IMAGE/TEXT RELATIONS AND INTERSEMIOSIS: TOWARDS MULTIMODAL TEXT DESCRIPTION FOR MULTILITERACIES EDUCATION

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ABSTRACT: *The literacies needed in this multimedia information age must embrace both images and the printed word in electronic and traditional media. Today both language and images are integral to the texts we use. As well as making meanings separately, language and images combine to make meanings in new ways in contemporary texts. A functional semiotic theory of the ways images and language interact to make meanings can provide a metalanguage for literacy education that takes into account the multimodal forms of contemporary texts. This presentation draws on two large on-going Australian Government funded research projects in which the author is a chief investigator, to describe emerging functional semiotic accounts of image/text relations and their implications for approaches to multimodal literacy education.*

1. Introduction

It is now widely accepted that literacy and literacy pedagogy can no longer be confined to the realm of language alone, and that reconceptualizing literacy and literacy education needs to account for the role of images (as well as other modes of meaning-making) in paper and electronic media texts. In Australia and in the United Kingdom substantial curriculum support documents and appendices to syllabi for government schools routinely include quite detailed technical accounts of (usually traditional) grammatical concepts to facilitate teachers' and students' explicit use of this metalanguage (Education, 1995; NewSouthWalesBoardofStudies, 1998). No such comparable accounts of a metalanguage describing the meaning-making resources of images and image/text interaction accompany these government school curriculum documents and syllabi. Faced with the requirement to address the multimodality of texts, the prescription of verbal grammar, and the absence in syllabi of comparably theorized descriptions of the meaning-making resources of images, some teacher educators and teachers have made use of the 'grammar of visual design' developed by Kress and van Leeuwen (1996) extrapolating from systemic functional linguistic (SFL) accounts of language. The commonality of the systemic

functional theoretical approach to language and image as social semiotic systems facilitates an articulation of visual and verbal grammar as descriptive and analytical resources in developing students' comprehension and composition of multimodal texts. However, beyond accounting for the independent, albeit sometimes strategically aligned, contributions of language and image to the meaning of composite texts, is the challenge of systematically theorising and describing resources for the construction of meaning at the intersection of language and image. The purpose of this paper is to outline some of the recent work addressing this challenge, and in so doing to indicate the pedagogic utility of formulating such a metalanguage of image/verbiage interaction.

The focus will be on the interaction of language and images in school science materials in the form of books and websites, and the discussion will be confined to the intermodal construction of ideational meaning. I shall draw on work done by my colleague Dr Chris Cleirigh as part of our Australian Research Council funded project with Jim Martin and Clare Painter, which is designed to describe emerging functional semiotic accounts of image/text relations and their implications for approaches to multimodal literacy education. I shall also refer to a recent study of Brazilian school science textbooks by Lilian Pozzer-Ardenghi and her colleagues (Roth *et al.*, 2005) and include some discussion of the account of image-text relations by Martinec and Salway (2005).

To contextualize the work to be presented in this paper, the next section will briefly note the increasing role of images in school science materials, the continuing problematic nature of some of these images, and the need for students' critical reading to extend to images. The following section will note earlier indications of 'mode specialization' in the role of image and verbiage in school science materials and the need for a more comprehensive account of image/verbiage interaction in the construction of ideational meaning. Then I shall describe some aspects of our current exploration of intermodal meaning-making in school science materials, discussing issues in our own work as well as issues arising from some other related work. Finally, I shall note implications for an agenda of ongoing research in image/verbiage interaction and for the development of a pedagogy of multiliteracies in school science education.

2. The increasing role of images and the need for critical visual literacy in school science texts

The latter part for the twentieth, and the early part of the twenty-first century has seen a significant shift to the prominence of images in school science textbooks (Kress, 1997; Kress & vanLeeuwen, 1995) and particularly in science books for children in the pre-teenage years (Parkinson & Adendorff, 2005). Typically in such books the double page layout is used and the images occupy a very significant portion of this as illustrated in Figure 1.
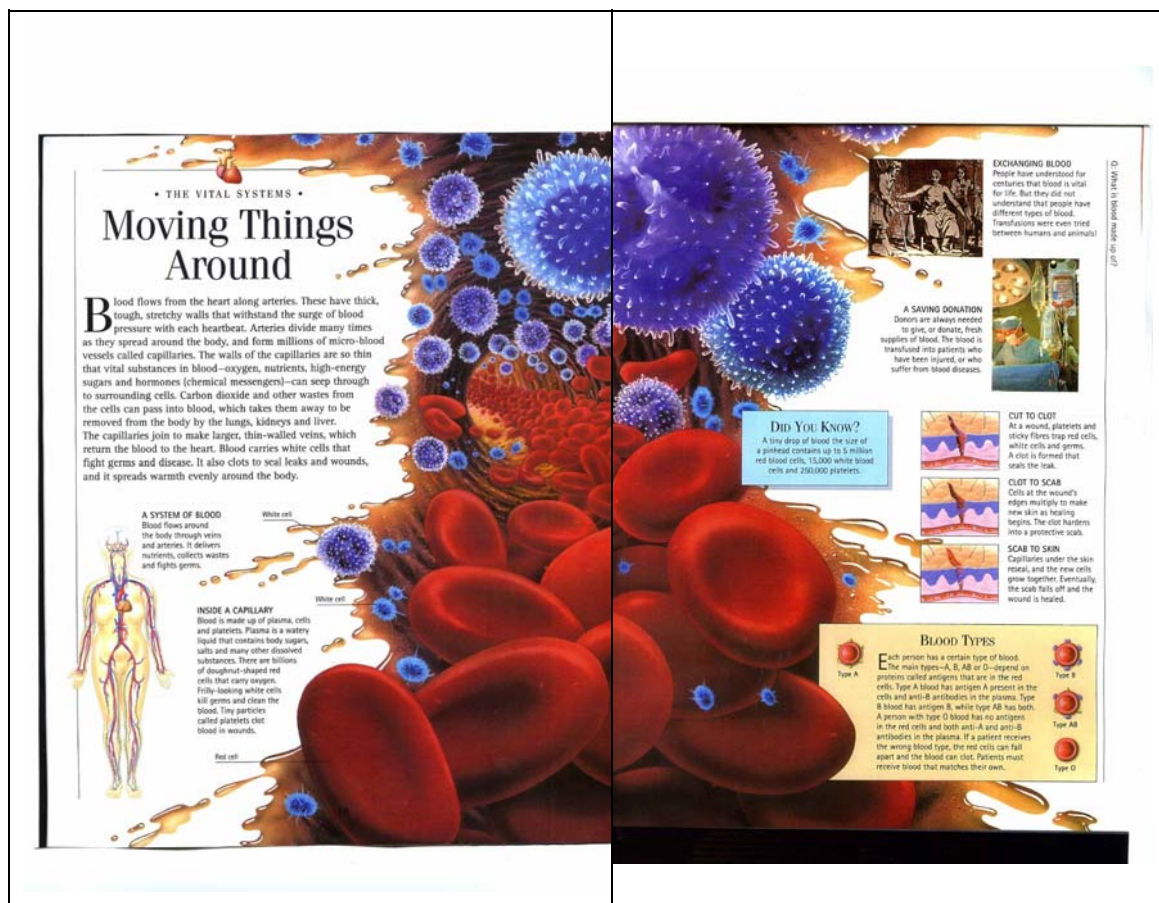

Figure 1 Double page spread in a science information book for young readers (Parker, 1999)

A similarly prominent role for images can be seen in the double page spread shown in Figure 2.
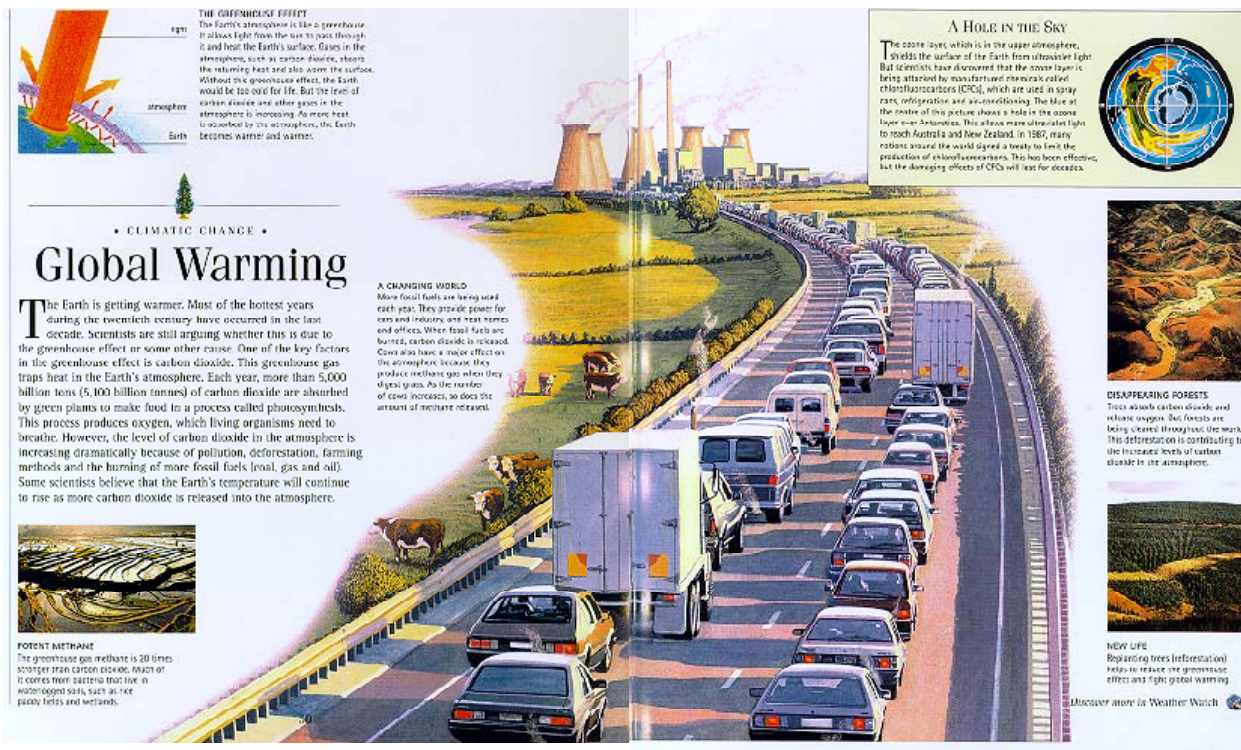
Figure 2 Prominence of images in science books for children (Ellyard, 1996)

