

# Words, Pictures, and Facts in Academic Discourse

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## Abstract

Researchers in Languages for Academic Practices are used to dealing with verbal texts of many sorts: exams, textbooks, lab notebooks, essays, and lectures. But academic discourse is increasingly multi-modal, incorporating various visual as well as verbal texts, including photographs, diagrams, outputs of imaging devices, and even cartoons. Some of these pictures are for entertainment, but some play a key role in establishing facts, for students or for scientific researchers themselves. Most research on images in discourse analysis has taken a semiotic approach, treating the pictures as a form of language. Recently, researchers have begun to look at the practices of production, distribution, and interpretation of images, as well as looking at the texts themselves. The focus on practices has implications both for researchers on academic discourse and for teachers of academic discourse and their students.

**Key words:** Languages for Academic Practices, academic discourse, multi-modality, visual elements, images

## Resumen

Los investigadores en lenguas para la práctica académica están acostumbrados a tratar con textos verbales de muchos tipos: exámenes, libros de textos, cuadernos de notas de laboratorio, ensayos y conferencias. Sin embargo, el discurso académico está convirtiéndose cada vez más en un discurso multi-modal en el que se incorporan tanto textos verbales como visuales. e incluso fotografías, diagramas, imágenes y también dibujos animados. Algunas de estas imágenes son para entretenimiento, pero algunas juegan un papel clave en establecer hechos tanto para estudiantes como para investigadores científicos. La mayor parte de la investigación sobre imágenes en el análisis del discurso se ha centrado en un enfoque semiótico, con un tratamiento de las imágenes como una forma de lenguaje. Recientemente, los investigadores han empezado a indagar en las prácticas de producción, distribución e interpretación de las imágenes, al mismo tiempo que analizan en los propios textos. Este enfoque en la práctica tiene implicaciones

tanto para investigadores sobre el discurso académico como para los docentes del discurso académico y para los estudiantes.

**Palabras clave:** lenguas para la práctica académica, discurso académico, multi-modalidad, elementos visuales, imágenes

The conventional stereotype of the academic has her or him standing in front of an audience reading out a paper (unless he or she is a mathematician, in which case they have just written a set of incomprehensible symbols on a blackboard). But anyone who walks around a university campus today will soon be aware that academic discourse is not just about words. There are colour-illustrated textbooks, videos, and interactive whiteboards boards in teaching sciences, materials and actions in labs, lectures and demonstrations, Powerpoint presentations in university lectures, web pages as support for teaching and publicity, and music signalling the ‘scientific’ in television documentaries. There are also new scientific forms of visualisation to learn about, such as DNA fingerprinting, sonograms, CAT scans, artificial colour astronomical images, or computer concordances. Of course science has always been multi-modal; historians have shown that it is our own textual bias that cuts out the elements of the visual and the performed from past scientific practice (Gross et al., 2002). But it could be that new technologies make it easier to carry non-verbal elements from medium to medium, and easier to interweave different modes.

The uses of images in science are important outside the university as well. On the one hand, scientific imagery carries over into other discourses, so that we see sonograph scans, infrared imagery, electron micrographs, graphs, x-rays, and other visuals used in advertising, movies, public service campaigns, and art. On the other hand, everyday life is full of images that raise questions of fact that were once the province of scientists, in ‘reality TV’ and television documentaries, in surveillance cameras, in satellite images, and in popular digital photography and video. So it is particularly important that teachers and students be able to analyse assertions of fact that are in visual as well as verbal form.

