CD ROM versions of books because the images distract students (Graham, 1996). From a multimodal perspective I see the design of image and writing as contributing in different ways to the meaning of a text. From this point of view the spatial relationship between image and writing is a resource for making meaning that can be useful. When writing is separated out and foregrounded to dominate the screen, it can be seen as a kind of "resistance" to the multimodal potential of new technologies and screen. In other words, a large amount of writing on screen is becoming a sign of convention or tradition. Writing on screen functions to reference the values of specialist knowledge, authority, and authenticity associated with print. It signals the literary text and the educated elite or, more prosaically, examination and assessment. It takes a considerable amount of work to maintain writing as the dominant mode on screen. This serves to assert the connection between the old and the new. However, writing is usually one part of a multimodal ensemble of image, music, speech, and moving elements on the screen. It is not only designers and teachers who make decisions about the relationship of image and word in texts. In the next section of this paper I look at an example of how students engaged in these decisions when they made (designed) texts.

Students' Design of Writing and Image

Students in the classroom (as elsewhere) are engaged in making complex decisions about what mode to use and how best to design multimodal configurations. Here I focus on an example of students' digital design of image and writing in a Year 7 English classroom. This discussion draws on video and observation of a lesson in which the students made a brochure about their secondary school to send to prospective students at local primary schools. The students worked in pairs and each pair designed a double page spread for the brochure using Microsoft Word and

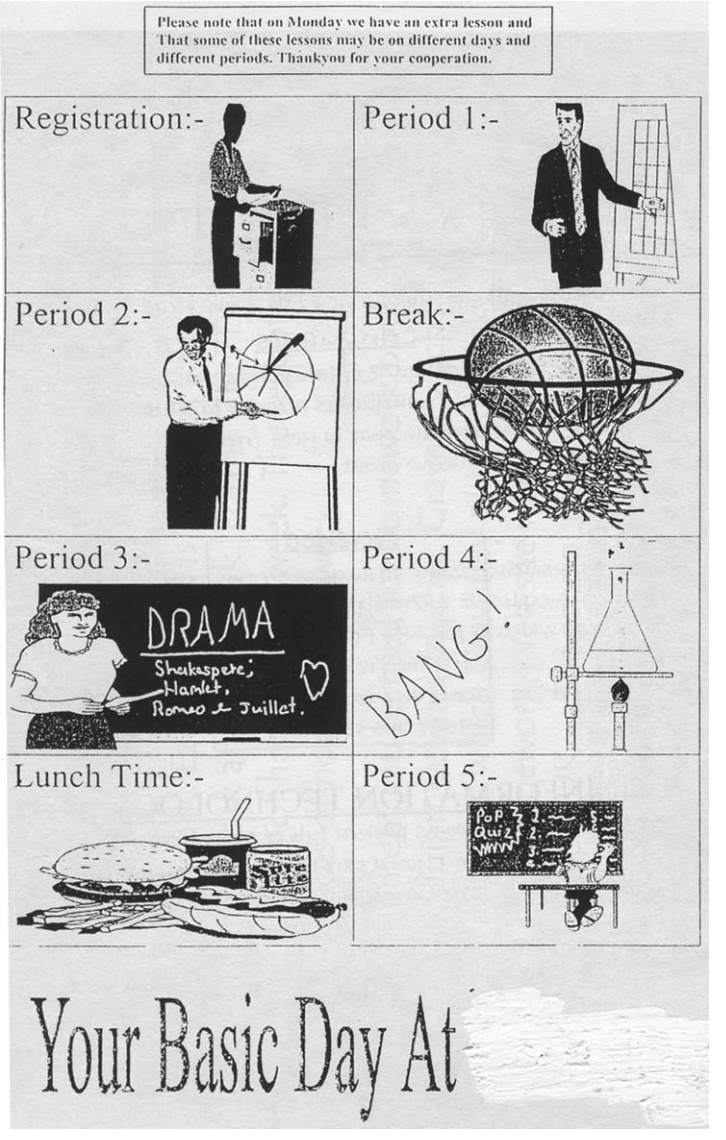

Figure 5. Page from student-made brochure *Your basic day at [school]*

digital cameras to produce the pages. Two of the final pages typical of the brochure are shown in Figures 5 and 6 (the name of the school has been deleted for anonymity).