This image is far from ideationally 'innocent'. As well as ostensibly constructing a narrative image of events in the central image, there are symbolic dimensions of significant ideological import. One might notice for example that the freeway appears to lead in one direction only (towards the polluting chimney stacks of industrialization) and there is no sign of any provision for traffic travelling in the opposite direction. Close inspection of the image indicates that the registration plate of the car in the immediate foreground is unable to be read, and yet the exhaust fumes of cars several vehicles further along the road are clearly visible. Such images in school science materials warrant critical interpretive scrutiny by students, yet as Roth and his colleagues note "… students generally neither receive instruction in critical analysis of photographs nor are provided with opportunities for participating in the associated practices" (Roth et al., 2005).

Critical interpretive capacity is also essential for students to be able to deal with the unfortunately not infrequent occurrence of images that obfuscate the ideational meanings at stake. Such images seem to occur

in materials apparently prepared by those with expertise in science education. For example Figure 3 is one page from a test booklet used in a written science test undertaken by all students in government schools in one Australian State in 2005.
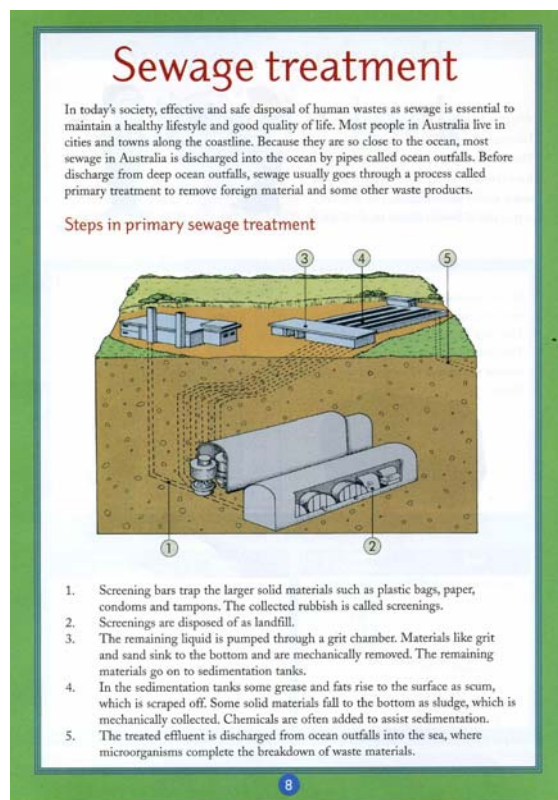

Figure 3 Essential Secondary Science Assessment – 'Sewage treatments' (NewSouthWalesDepartmentOfEducationAndTraining, 2005)

One might assume that the lower part of the image indicates that this section of the sewage treatment plant is located underground, and apparently some distance away from the surface sections of the plant. The numerals on the image relate to the segments of the main text below the image. Perhaps the dotted lines on the image represent pipes, although it is not possible to confirm this from the image or the main text (dotted lines do not seem to be a commonly accepted diagrammatic means of representing pipes). It is very difficult to understand what 'screening bars' in section 1 refers to, where they are located, and if located at the point indicated in the diagram, how would the solid materials "such as plastic bags, paper, condoms and tampons" be removed. Then if we look at number 2 on the diagram, this corresponds

to the main text information that such "screenings" are disposed of as landfill. But the diagram simply locates a section of plant apparently far underground with no indication in the diagram of the main text as to how such items could be transported as landfill.   The instructions for completing this test require students to "read the texts in the magazine and then answer the questions". The students are also advised that

> "In this test, the questions may ask for information located in the magazine. However, many questions will require you to answer using your own knowledge or understanding of science."

But student are not told when reading the magazine texts are relevant to the questions. In the case of Figure 3, none of the test questions require a reading of the magazine text.   This means if students follow test instructions they may well spend some time trying to negotiate highly problematic image/verbiage relations to no avail and of no relevance to the questions they are required to answer. Nor is this an isolated case. Figure 4 is another page from the same test booklet.
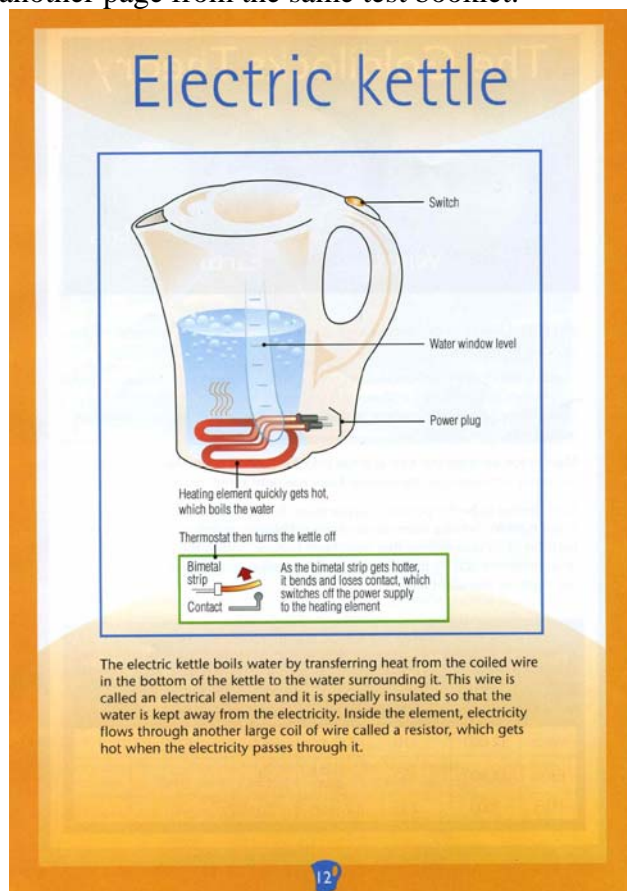

Figure 3 Essential Secondary Science Assessment – 'Electric kettle' (NewSouthWalesDepartmentOfEducationAndTraining, 2005)

The section at the bottom of the diagram framed in blue deals with the thermostat and is framed in green. There is no indication in the diagram of the kettle as to where the thermostat is located and nor is there any mention of the thermostat in the main text. Again, this turns out to be immaterial to the questions the students are required to answer.

Previous studies have noted the difficulty students experience in interpreting images in science texts (Henderson, 1999) and the confusing nature of some images such as those discussed above (Unsworth, 1992). More recently attention has been drawn to interpreting the interactive role of image and verbiage as part of the routine repertoire of literacy practices required in constructing meaning in school science materials (Kress, 1997, 2003a; Lemke, 1998a, 1998b, 2002; Unsworth, 1997, 1999, 2004).

3. "Mode specialization" and partial accounts of image/verbiage relations in school science texts

Kress, (1997, 2000a, 2003a, 2003b) and Lemke (1998b) have explicated what they call the 'functional specialization' of language and image. According to this specialization principle the resources of language are most apposite to the representation of sequential relations and the making of categorical distinctions, while the resources of images are most apposite to the representation of spatial relations and for formulating

> … degree, quantity, gradation, continuous change, continuous co-variation, non-integer ratios, varying proportionality, complex topological relations of relative nearness or connectedness, or non-linear relationships and dynamical emergence…(Lemke, 1998b, p.87)

Lemke provides a detailed discussion of the meaning-making resources of a scientific article that includes diagram and text, but this does not amount to a framework of intersemiotic relations that would explicate the kinds of linkages between images and verbiage.

Kress (1997, 2000a, 2003a, 2003b) has exemplified the functional specialization principle. His analysis of a textbook page dealing with 'electronics' shows that …

> The language is about events: relatively simple sentences (one or two clauses), which are about actions – what had been done; what is to be done; what might happen if… The diagrams represent the core information of this bit of the curriculum: what a circuit consists of, and in what relation its components stand to each other (Kress, 2000b, p.197).