Of course analysts already know that academic discourse is multi-modal, and there are many perceptive comments throughout the literature on Languages for Academic Purposes (LAP) and related fields on the visual elements in texts and the non-verbal elements in teaching and talking about academic discourse. But it remains the case

that all the classic studies to which we might turn first for a guide to a new analysis (Bazerman, 1988; Swales, 1990; Halliday & Martin, 1993; Berkenkotter & Huckin, 1995; Hyland, 2000) deal mainly with words. And LAP is firmly rooted in the study of verbal texts, with such topics as the terminology or specialist fields, the use of passive vs. active voice, the construction of noun phrases, verb tense and aspect in article introductions, hedging in scientific articles and popularisations, and organising signals in lectures. Our own skills and practices tend to make us focus on the words. Where do we turn for analytical resources to deal with these complex texts? Earlier work tried to extend structural linguistic analysis to visual texts, usually drawing on some form of semiotics (Barthes 1977; Kress and van Leeuwen 1990; Myers 1990; Cook 1992; Forceville 1998; Royce 2002). I will argue that these texts still provide a guide to useful frameworks: the basic semiotic relation of signifier and signified; the distinction between symbolic, iconic, and indexical signs; the distinction between anchorage and relay; ideas of information structure and layout. But as we will see, there are basic theoretical problems with approaches based on codes.

Let us consider first what we can learn about scientific texts from these semiotic approaches, as they are applied to other discourses such as those of advertising, narrative films, or magazines.

- **anchorage and relay** - Barthes' analysis of an ad for pasta sauce helps us deal with the different relations between text and image, 'anchorage' for relations in which the words limit the polysemy of the image (for instance the caption to a scientific illustration) and 'relay' for relations in which the words and pictures each contribute to the interpretation as the reader moves back and forth (as in many diagrams in science textbooks).
- **icons and indices** - Charles Saunders Pierce's account of different relations between signifier and signified is also applicable to scientific illustrations (see Myers, 1994, for an application to advertisements). Students learn to move between reading of 'symbolic' signs, in which the relation of signifier and signified is arbitrary and conventional (like the letters 'DNA' on the page) and 'iconic' signs, in which there is a relation of resemblance (as in the familiar diagrams of the DNA double helix, with more or less conventionalised signs for the atoms). Pedagogical and popular science seek out iconic representations to lend a sense of the concrete to new concepts. In Pierce's third category, 'indexical' signs, there is an inherent relation between the

signifier and signified, as in an instrumental reading. Rosalind Franklin's famous x-ray diffraction patterns of one form of DNA, which were used in the discovery of the double helical form, were produced by passing a stream of x-rays through the DNA itself; they do not look in any way like DNA, but can provide a basis for calculations of distances within it. Scientific journal articles tend to use indexical signs, rather than iconic signs, in the early stages of discovery, because they establish that something is there independent of the researcher. When entities become stabilised, and their existence is not in question, symbolic signs can convey the information more concisely, for instance, in the strings of letters (ATGC) used to show sequences of newly-coded genes.

- **composition** – Semiotics can also help with analysis of the complex composition of images on a page. Kress and van Leeuwen have suggested that there are several tendencies in the reading of complex layouts, for instance taking the left as given and the right as new, or the top as ideal and the bottom as real, or the centre as salient (Kress & van Leeuwen, 1996). They were analysing magazines, but the same principles apply to the revision guide to biology that my daughter is using for her exams: a page with a large central image of DNA transcription moves from what is given (structure of the double helix) to what is new (the unzipping and replication of this helix).

These semiotic approaches can be applied to our understanding of facts in scientific texts. We have some idea how facts work in verbal text; they are statements stripped of the personal agency and temporal perspective that might mark them as contingent (Latour & Woolgar, 1979). Hyland and others have shown how hedging is used in subtle ways in academic texts to qualify these assertions of fact (Hyland, 1998). In images, the facticity of an image may be conveyed by an iconic sign, for instance in medical images, micrographs, read-outs of detectors, satellite images, or closed-circuit television. The backgrounds and other non-meaningful traces are important in suggesting that this is a real observation. The student has to learn to connect these images to the mathematicised symbolic forms of their other academic knowledge.