The technology provided students with access to a range of images, including clip art, borders, word art, imported logos, digital photos, and downloaded images, as well as their own drawings made using Word Draw tools. Each of the spreads in the finished brochure is produced in a different font, from plain Courier to "ornate" Apple Chancery. Some students capitalized their written texts, others used bold or

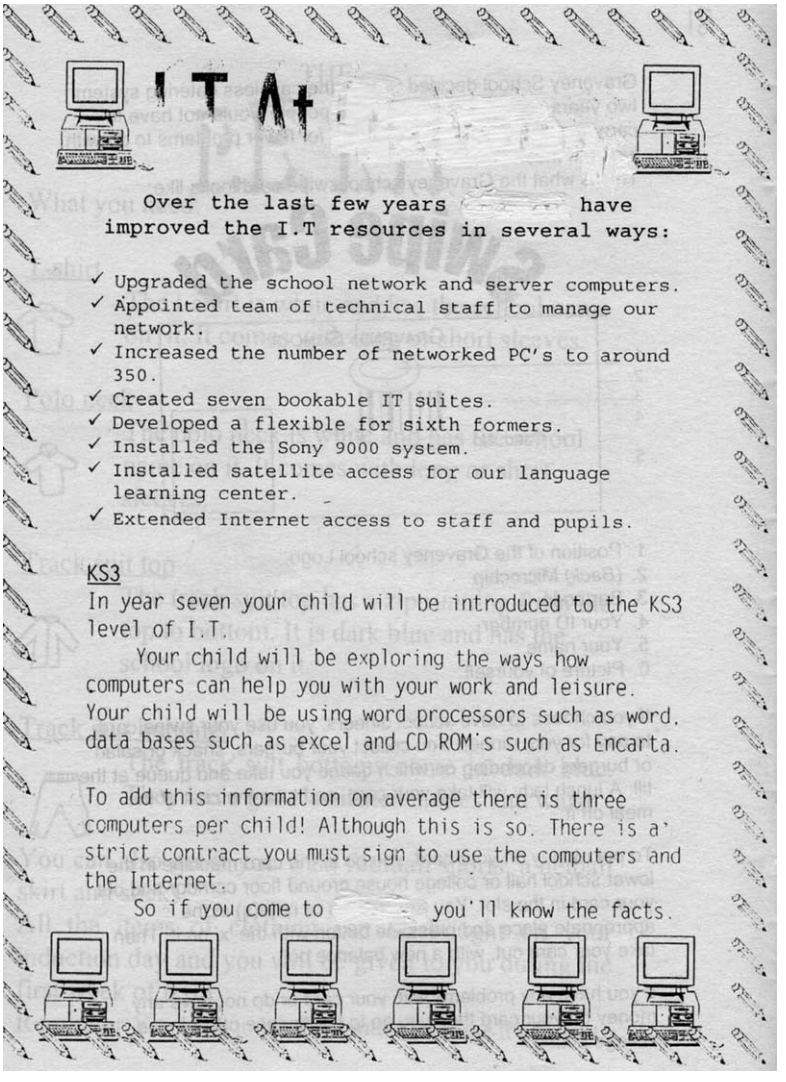

Figure 6. Page from student-made brochure *IT at [school]*

italic. Other students chose to use Word Art, complete with shadow and three-dimensional effects. The students appeared to use font as a resource with which to visually mark their individuality within the collective process of making the brochure, rather than the conventional use of font to mark coherence and a sense of audience, in which the individual is masked within the uniform character of the collective.