But the discursive accounts provided by Kress in a number of papers use the same example of a page from a book dealing with electronics and do not develop a system of intersemiotic relations. In addition, it should be noted that the interaction of language and image is not restricted to the areas of representation indicated by the functional specialization principle, as indicated in the more pedagogically oriented approach to intermodal analysis by Roth and his colleagues (Roth et al., 2005).

One key element of the analyses of the Brazilian school science textbooks by Roth and colleagues (Roth et al., 2005) focuses on the role of photographs and argues that there are four functions relating photographs and their captions to the main text – the *decorative*, *illustrative*, *explanatory* and *complementary* functions. The *decorative* function refers to images that are frequently placed at the beginning of a chapter, do not include a caption and are not referenced in the main text. This function is seems quite clear and, from a systemic functional perspective, may be more interpersonally than ideationally oriented, included to engage the reader interactively or through some aspect of appraisal. The discussion of the *illustrative* function begins to raise concerns about the broad categories used in the analyses. One of these is that the analysis seems to deal with the relationship of the caption text to the main text rather than examining the role of the image to the verbiage of the caption and/or the main text. Hence the illustrative function is said to apply when photographs include "a caption that names or describes what the reader is to see … but does not provide additional information to the main text" (p.93). If the function was, in fact, to refer to image/verbiage relations, the illustrative function might refer to the image exemplifying what is in the verbiage (of the caption in this case) or it might be a relation of 'exposition', where the image re-expresses in a different modality what is in the image. Both exemplification and exposition therefore could entail naming or describing what the reader is to see in the image, and may be highly utilitarian in understanding the text, but in the Roth study the illustrative function seems to be regarded as being of less import since the reader is still able to understand the

concept treated in the text "without the information provided by this photograph and caption (p. 94)".

In the *explanatory* function a similar emphasis is on the role of captions "that provide an explanation or classification of what is represented in the photographs" (p.94). In fact, classification is very different from explanation, and the only example provided for this category is one of classification in which the caption "Aspects of a forest: A climax community" …. "is *marked* as an example of a climax community (p.94)". This will be discussed further under our category of *Exemplification* in the next section of the paper - "Describing the inter-modal construction of ideational meaning in school science materials". The final of the four categories in the Roth et al study (Roth et al., 2005) is the *complementary* function. This also deals with the relationship between the caption and the main text rather than image/verbiage relations. As the authors point out, the first section of the caption names the fish in the image as an example of abyssal fish. Then they indicate…

> The remainder of the caption provides propositions with content not made available in the main text, and therefore we classify this photograph-caption ensemble as complementary (p.98).

Although the Roth et al study (Roth et al., 2005) is very useful in drawing attention to the need for a multimodal conceptualization of reading comprehension of science text books, it does not provide a sufficiently precise intersemiotic framework dealing with "… the function of photographs and their relation to captions and texts…(p.83)". As noted above, Kress (1997, 2000a, 2003a, 2003b) and Lemke (1998b) have drawn attention to a "functional specialization" principle in relation to the role of images and verbiage in science texts, but again have not explicated an intersemiotic framework of image/verbiage relations. Martinec and Salway (2005) did not focus on science materials, but rather on advertisements and online news sites and galleries, proposing "A system for image-text relations in new (and old) media". This is an attempt to specify a system of logico-semantic relations between images and text, which usefully describes some image-text relations in the "contemporary image-text combinations" that were analysed, but is a long way from the robustness required for more generalized application. What is presented in the next section then, are some very tentative indications from work in progress exploring the nature of image-verbiage interaction in the construction of ideational meaning in school science materials in book and electronic media.

4. Describing the inter-modal construction of ideational meaning in school science materials

What is being investigated here is the space of integration between language and image as social semiotic systems in order to provide a theoretical description of the dynamics of interaction between language and image in meaning making (Lim, 2004). Like Martinec and Salway (2005) we have derived our initial framework from Halliday's (2004) account of logico-semantic relations, which he has shown to recur throughout the grammar and which Martin (1992) has extended to model relations between discourse units. Our very tentative framework is the subject of ongoing work and is summarized in its present form in the network shown in Figure 4.

The content plane unit of analysis can be proposed to consist of an image (simplex or complex) and all the verbiage related to it by content. In the case of ideational meaning, a unit comprises an image and all the verbiage related to it by ideational content. However, such units are not linear, like writing (or speech), where the sequence of meaning-making created by the producer is the sequence of meaning-making experienced by the reader (or listener). Instead, the multidimensionality of the two modalities — verbiage as 1-D on a 2-D page, image as 2-D or more on a 2-D page — allows the reader to make multiple passes between the image and its related verbiage, in a way that is probabilistically related to the sequencing of meaning by the producer.

Thus, an intermodal unit of analysis consists of all the intermodal cycles that a reader can make between an image and its related text. There may be multiple *recursive* 'intermodal passes' made between verbiage and image for a given unit of analysis — one pass for each of the simultaneous systems in the network that represents the potential intermodal relations for the unit of analysis.
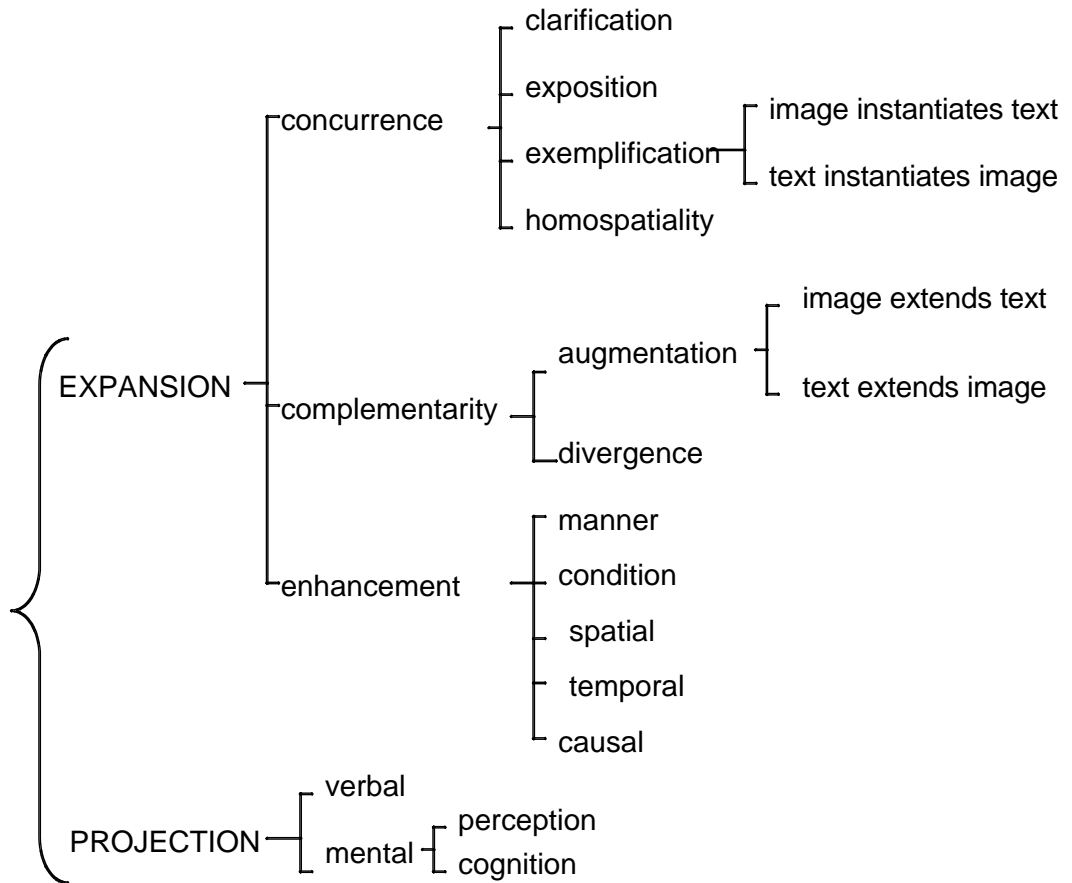
Figure 4. Towards a framework of image-language relations in the construction of ideational meaning

Within EXPANSION we have distinguished *concurrence*, *complementarity* and *enhancement*. Ideational concurrence was described by Gill (2002) in a study of image/text relations in picture storybooks for young children. Concurrence referred to ideational equivalence between image and text. This image-text concurrence we have described more delicately in terms of four subcategories: *Clarification* can be glossed as 'viz', 'to be precise' since the image clarifies or explains the text. *Exposition* refers to the re-expression of the meanings of the image or the text in the alternative mode. In *exemplification* the image may be an example or instance of what is in the text or the text may include an example of what is depicted more generally in the image. The phenomenon of *homospatiality*, discussed by Lim (2004), refers to texts where two different semiotic modes co-

occur in one spatially bonded homogenous entity. It might be thought of as words being able to be construed simultaneously as words and as images of the meanings realized by those words – word-pictures.