Semiotic approaches remind us that all reading, visual as well as verbal, is conventional. A biology student has to learn conventionalised ways of reading a diagram of a virus, or the direction of a DNA strand (see for example some web pages for biology students, <http://www.med.sc.edu:85/mhunt/dna1.htm> and

<http://www.csu.edu.au/faculty/health/biomed/subjects/molbol/index.htm>). The picture does not 'look like' DNA until they learn to look in this way. They also learn processes of mathematicization through which iconic images are converted into symbols, for instance mapping the strand of the genome, matching the colour of the soil in an archeological dig (Goodwin, 1995), or measuring an electron micrograph for nerve growth (Lynch, 1985).

Semiotic approaches to images have been useful across a range of disciplines and discourses, because they are simple, teachable, and abstract enough to get us to look beyond the obvious. But they also present some basic problems:

- Semiotic systems are not (as was once hoped) a universal grammar for all meaning making, just a set of terms that sometimes have heuristic value
- Semiotics simplifies the process of reading to a matching of signifier and signified, while real reading is complex and situated in a particular setting
- Semiotic approaches tend not to deal with the material production of the image, so it is hard to apply to issues of new media
- Most important, they privilege the analyst, who builds the system of meaning for the discipline, rather than the practitioners.

LAP researchers and teachers are likely to be uncomfortable with this kind of analysis when it becomes heavy-handed, and to look for some approaches that let them learn about the scientists and students they study, as well as about the images.

Fortunately it seems that semiotics, however unfashionable it is at the moment, can be rescued. Current work on visual culture (Kress et al., 2000; Kress & van Leeuwen, 2001; Rose, 2001; Sturken & Cartwright, 2001) marks a shift from the analysis of codes to analysis of practices. They look at texts in relation to the activities of producers, distributors, and audiences. This line of approach, which has been useful in dealing with texts as different as teen magazines, museums, Benetton ads, the Human Genome Project, computer games, and popular music, can also lead to insights about academic discourses.

'Practices' turn out to be hard to define, partly because 'practice' is so often defined in opposition to something else. We can take and extend the definition from the textbook by Sturken and Cartwright (2001: 363): 'activities of cultural consumers through which they interact with cultural products and make meaning from them'.

This definition focuses on what consumers do with a text; teenage girls reading a magazine together, dance music fans making a compilation for a party, a student searching the internet for a cover picture for a school project, a scientist assessing the usefulness of an electron micrograph. But this definition only deals with consumers, and clearly there are issues in the production and distribution of these images, as well as in their reception. Gillian Rose (2001: 17), in another recent textbook, provides a list of such issues:

- technological – what are the affordances and constraints of this medium?
- compositional – what are the formal strategies and how do the parts fit together?
- social – what are the economic, cultural, and regulatory frameworks?

Seen in these terms, we might consider other practices, such as a university choosing photos of happy students for its prospectus, a teacher drawing on the chalk board, or holding up a plastic model of the body, a student filmmaker looking for some non-copyright music for the background of a video.

Let's consider three black and white sketched diagrams as examples of these practices. Take first a page of Edison's patent notebook for 9 September 1878, discussed in Charles Bazerman's extraordinary study, *The Languages of Edison's Light* (1999: 67). This is a sketchbook in which various versions of an idea (in this case, a temperature regulator for a light bulb) are tried out in rough form. It may seem odd to talk about a technology of an unbound notebook, but it is worth noting that a blank sheet of paper (unlike, say, a blackboard) allows such additions while preserving earlier versions, and that the page numbers show it is one in a series, with cross reference to others (so if a page were missing it would be noticed). The compositional principle is that one idea replaces another as he moves down the page; the notebook is tied to other practices of fabricating some prototypes and trying them out while leaving others on paper. The economic and regulatory framework is evident in the upper right hand corner of the page, where Edison and two assistants have signed and dated the page so that it can be used later, if necessary, in support of a patent claim. So what seems to be a rough sketch of the sort any of us might do is, at the same time, a legal document carefully designed for its purpose.