The facilities of word processing enabled the students to design and redesign their brochure pages, to wrap and unwrap the writing around images, to alter the page set-up from landscape to portrait and back again, to change the margins, to move between different font styles and sizes, to import and delete images, and so on. The

affordances of Microsoft Word enabled the students to manipulate and design the visual and written elements of their texts with ease. This highlighted the iterative work of design, selection, adaptation, viewing, and so on in which initial commitment was not required. In the process of making the pages the students were engaged in a series of decisions and negotiations. These included whether or not to use a border, what kind of border, whether to import images from "clip art" or to use "Word Art"; decisions about the use of "ready-made" versus "home-made" elements. The students had to compose the writing and decide how to arrange it and the other elements on the page. The students spent considerable time on the layout of their pages.

The students used tables, grids, and other "devices" in their design of the relationship between image and writing on the page. The use of a grid in the "Basic Day" text (Figure 5) both organizes the image and writing and provides a visual statement on the organization of time in the school as a regulatory grid for practices. The writing works as a uniform kind of label that equalizes the different periods and produces uniformity focused around time. The layout of the table, its symmetry, and the cells being the same size contribute to the text's representation of the school day as consisting of regularized chunks of time. The images distinguish between the periods by offering visually iconic content. The students used the visual resources that were easily available to them in the classroom, clip art. They adapted some of the images by adding writing. The images they selected from clip art present teaching and school as synonymous with business and a primarily didactic practice. People stand and point at boards. The students' use of images is imaginative and at the same time limited by the provenance of the images within clip art as an Office-based tool.

The students' choice of border in the text "IT at school" (Figure 6) is one of pencils poised to write, set around a horizontal border of images of computers that the students made from the clip art image of a computer. They experimented with different borders and settled on this one as they said when asked it is "about writing". In a sense their selection can be seen as a kind of visual classification of "technologies of writing" that realizes their main use of the computer in school to produce word processed texts.

Now I turn to the question of what the reconfiguration of image and word on screen described so far in this paper means for reading.

Reading as a Multimodal Practice

Recognising the multimodal character of texts, whether print-based or digital, impacts on conventional understandings of reading. Texts that rely primarily on writing can still "fit" with the concept of reading as engagement with word. What is ostensibly a monomodal written text offers the reader important visual information which is drawn into the process of reading. Reading is affected by the spatial organization and framing of writing on the page, the directionality, shape, size, and angle of a script (Kenner, 2004). In this way "different scripts can be seen as different

modes, giving rise to a variety of potentials for meaning-making" with different "representational principles" underlying each writing system (Kenner & Kress, 2003, p. 179). In other words, both writing and reading are multimodal activities.

The need to rethink reading (as well as conceptions of text) has not been confined to digital technologies or the screen. As I have mentioned earlier, there is always "slippage" and "connections" between the "old" and the "new". As a consequence, conceptions of reading across a variety of sites of display are in a process of change. The multimodal resources available to readers are central to rethinking what reading is and what it might become in a blended, digital communicational environment. Having said this, the "new" range and configurations of modes that digital technologies make available present different potentials for reading than print texts. These modal reconfigurations almost demand that the multimodal character of reading be attended to.

When comparing the experience of reading a printed novel or a digital text (a "novel as CD ROM" or internet novel) people often talk about what is "best". This comparison is in a sense a false one, as "new" technologies are usually blended with "old" technologies in the classroom; it is rare that a CD ROM actually replaces the original book. Rather than ask "what is best?", the book or the screen, I think it is more useful to ask what is "best" for what purpose. I find Kress's notion of semiotic losses and gains useful for thinking about this (Kress, 2003). This idea can be applied to the difference (the losses and gains) for reading in the shift from one media, the printed book, to another, the digital screen. Elsewhere, I have discussed students' reading of "a novel as CD ROM" and how this enabled the students to engage with the novel as "film", "comic", and "musical" (Jewitt, 2005). Here I discuss how these differences shape the practice of reading using an example of students reading of a CD ROM simulation in school science. The application *Multimedia science school* is multimodal and, as I have already mentioned, writing is restricted to minimal labelling. The students have to read colour, movement, and image in order to make sense of the concept "particles".