Complementarity includes *augmentation* and *divergence*. *Augmentation* may involve an image extending or adding new meanings to those realized by the text or the text extending the meanings realized in the image. *Divergence* is where the ideational content of text and image are at variance.

Enhancement remains problematic for us. In our data to date we have identified examples of condition and manner, which we will illustrate in the section dealing with enhancement below. Martinec and Salway (2005) identified enhancement relations of place, time and cause. Their example of causal relations clearly shows the image providing the reason for the proposition contained in the verbiage, but in the case of enhancement by time, the time reference was in the caption accompanying the image and in the case of 'place' the enhancement was achieved by the name of the town in verbiage within the image. So what is not made clear is whether all categories of enhancement can be either image enhancing text or text enhancing image.

Projection also remains an area that requires much more work and in this paper I shall simply indicate alignments between our data and previous work and indicate issues that we need to pursue further. The following discussion deals with examples of the intersemiotic relations constructing ideational meanings, which we have found in school science data to date.

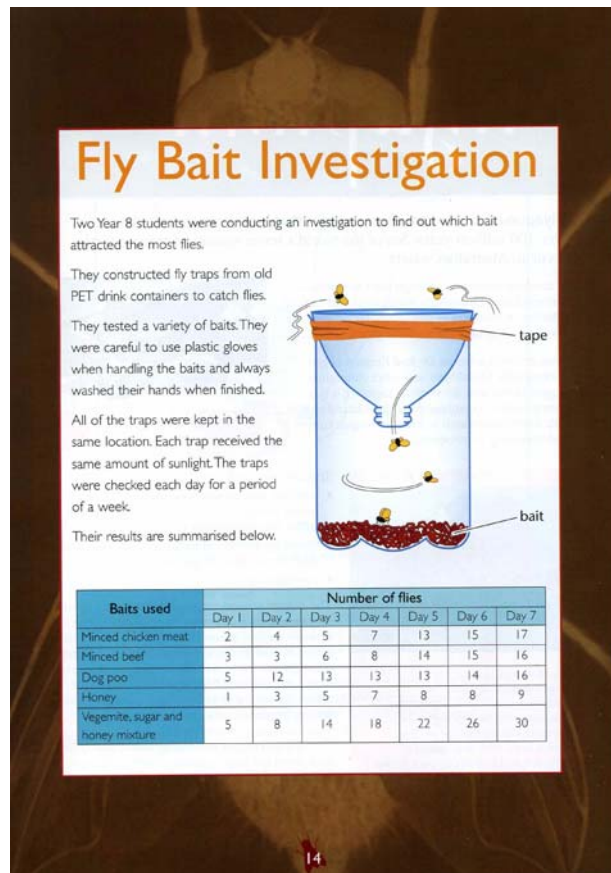Ideational Concurrence
Clarification

Figure 5. Image clarifies text
(NewSouthWalesDepartmentOfEducationAndTraining, 2005)

In the verbiage in Figure 5 the information about fly traps is simply "…
constructed fly traps from old PET drink containers to catch flies." The
nature of the trap and how it catches flies are clarified by the image.

Exposition
Although Martinec and Salway (2005) do not use the category
concurrence, they describe one such type of image-text relations as
'exposition' – 'where the image and the text are of the same level of
generality'(Martinec & Salway, 2005:350).   Their example is the
relation between an image and its caption "Light micrograph of a bone.'
(Martinec & Salway, 2005:362). We have emphasized the concurrence
or equivalence of the meanings represented in the different modes. On

this basis we would classify as exposition the relation between the image and the caption text in Figure 6 quoted from the study of Brazilian school science books (Roth et al., 2005).

88   Chapter 4

Fig. 577. The European partridge, during the winter, shows white plumage, blending with the snow. At the end of the winter, it starts to change its plumage, and acquires a coloration that blends with the dry vegetation where it lives. This is a good example of *camouflage*.

Figure 6 Image-Caption related by exposition (Roth et al., 2005)

Pozzer-Ardenghi and her colleagues (Roth et al., 2005) point out that the European partridge is not mentioned in the main text and hence the image/caption combination is *complementary* to the main text, providing additional information, but the image/text relation between the caption and the image sequence in our framework is exposition.

A less straight-forward example is shown in Figure 7, which is a page from the science book for young children entitled "Sight" (Woodward, 2005).   Here the image functions as an alternative realization of the meanings of the verbiage:

> The purple lines may look as if they are bendy….
> …. they are straight.
> Your eyes have been tricked by the round, black spot and the thin, black lines.

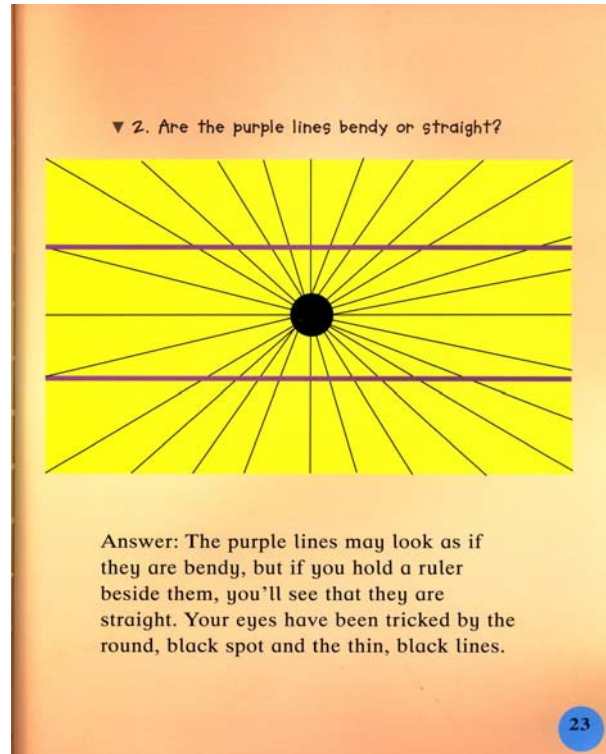At this stage we have regarded these image-language relations as exposition also.

Figure 7 Image-Language relations as exposition (Woodward, 2005)

In Figure 8 also from the "Sight" book, the relation between the image and the caption is one we have classified as exposition (although perhaps "looking for food" is not explicitly realized in the image). However, the relation between this image and main text is one of Complementarity: augmentation: text extends image.
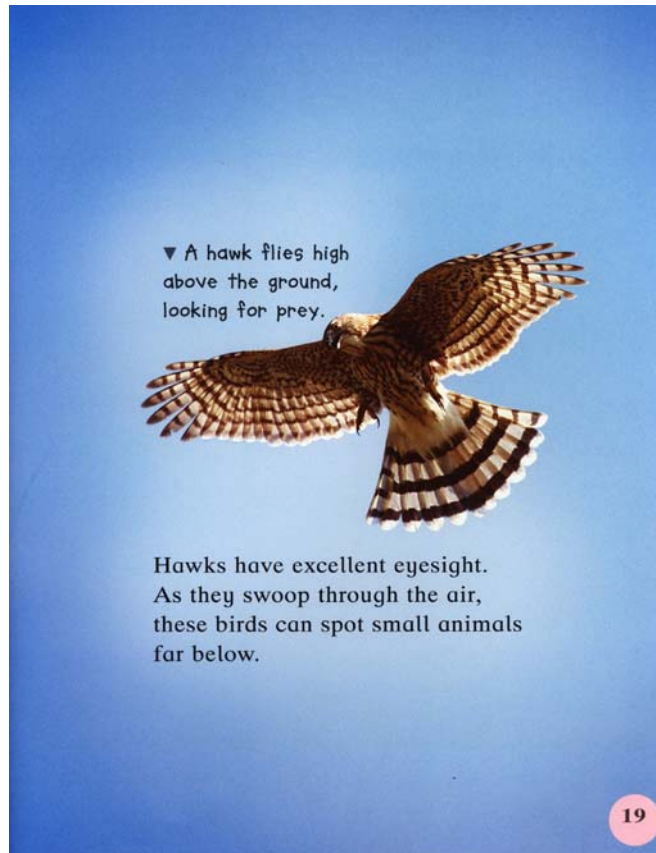
Figure 8 Multiple image-language relations in one image page layout (Woodward, 2005)

Exposition may also apply to relations between single entities represented both visually and verbally. For example, this can be seen in the image of the aguape plant and the accompanying caption in Figure 9 quoted from the Brazilian science textbook study.

Photographs in Biology Texts   93

Fig. 4.3 Photograph of plants of aguapé in blossom.

Figure 9 Exposition between whole image and verbiage element (Roth et al., 2005)

Exemplification

The Martinec and Salway (2005) work on news websites, textbooks and advertisements identifies 'exemplification', which we have listed as a form of ideational concurrence. This relation obtains when either the image or the text is more general.

One example of Exemplification: Text more general from the Brazilian science text books study (Roth et al., 2005) is shown in Figure 10. The main text discusses ecological succession resulting in a climax community (97) and hence the relationship between the image and the caption is one of the image of the rainforest exemplifying the category of 'climax community' in the caption.

96   Chapter 4

Fig. 84.1- Aspect of a forest: climax community.