As a second example, consider the overhead projector slides that a group of physicists is preparing in Susan Jacoby's and Elinor Ochs' (1997) study of collaboration on a conference paper presentation. They are discussing whether to include a graph that

shows in a dotted line an extrapolated result. Graphs are a technology that allows them to represent quickly and coherently a claimed tendency for a range of observations by different people at different times. The dotted line is a convention that lets them suggest a degree of uncertainty among the black and white of the diagram; the overhead projector is a failsafe way of sharing the same diagram with a room full of people while the speaker keeps control of how it is shown and interpreted. The key compositional constraint here is time – they must keep to a strict limit, and each slide requires some explanation. The social and cultural context is the need for two collaborating groups to agree on a claim that has impact, and can be made in the allotted time, while not overstating and risking refutation and humiliation. In this case, the decision not to include the slide is both a concession to the time limit, and a reining in of the claim that would be made by the more enthusiastic members of the group.

As a third example, consider a page on ‘The Alkane family’ from my daughter’s revision notebook for the national chemistry exam in the 11th year of school. It contains words written down from the teachers’ lecture. It also has three kinds of visual images: at the top, a diagram of an arrangement of a two test tubes, a tube, and a tank, showing catalytic cracking. At the bottom is a chemical diagram, with letter symbols linked by short lines, showing in process form the breaking of a large hydrocarbons into small ones. In the middle is a picture of a cat cracking a whip, presumably a mnemonic device provided by the teacher. The technology is fairly simple: all this was copied down from the board, even the cat joke. Of course it could have been photocopied on a handout, but that wouldn’t have given the pupils experience drawing and spelling (the spelling of ‘Alkene / Alkene’ is changed). The social framework here is that of the examination and the national curriculum that requires the students to learn, not just a verbal record of the facts, but some basics conventions of representation, such as chemical formulae and diagrams of experiments (Ogburn et al., 1996; Kress et al., 2001).

What do these practices tell us about the relation between pictures and facts? There is no simple, general code that says dotted lines are hedged, pictures are more factual than words, or the more detailed the picture, the more factual. The three diagrams are all dealing with facts, but in different contexts of interpretation. Edison’s notebook is not describing an existing object, but imagining a potential object. By making it visual, he both makes it possible for a skilled assistant to fabricate such an object (if he decides it is worth following up) and claims his ownership of this thing, or things in principle like it, at some point in the future. The physicists’ graph can

represent different facts, depending on how it is interpreted; the dotted extrapolation supports one of these interpretations, and the fact that it is dotted shows their care not to claim results they do not (yet) have. The school pupil's chemistry notebook seems to have the same sketch-like quality. But it is showing what students are to take as a general process, not a specific observation of their own. All are concerned with facts, but facts as projected, claimed, or learned.

Kress and van Leeuwen (2001) argue there are two kinds of meaning potential that work as systematic 'semiotic principles'. One is 'provenance', where the sign comes from; the other is 'experiential meaning', what people do with this sign. Both are relevant to the picturing of facts. We may take a picture as fact because it comes from a scientific laboratory, or a teacher, or a news photographer; Edison is explicitly marking the provenance of his sketch in a case where the traceability of the image is particularly crucial. Or people may make a picture a fact in the way they use it, to fabricate a regulator, to represent a series of experiments in the most telling way, to recall terms for an exam. Sometimes more or less explicit conventions are at work (the dotted line for extrapolation, the two-dimensional sketch for the experimental set-up, the lines to show an electrical circuit), but these conventions rely on the larger processes by which we take facts from others or make facts in a competing field.

All this is relevant to Languages for Academic Purposes because we see that students have to learn, not just a new way of reading and writing, but a whole set of conventions for visual representation. They learn simplifications of iconic representations, narrative relations in diagrams and non-narrative relations in tables, abstraction and mathematicisation in graphs, labelling and captions, and their relations to the visual images, and relations between academic conventions of representation (such as ways of showing volume by showing two different views) and non-academic conventions (such as ways of showing volume by shading). They learn ways of orienting themselves in these images, telling what matters from what doesn't, relating them to each other and to the words, looking for explanations in the text, and finally producing such images themselves.