The application *Multimedia science school* uses image and colour to construct the entities "states of matter" (solid, liquid and gas) and "particles". On the CD ROM images are presented as evidence of the criterial aspects of "particles". The work of the students (in this example Year 7 students in a science classroom) is to "read" the meaning of these in order to construct the notion of particle. In order to "read" the images the students need to be able to understand what it is that they should attend to. They need to know what to select as relevant and important elements from the visual representation. The students that I observed and video recorded using the application were actively engaged with the visual resources of the CD ROM displayed on the screen.

At some points the visual resources of colour, texture, and shape used in the application appeared to stand in conflict with their everyday visual reading of the world. For some students there was a tension between the visual realization of the scientific theory and the everyday as it was shown in the CD ROM. This caused considerable confusion for students' reading and construction of particles.

An example of this is the students' reading of the simulation sequence showing the transformation from a solid to a liquid. Image, animated movement, and colour are designed to represent the arrangement of the "particles" in a solid and a liquid. The design is intended to show the animated particles overlaid on the water as an alternative representation of a liquid. During the lesson I noticed that several students interpreted the "particles" in the image as "a part of" a liquid (the water shown in the background). While working with the CD ROM one of the students, Lucy, commented that the particles were "held in the water like jelly". She did not understand the image of the particles as a representation of the water. Lucy did not distinguish between the visual resource of background or foreground (overlay). Instead, her construction of the entity "particle" is of something that "exists within" a liquid, a solid, or a gas rather than the particle as a thing that constitutes a liquid, solid, or gas.

Another problematic visual representation in the CD ROM is the transformation from a liquid to a solid. The use of colour in this sequence was the most problematic for some of the students to "read". The opening screen of the "liquid" to "solid" transformation shows a beaker inside another beaker. The outer one contains ice and the inner one contains water. The water is represented by a pale blue/white colour with reflective qualities. The writing on the "frame" of the screen clearly shows what it is that the students are looking at. Despite this clear label the students are confused about what they are looking at. The students do not "take up" the written information offered to them by the writing on the scientific "frame" of the CD ROM. Instead, they rely solely on image and colour to "read" the transformation. This is one example of the dominance of the visual mode and its impact on student reading. It is as if the conceptual "gap" between the writing on the "frame" and the image on the "screen within the screen" is just too great for the students to be able to make sense of. This difficulty appeared to be a consequence of a difference in the principles that students and the application designers used in relation to the use of the modal resources of colour, texture, and shape. The designers' principles clashed with the students' principles for understanding these resources. Students often privilege one mode over another when they read multimodal texts. In my view it is increasingly the case that readers, especially young readers and computer literate readers, privilege image and colour over writing when reading a multimodal text.

In the example of the transformation from a liquid to a solid the students "read" the visual representation of a liquid to "be a solid". This incident shows how students engage with the modal representations on the screen differently to make sense of a representation. It shows how students sometimes privilege or foreground some modes as being more "reliable" modes in their reading. The multimodal sequence is clearly labelled in writing in the "frame" as being the transformation of "liquid to solid". The "particles" are shown moving more freely and faster at the start of the sequence than they are in the final screen in which the "particles" move slower, "hardly at all", and are compactly arranged. The direction of the line plotted on the graph shows the temperature at the top of the graph as being "higher" than the temperature at the bottom of the graph. In other words, the directionality of the

graph represents a decrease in temperature. Even the students' talk demonstrates that they understand the substance is being cooled and the graph is showing a decrease in temperature. Despite all of this information, the students do not read the transformation as being one from a liquid to a solid. The prominence and high value of realism given to resources of image, colour, and texture override everything else that the students know. The designers produced a multimodal text; these students "read" it visually. This highlights the important role of the teacher in mediating the computer applications in the classroom. For example, the teacher could have utilized this reading as a useful point for the discussion of realism and the ways in which school science offers alternative ways of viewing and thinking about the world.