Figure 10 Exemplification: text more general (Roth et al., 2005)

A simpler example can be seen the page from the "Sight" book shown in Figure 11. The image is an example of a spider with eight eyes as noted in generic terms in the main text "Spiders have eight eyes".
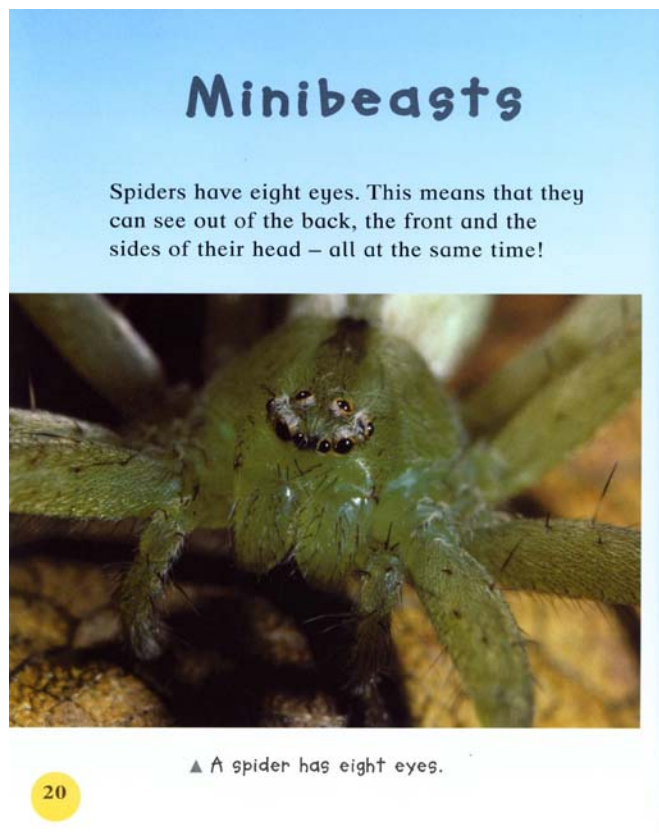
Figure 11. Exemplification: text more general (Woodward, 2005)

The example of the image being more general provided by Martinec and Salway (2005) is a skull and crossbones image with the caption 'Kills by biting prey with jagged teeth.' This refers to the moray eel's method of killing its prey as described in the CD ROM "Dangerous Creatures".

Homospatiality

A further means by which ideational concurrence is achieved inter-modally is perhaps the most immediately arresting to the reader/viewer. This is the phenomenon of 'homospatiality', discussed by Lim (2004), and refers to texts where two different semiotic modes co-occur in one spatially bonded homogenous entity. One example shows the linguistic representation, 'snaaap', which visually appears with the 'sna' segment forming one arm of an inverted 'v' shape and the 'aap' segment forming the other arm, so that it appears that the word itself has 'snapped', as indicated in Figure 12.

Figure 12. Homospatiality: 'Snaaap' (2004),

Another example shows an image of a campfire with the heat arising from the fire represented by curved lines, which can be read to spell the word 'hot' (Figure 13).
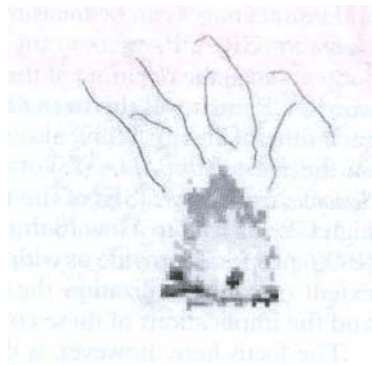

Figure 13. Homospatiality: 'hot'

Ideational concurrence then, is consistent with Lemke's (2002) notion of the multiplicative nature of the meaning-making capacity of multimodal texts being the logical product of the capacities of the constituent semiotic systems.   In other words the visual-verbal interface is synergistic, producing a total effect that is greater than the sum of the contributions of each modality (Royce, 1998). At this point we could summarize our partial framework for understanding the construction of ideational meaning at the intersection of language and image as a set of semantic options for intermodal relations as indicated in Figure 14.
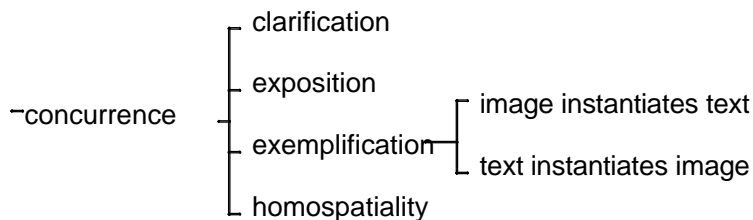
clarification

exposition

concurrence

exemplification

image instantiates text

text instantiates image

homospatiality

Figure 14. Ideational Concurrence

Ideational Complementarity

Ideational complementarity refers to the situation in multimodal texts where what is represented in images and what is represented in language may be different but complementary, and joint contributors to an overall meaning that is more than the meanings conveyed by the separate modes.

Augmentation – text extends image
One type of ideational complementarity is *augmentation* – where each of the modes provides meanings additional to and consistent with those provided in the other mode. Martinec and Salway (2005) refer to this as 'extension', but provide only examples that indicate the text adding to the meaning of the images. One example of the text extending the image is in the greenhouse effect section of the USA Today website (http://www.usatoday.com/weather/tg/wghwrmng/wghwrmng.htm), shown in Figure 15.
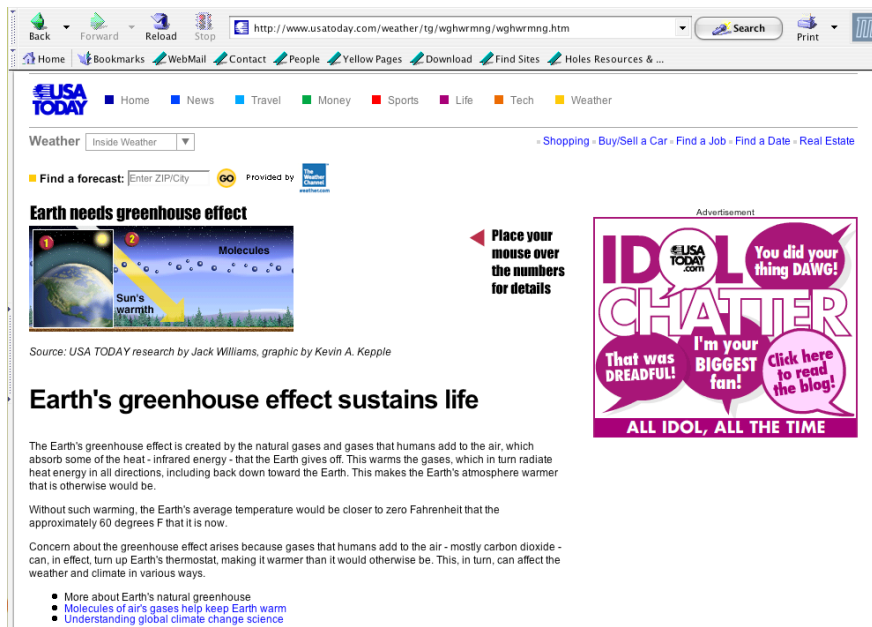
Figure 15. USA Today website on the greenhouse effect

Following the instructions and moving the mouse over the Figure two reveals the image and caption shown by the screen shot depicted in Figure 16. The dynamic aspect of this website animation cannot be shown here but it depicts yellow lines with arrowheads arising from the surface of the Earth. Some of these are reflected back to Earth and some continue into space, as indicated in Figure 16. Nevertheless, even with the animation the text extends the meanings by discussing the absorption of the energy by the atmospheric gases and the release of this radiation in all directions.