An approach that looks at visual practices, not just coded images, challenges some common misconceptions about the relations between words and pictures:

- that pictures have a grammar, like language, that can allow meanings to be read off,



- that pictures are more factual than words,
- that pictures are associated with play, or aesthetic pleasure, or younger readers, or less serious readers, and words are for information,
- that pictures (especially photographs) refer in an objective way to what is there,
- that visual culture is inherently postmodern, while print culture is inherently modern,
- that visual culture arises from new technologies like the World Wide Web or third generation mobile phones.

All these simplistic generalisations fail because they take the images out of the practices of production, distribution, and consumption. In one set of practices (television documentaries) metaphorical and everyday images may be a way of luring less committed viewers into engagement with difficult abstract concepts, while in another set of practices (preparing an article for publication) the images may be the data, and a particularly striking image may be reproduced as support for a claim. Then the same image, on the cover of the scientific journal, may be reproduced for aesthetic effect (Lynch & Edgerton, 1988).

Perhaps most important, for language researchers and teachers, a focus on practices undermines the widely held notion that pictures are a universal language, taking us back before Babel. This notion underlies picture dictionaries for learners, warning signs, and international advertising campaigns, but it is a notion that becomes less believable, not more, as pictures proliferate in various media. Yes, an engineering student for whom English is a second or third language may find the diagrams in her textbook more accessible than the text, but this is because she has learned the conventions of these diagrams and their symbols in another engineering class, not because they are graspable on some more immediate and universal level than the English words. The efforts of a well-meaning and hard-working committee to find symbols to label a radioactive waste dump, symbols that will be readable to anyone in any language for tens of thousands of years, unintentionally demonstrates the conventionality of symbols and the futility of a search for the universal code.

The study of visual practices has several implications for researchers on academic discourse. As I have noted, many researchers already take into account the visual and material aspects of the texts they study (e.g., Martin & Veel, 1998; Miller, 1998; Scollon, 1998; van Leeuwen & Jewitt, 2001). But there may still be a tendency to leave

them out, for instance when one scans text for larger corpora, or uses a databank of newspapers or articles. Another lesson is that visual texts cannot be treated as the equivalent of verbal utterances. Yes, most of us are better at analysing verbal texts than visual, but that is no reason to expect them to conform to the terms and concepts we have developed for different purposes. On a more positive note, the analysis of visual practices can lead us beyond our desks to look at what people are doing with these texts, how these texts fit in their times, their spaces, their daily routines. A focus on visual practices also breaks down some of the boundaries we might assume between one discourse and another, as images travel from scientific journals to television documentaries to advertising to fashion and pop videos. These more popular forms of representation may be crucial to come of the questions we ask about the wider circulation of academic knowledge.

The analysis of visual practices has implications for teaching as well. I have already noted how students reading in a second language may use visual texts, and conventions with which they are already familiar, to help them understand verbal texts. All students in any language have to learn disciplinary conventions of visual texts. LAP teachers cannot assume that tasks based on these visual texts are linguistically neutral and accessible. And teachers cannot avoid dealing with the visual conventions of the disciplines they encounter. We might even enjoy learning them.

## Note

This is an expanded version of a paper given at the First International Conference of AELFE, Asociación Europea de Lenguas para Fines Específicos (European Association of Languages for Specific Purposes). My thanks to Marinela García Fernández and the AELFE board for inviting me. The conference was held at the Universidad Politécnica de Madrid, September 2002, where the pleasant lobbies and halls of the school of forestry were filled with posters, maps, dioramas, and samples that abundantly confirmed the multi-modality of academic discourse.