Along with the choice of what mode to "read", the structure of many digital texts opens up options about where to start reading a text—what reading path to take. This question is intrinsically linked to the central focus of this paper, i.e. how the relationship between image and writing changes both the shapes of knowledge and the practices of reading and writing. The design of modes often offers students different points of entry into a text, possible paths through a text and highlights the potential for readers to remake a text via their reading of it. The "reader" is involved in the task of finding and creating reading paths through the multimodal, multidirectional texts on the screen, a fluidity that is beginning to seep out onto the page of printed books (Kress, 2003; Moss, 2001). Writing, image, and other modes combine to convey multiple meanings and encourage the reader to reject a single interpretation and to hold possible multiple readings of a text (Coles & Hall, 2001). The multimodal character of the screen does not indicate a single entry point, a beginning, and an end, rather it indicates that texts are layered and offers multiple entry points. This offers the reader new potentials for reading a text and the design of the text through engagement with it. Reading a written text on a page is usually a linear event in which the author and illustrator guide the eye in a particular direction connected to the reading of a text.

It is certainly the case that multiple reading paths are always a part of the repertoire of an experienced reader (Coles & Hall, 2001). Multimodal texts of the screen redefine the work of the reader who has to work to construct a narrative or assert her or his own meanings via their path through a text. Some have proclaimed that linear narrative is dead and others claim it never lived. I think narratives "live on" in different ways across a range of media. Having said that, I think the facilities of new technologies make non-linear narrative more possible than the printed page does. The design of some children's books (such as *The jolly pocket postman*, Ahlberg & Ahlberg, 1995) and many magazines aimed at young people serves to fragment the notion of linear narrative and to encourage readers to see themselves as writers. In doing so, these texts "undo" the literary forms of closure and narrative. However, the potential for movement and closure through the screen texts is fundamentally different from the majority of classic book-based literary forms and offers the reader the potential to create (however partially) the text being read. The question is not what kind of narrative is best, but what can be done (meant) with the resources that different types of narrative make available. It is a question of what kinds of narrative

best fit with the facilities of different media for particular purposes and what role image and writing have in configuring this.

Concluding Comments

Despite the multimodal character of screen-based texts and the process of text design and production, reading educational policy and assessment continue to promote a linguistic view of literacy and a linear view of reading. This fails to connect the kinds of literacy required in the school with the "out-of-school worlds" of most people. The government's National Literacy Strategy (Department for Education and Skills, 1998) for England is one such policy. It is informed by a linguistic and print-based conceptualization of literacy in which the focus is on "word", sentence, and text. At the same time, governments' strategies herald the power of new technologies to change everything. The multimodal character of new technologies produces a tension for traditional conceptions of literacy that maintain written language at their centre.

Traditional forms of assessment continue to place an emphasis on students' handwriting and spelling, skills that the facilities of computers make differently relevant for learning. At the same time, assessment fails to credit the acquisition of new skills that new technologies demand of students, such as finding, selecting, processing, and presenting information from the internet and other sources (Somekh et al., 2001). I want to suggest that the multimodal character and facilities of new technology require that traditional (print-based) concepts of literacy be reshaped. What it means to be literate in the digital era of the 21st century is different than what was needed previously (Gardener, 2000). If school literacy is to be relevant to the demands of the multimodal environment of the larger world it must move away from the reduction of literacy to "a static series of technical skills" or risk "fostering a population of functional illiterates" (McClay, 2002). In short, school literacy needs to be expanded to reflect the semiotic systems that young people use (Unsworth, 2001; Jewitt, 2005).

Note

1. This discussion is based on video recordings and observation of the use of the CD ROM *Of mice and men* over a series of five Year 9 English lessons in a London school.

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