Figure 16. Dynamic representation of the greenhouse effect on USA Today website

Augmentation – Image extends text
In a study comparing school science explanations in books on CD ROMs and on the World Wide Web (Unsworth, 2004) in terms of the relationships between illustrations and the main text, data for the image-text relation of extension included instances where the image extended the meanings of the text. In the diagram showing the water cycle in the Baines (1991) trade book (shown in Figure 17) there is a lot of re-statement of the main text (shown in Figure 18). But as well as this, there is the extension commentary that *'snow and ice melt and water runs into rivers'*, which is not mentioned in the main text, and also further specification of information from the main text. For example, in clauses three to eight the absorption of evaporated moisture in the air, its movement and eventual precipitation is described without any mention of 'clouds'. It is in the diagram that the formation and transport of clouds and precipitation from them are specified
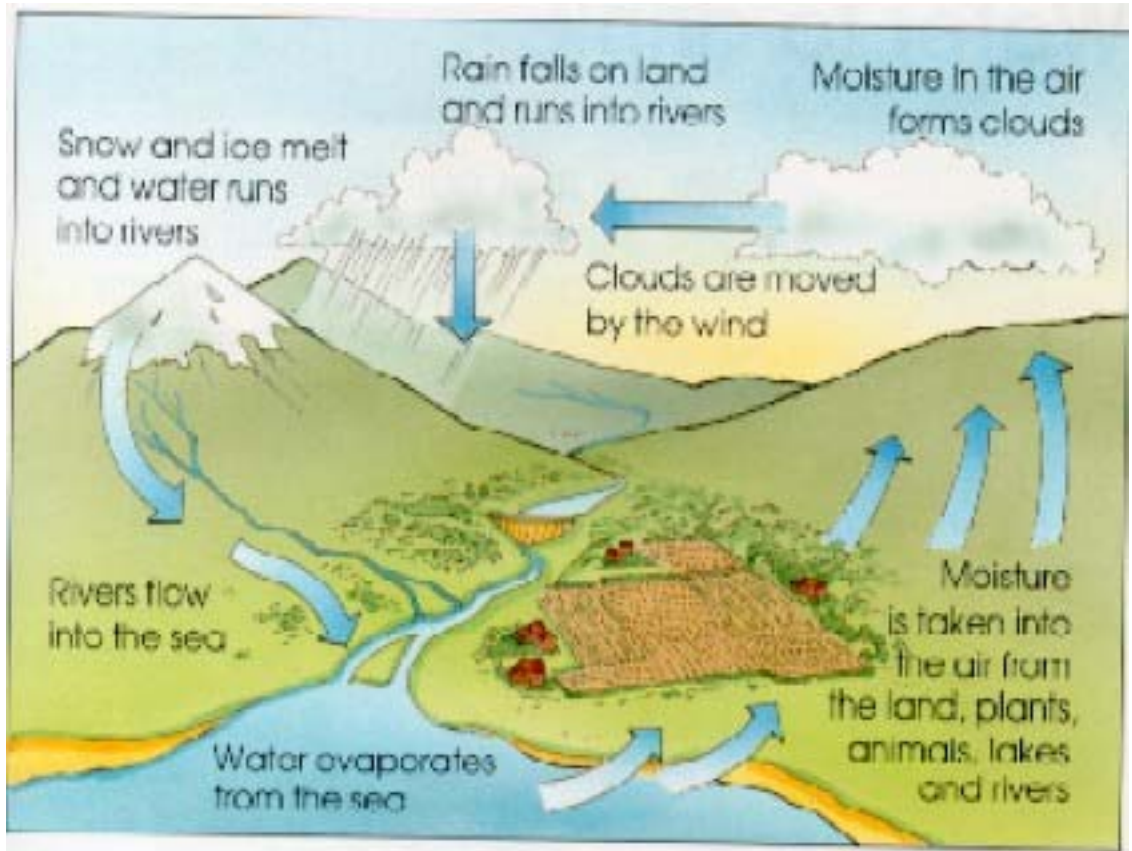
Figure 17. The Water Cycle (Baines, 1991)

01 Rainfall comes from moisture in the air.
02 The moisture gets into the air from puddles,
     lakes, rivers, the soil, plants, animals and the
     sea.
03 Water evaporates
04 and is absorbed by the air.
05 The air moves over the Earth as the wind
06 and carries the moisture with it.
07 When the air cannot hold any more moisture,
08 it drops as rain, snow or mist.
09 Some falls on the oceans.
10 Some falls on the land
11 and soaks into the ground
12 or flows into streams and rivers.

Figure 18. Text of the water cycle explanation (Baines, 1991)

A further example of the image augmenting the text is seen in Figure 19.

THE GREENHOUSE EFFECT
The Earth's atmosphere is like a greenhouse. It allows light from the sun to pass through it and heat the Earth's surface. Gases in the atmosphere, such as carbon dioxide, absorb the returning heat and also warm the surface. Without this greenhouse effect, the Earth would be too cold for life. But the level of carbon dioxide and other gases in the atmosphere is increasing. As more heat is absorbed by the atmosphere, the Earth becomes warmer and warmer.
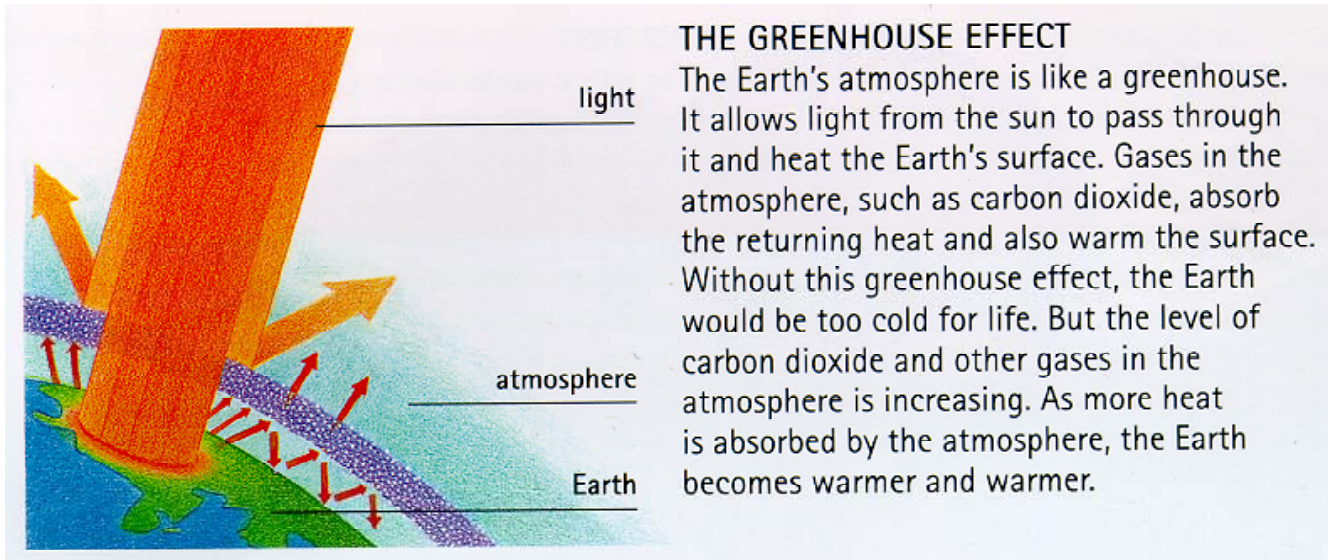
light

atmosphere

Earth

Figure 19. Explanation of the greenhouse effect (Ellyard, 1996)

In the diagram in Figure 19 the broad arrows pointing diagonally out into space are not explained in the main text. In fact these indicate that some of the energy from the sun directed toward the earth is in effect 'reflected' back into space by the Earth's atmosphere. The two narrower parallel arrows pointing into space are also not mentioned in the main text. In fact these indicate that the gases in the atmosphere absorb the energy re-radiated from the Earth and release it all directions, including back towards the Earth.

Divergence
Another form of Ideational Complementarity is *Divergence*, where the ideational content of text and image are at variance. Ideational divergence does not seem to have figured in the research dealing with intersemiotic concurrence and complementarity, and it is not mentioned in the system for image-text relations proposed by Martenic and Salway (2005). Nevertheless, it is clearly important in children's literary picture books. For example, in the 'Shirley' books by John Burningham (1977; Burningham, 1978) the text and images of Shirley's parents convey a narrative of a typical beach visit or of a child taking a bath, while the images of Shirley depict her participation in exciting adventures such her

encounter with pirates. Similarly McCloud (1994) has drawn attention to the role of ideational divergence in the narrative art of comic books with his category of image/text relations he refers to as 'parallel combinations' where 'words and pictures seem to follow very different courses – without intersecting'(McCloud, 1994:154).   An example of Divergence in school science material is shown in Figure 20.
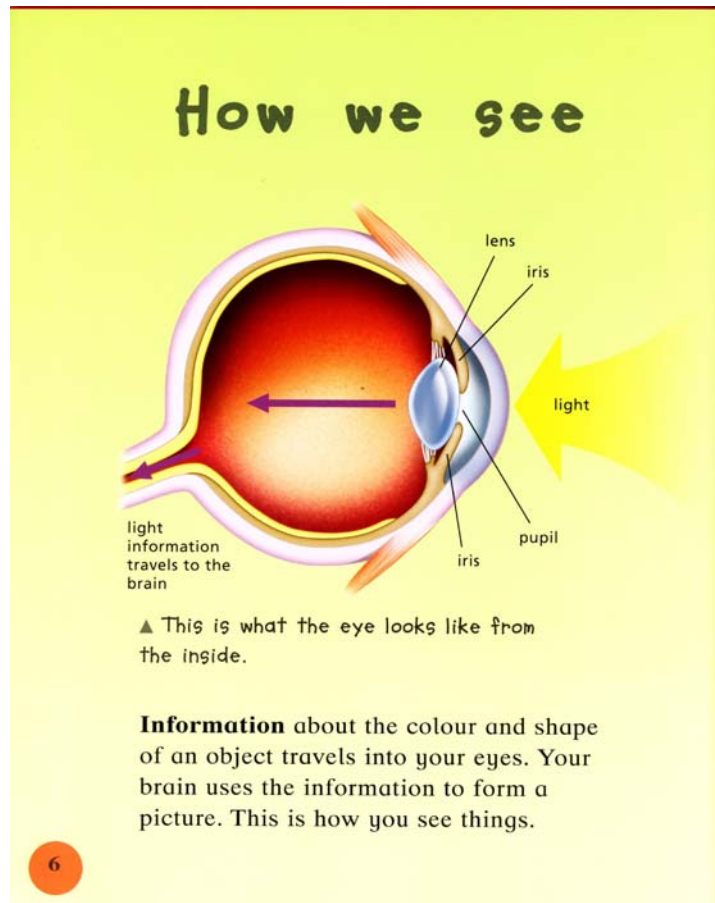

Figure 20 Image and Language related by Divergence.