## REFERENCES

- |   |   |  |
|---|---|--|
| <p>Barthes, R. (1977 [1964]). "The rhetoric of the image". <i>Image - Music - Text</i>. London: Fontana.</p>        | <p><i>Science</i>. Madison, WI: University of Wisconsin Press.</p>                            | <p>Berkenkotter, C. &amp; T. Huckin (1995). <i>Genre Knowledge in Disciplinary Communication</i>. Mahwah, NJ: Lawrence Erlbaum Associates.</p> |
| <p>Bazerman, C. (1988). <i>Shaping Written Knowledge: The Genre and Activity of the Experimental Article in</i></p> | <p>Bazerman, C. (1999). <i>The Languages of Edison's Light</i>. Cambridge, MA: MIT Press.</p> |  |

- Goodwin, C. (1995). "Seeing in depth". *Social Studies of Science* 25: 237-274.
- Gross, A., J. E. Harmon & M. Reidy (2002). *Communicating Science: the Scientific Article from the 17th Century to the Present*. Oxford: Oxford University Press.
- Halliday, M. A. K. & J. R. Martin (1993). *Writing Science*. Pittsburgh, PA: University of Pittsburgh Press.
- Hyland, K. (1998). *Hedging in Scientific Research Articles*. Amsterdam: John Benjamins.
- Hyland, K. (2000). *Disciplinary Discourses: Social Interactions in Academic Writing*. London: Longman.
- Kress, G., C. Jewitt, J. Ogburn & C. Tsatsarelis (2001). *Multimodal Teaching and Learning: The Rhetorics of the Sciences Classroom*. London: Continuum.
- Kress, G. & T. van Leeuwen (1996). *Reading Images: The Grammar of Visual Design*. London: Routledge.
- Kress, G. & T. van Leeuwen (2001). *Multi-modal Discourse: The Modes and Media of Contemporary Communication*. London: Arnold.
- Latour, B. & S. Woolgar (1979). *Laboratory Life: The Social Construction of Scientific Facts*. Beverly Hills & London: Sage Publications.
- Lynch, M. (1985). *Art and Artifact in Laboratory Science: A Study of Shop Work and Shop Talk in a Research Laboratory*. London: Routledge Kegan Paul.
- Lynch, M. & S. Edgerton (1988). "Aesthetics and digital image processing: representational craft in contemporary astronomy" in G. Fyfe & J. Law (eds.), *Picturing Power: Visual Depiction and Social Relations*, 184-220. London: Routledge.
- Martin, J. R. & R. Veel (eds.) (1998). *Reading Science: Critical and Functional Perspectives on Discourses of Science*. London: Routledge.
- Miller, T. (1998). "Visual persuasion: A comparison of visuals in academic texts and the popular press". *English for Specific Purposes* 17: 29-46.
- Myers, G. (1994). *Words in Ads*. London: Edward Arnold.
- Ochs, E. & S. Jacoby (1997). "Down to the wire: The cultural clock of physicists and the discourse of consensus". *Language in Science* 26: 479-506.
- Ogburn, J., G. Kress, I. Martins & K. McGillicuddy (1996). *Explaining Science in the Classroom*. Buckingham: Open University Press.
- Rose, G. (2001). *Visual Methodologies*. London: Sage.
- Scollon, R. (1998). *Mediated Discourse as Social Interaction: A Study of News Discourse*. Harlow: Longman.
- Stroud, D. (2002). "Millennia Markers". *Las Vegas Review-Journal*. [http://www.lvrj.com/lvrj\\_home/2002/Ju1-06-Sat-2002/news/19106197.html](http://www.lvrj.com/lvrj_home/2002/Ju1-06-Sat-2002/news/19106197.html)
- Sturken, M. & L. Cartwright (2001). *Practices of Looking: An Introduction to Visual Culture*. Oxford: Oxford University Press.
- Swales, J. (1990). *Genre Analysis*. Cambridge: Cambridge University Press.
- van Leeuwen, T. & C. Jewitt (eds.) (2001). *Handbook of Visual Analysis*. London: Sage Publications.