The variation is shown in Figure 21.

Verbiage Functions			Image Relation	
doing: happening	Actor/Medium	Information about the colour and shape of an object	+ variation	= exposition
	material	travels		
	Location	into your eyes		

Figure 21. Coding of Divergence in image-language relations

The first figure in the main text verbiage, [happening], is re-presented in the image, but the Actor participant 'Information about the colour and shape of an object' is varied in the image to 'light'.

In school science books divergence seems to be a not infrequent form of unintended 'misrepresentation'. One example of this is the section on ocean zones (shown in Figure 22) in the 'Eyewonder' book about oceans for young readers published by Dorling Kindersley (Gray, 2001). The text and images are set out on the double page spread in a portrait orientation to simulate the levels of the various zones occurring at successive depths in the ocean. It should be noted that pictorially these levels are allocated equal proportions of the layout space and hence are not to scale, since the text states that the sunlit level is 150 metres deep; the twilight zone starts at 150 metres below sea level and finishes around 1000 metres below the surface; the midnight zone starts at the end of the twilight zone and continues to the sea bed, possibly being as deep as 4000 metres and in some trenches more than 6000 metres. This non-scale depiction of the sea levels used in the layout is also repeated in the diagrams showing the three main ocean depth zones beginning each descriptive paragraph. Hence, notwithstanding what is explicitly stated in the verbiage about the relative depths of the different ocean zones, visually these are strongly represented as being equivalent.

Figure 22. Divergence in image-language relations in a science book for children (Gray, 2001)

A simple framework summarizing these types of image-text ideational complementarity is shown in
Figure 23.

image extends text

augmentation

text extends image
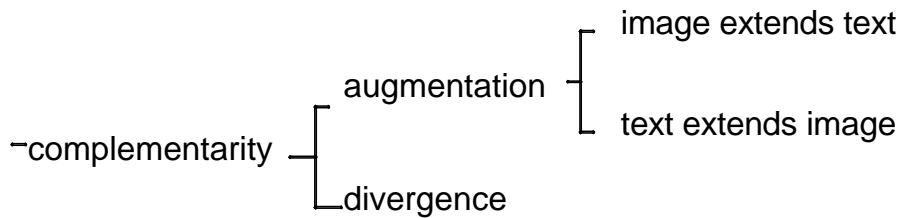
complementarity

divergence

Figure 23. Ideational Complementarity

Some images, despite their similarity of appearance, size and position within page layout, have quite different ideational relations to the segments of main text to which they are relevant. In Figure 24 for example, the drawing of the whale shark at the bottom left hand column and the drawing of the great white shark in the bottom right column function very differently in relation to the main text segments above. The image of the whale shark augments the main text, while the image of the great white shark relates to the main text by exposition – "(The great white shark) can grow to more than 12 metres". Within the image of the whale shark at the bottom left, the image relates to the caption by exposition.
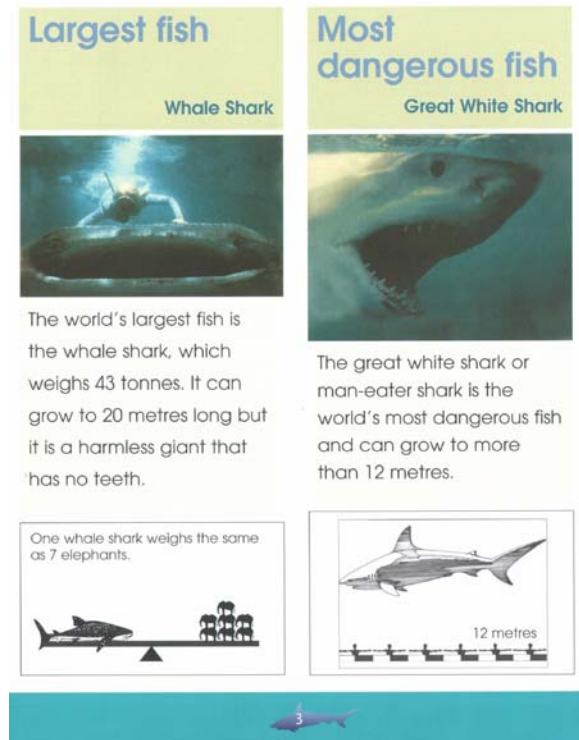
Figure 24. Similar appearance, size and layout but different image-language ideational relations

Enhancement

Martinec and Salway (2005) identified causal, temporal and spatial relations between images and verbiage. To these we would add condition and manner. In figure 25 the image of the merry-go-round is an example of what readers might see if they 'Look around.' That is the verbiage constructs the condition and the image the consequence.
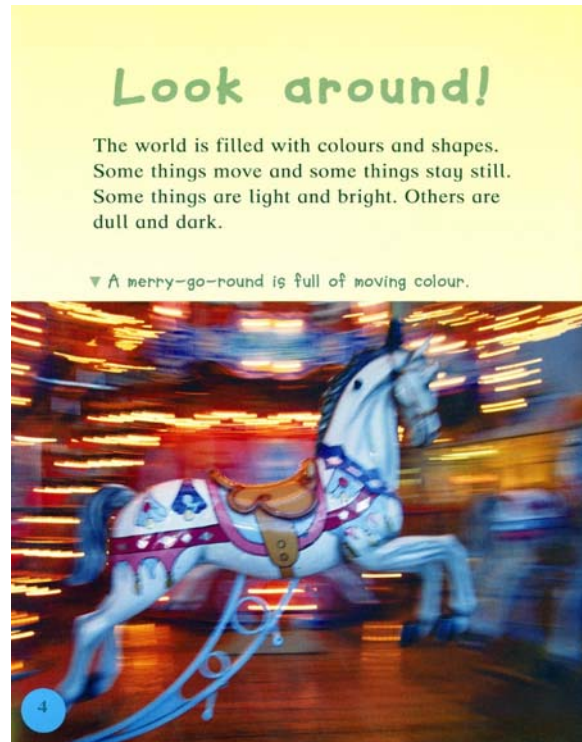
Figure 25 Verbiage/Image relations of Condition/Consequence

(Woodward, 2005)

In Figure 26 the cropped colour photograph can only logically relate to the bold caption below it by 'manner/means' (although I would have thought that today the means of administering hormone replacement therapy was oral.)

Figure 26. Manner: Image enhances text (Beatty, 2001:24)

Causal relations are illustrated by Martinec and Salway (2005) by means of an image showing what appears to be people walking around a line up of 'body bags' or 'coffins accompanied by the caption; "Police believe a short circuit set fire to the hall's thatch roof." The authors claim here that "the image enhances the text. The dead bodies lying on the floor are the result *of a short circuit set fire to the hall's thatch roof*." (Martinec & Salway, 2005:351) However, one might also reason that the text enhances the image since the short circuit… was the cause of the line up of dead bodies.

Martinec and Salway (2005) illustrate temporal relations between image and text with a segment showing an image of one of Max Beckmann's paintings and an accompanying main text, which begins:

> Beckmann worked for the Germany's medical corps during the war, sketching the horrors of what he saw. Following a nervous breakdown, his paintings became harsher…"
> (Martinec & Salway, 2005:351)

The authors indicate that "Following a nervous breakdown" situates in time the example of Beckmann's paintings provided by the image. Martinec and Salway (2005) illustrate enhancement by place with an image of Newcastle Airport (with the name and location of the airport on a sign in the image) and the following accompanying caption:

> The woman arrived too late to board the flight to Paris.
> (Martinec & Salway, 2005:350)

Projection
Projection in the Martinec and Salway (2005) system refers to either a 'locution', which is the quoting or reporting of wording, or an idea, which is the quoting or reporting of thought. They cite the speech or thought bubbles in cartoons as the typical realizations. The projection of wording can be seen in Figure 27 from a book dealing with primary/elementary school science, in this case a book about bats.
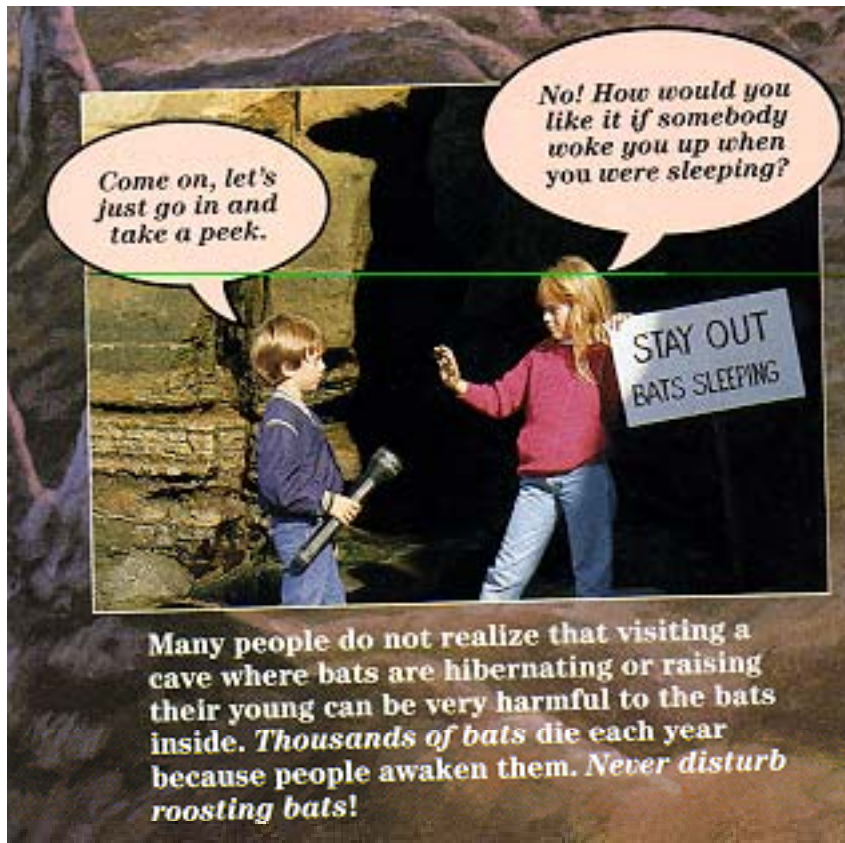
Figure 27 Verbal processes in images (Wood & RInk, 1991) P.17

The projection of ideas can be seen in the last frame of the cartoon presentation of information
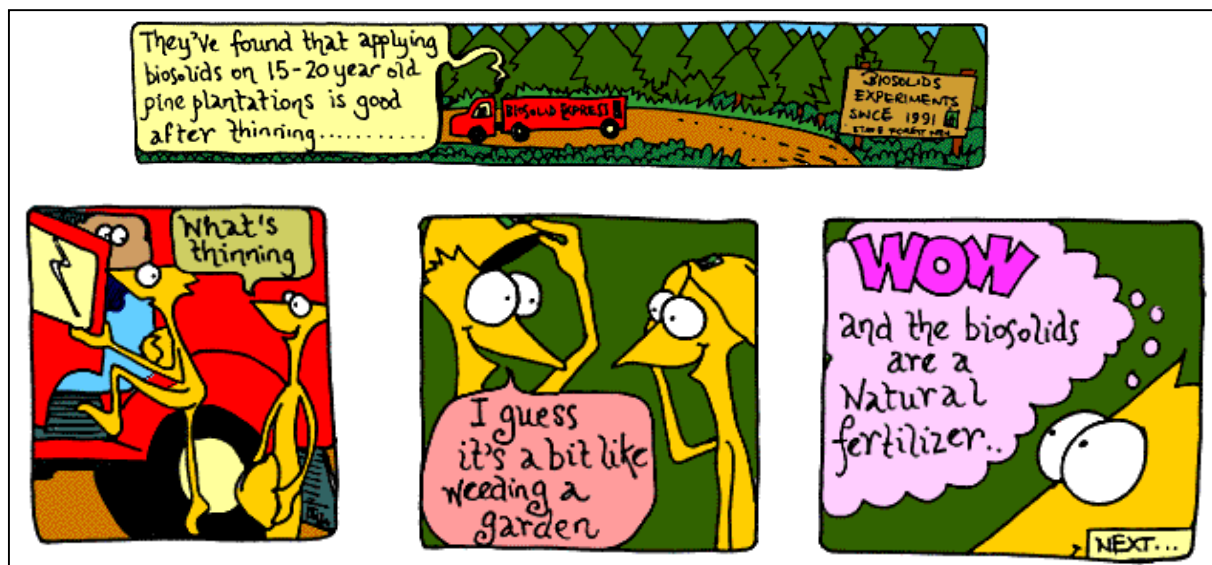

Figure 28. Visual representation of Verbal and Mental processes
http://www.forest.nsw.gov.au/Frames/f_kids.htm

about forest management prepared for primary/elementary school age children on the website of the Forestry Department of the government of the Australian State of New South Wales (Figure 28). These relations of projection are realized by verbiage within images. A further realization of projection is proposed by Martinec and Salway (2005) to account for occurrences of a diagram that recapitulates the ideational content of a juxtaposed segment of main text. Martin proposed, although did not exemplify, that in the context of macrogenres, figures, tables, graphs and diagrams might involve the direct projection of ideas, bypassing wording and reporting meaning directly (Martin, 1994). Martinec and Salway (2005) do not make it clear whether they regard this relation between such images and text as a locution or an idea in their descriptions. What is different from the earlier examples of projection however, is that this involves the projection of an image by the verbiage rather than the projection of verbiage within image. But can the main text project images such as photographs and drawings? We know that this occurs in picture story books for children (Unsworth, 2006) but, for us the situation with science materials remains unclear.

In Figure 29 it seems that the image at the bottom of the page depicts what the students saw when they observed the onion peel through a microscope, although they clearly did not see the labels 'A', 'B' and 'C' (These labels are to facilitate questions in the accompanying test booklet). This image-language relation does not seem to be adequately categorized as 'clarification', but it is also not clear whether this can be regarded as a form of perception. As we grapple with these kinds of issues our initial tentative network of ideational meanings in image-verbiage relations is likely to require further development.
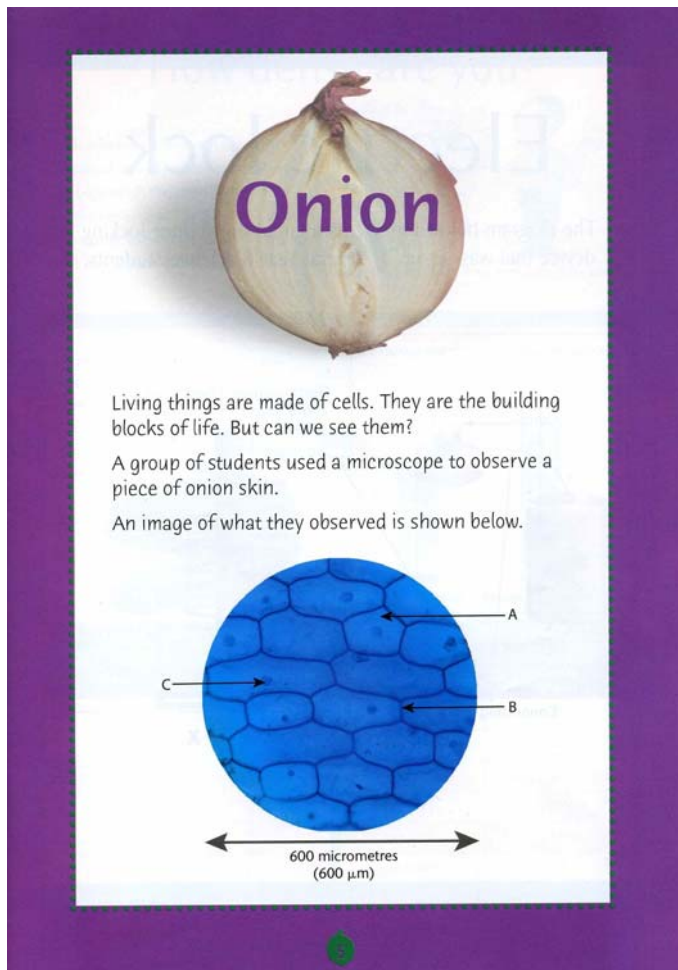

Figure 29. An image representing perception through a microscope
(NewSouthWalesDepartmentOfEducationAndTraining, 2005)

5. Conclusion: The pedagogic potential of a systemic functional perspective on metalanguage and multimodality

There seems to be significant support for the view that the need to redefine literacy in the contemporary multimedia age entails the development of a metalanguage that will facilitate metatextual awareness of image/text relations (Kamil *et al.*, 2000; Kress, 2003b; Macken-Horarik, 2004; Richards, 2001; Russell, 2000). This paper suggests that systemic functional semiotic theory has much to offer in this respect. However, the work on grammars for exploring the co-articulation of image and verbiage is in its infancy (Kress, 2001; Macken-Horarik, 2003). Little classroom research has been done on the pedagogic use of such emerging grammars, although there is some evidence that young children can learn and productively use aspects of Kress and van Leeuwen's (1996) visual grammar in work with picturebooks and with multimedia CD ROMs in curriculum area learning (Callow & Zammit, 2002; Howley, 1996). There is also a good deal of evidence of the efficacy of the metalanguage of SFL in literacy development and learning in primary/elementary and secondary/high school contexts (Quinn, 2004; Schleppegrell, 2004; Schleppegrell *et al.*, 2004; Torr & Harman, 1997; Williams, 1999, 2000). What is suggested here is that the theoretical bases of the social semiotic research arising from SFL, can eventually provide a generative and inclusive framework for the transdisciplinary development of a metalanguage that will facilitate the kinds of multimodal literacy pedagogies advocated by Roth and his colleagues (2005) as being essential to the enhancement of school science education.

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