Chapter 4 Reports and explanations

4.0 Classifying and explaining

Whereas history functions as capital for negotiating control of the social world, the broad social function of science is to facilitate control of the natural world. In this respect, science works hand in glove with industry: industry providing the material resources science needs for investigating nature; science providing the discursive resources industry needs for exploiting nature. Science in this view is a set of semiotic practices; it is concerned with manipulating material activities, but these activities are informed by what science has to say about the world; industrial practices and products make sense within the technical discourses that science has accumulated over the five centuries since Galileo described the movement of the earth around the sun. The historical development of scientific discourse from this moment has been mapped by Halliday 1993, 1998. Genres in the sciences have been described by Halliday & Martin 1993, Lemke 1990a&b, 1998, Martin 1986, 1989, 1990, 1998, Martin & Painter 1986, Rose 1997, 1998, Rose et al 1992, Unsworth 1997a,b&c, 1999, 2001a&b, 2004, Veel 1997, 1998, Wignell 1997, Wignell, Martin & Eggins 1993.

From this body of research we are able to make a broad generalisation that science semioticises the natural world by generalising about things and processes in four regular ways: by classifying and describing phenomena, by explaining how processes happen, by instructing how to observe phenomena (e.g. in experiments), and by recounting and interpreting what was observed. So four families of genres that characterise science are **reports** that classify and describe, **explanations** of causes and effects, **procedures** for observing and experimenting, and **procedural recounts** for reporting on observations and experiments (cf Veel 1997). In this chapter we will analyse a range of reports and explanations. Procedures and procedural recounts will be addressed in Chapter 5, as they function to direct activities in industry.

Reports and explanations draw on two complementary sets of resources that language provides for construing relations between phenomena, focusing on one hand on **entities** - their description, classification and composition, and on the other hand on **activities** - in sequences of cause and effect. In the history of scientific fields description and classification tends to precede explanation of causes. In astronomy and physics for example, telescopes enabled classification of parts of the solar system centuries before Newton explained why they moved as they do, and the relation between the most general physical classes of matter and energy was not explained until Einstein's theory of general relativity in the last century. Today physicists have decomposed matter into some 40 subatomic particles, but they are not yet able to explain how they function to compose protons, neutrons and electrons, the building blocks of atoms. Likewise the major activity of biology was for centuries the description and classification of species, until Darwin explained how they came to be so through natural selection. And until very recently the major activity of linguistics remained the description and classification of elemental particles - phonemes, morphemes and syntactic rules - at least until Halliday among others began to explain how they function to realise social contexts.[41] In this chapter we will follow a similar course, beginning with classification and composition in reports,

followed by causal relations in explanations. In the final section we will use the principles developed here to describe multi-modal texts, including the structures of visual images and their relations to verbal texts.

4.1 Reports: classifying and describing things

Science classifies and describes phenomena in three types of reports. **Descriptive** reports classify a phenomenon and then describe its features. **Classifying** reports subclassify a number of phenomena with respect to a given set of criteria. **Compositional** reports describe the components of an entity.

4.1.1 Descriptive reports

The purpose of a descriptive report is to classify and describe a phenomenon, so its stages are most generally Classification followed by Description. Classification and description of species in biology is a common site for descriptive reports, illustrated in text [4:1] about the canonical group of reptiles in Australia known as *goannas*.

[4:1] **Goannas**
Australia is home to 25 of the world's 30 monitor lizard species. In Australia, monitor lizards are called goannas.

Goannas have flattish bodies, long tails and strong jaws. They are the only lizards with forked tongues, like a snake. Their necks are long and may have loose folds of skin beneath them. Their legs are long and strong, with sharp claws on their feet. Many goannas have stripes, spots and other markings that help to camouflage them. The largest species can grow to more than two metres in length.

All goannas are daytime hunters. They run, climb and swim well.

Goannas hunt small mammals, birds and other reptiles. They also eat dead animals. Smaller goannas eat insects, spiders and worms.

Male goannas fight with each other in the breeding season. Females lay between two and twelve eggs.

Silkstone 1994

This report from a school textbook first classifies the phenomenon as a group of species known as monitor lizards or goannas, and then describes them in terms of four sets of characteristics - their appearance, behaviour, feeding and breeding habits. Each characteristic constitutes a phase of the Description, and this phasal structure is made explicit with paragraphing. The generic structure is set out as follows, with stages and phases labelled, and key elements in bold.

[4:1'] **Goannas**

Classification	
	Australia is home to 25 of the world's 30 **monitor lizard species**.
	In Australia, monitor lizards are called **goannas**.
Description	
appearance	Goannas have flattish **bodies**, long **tails** and **strong** jaws.
	They are the only lizards with forked **tongues**, like a snake.
	Their **necks** are long and may have loose folds of skin beneath them.
	Their **legs** are long and strong, with sharp **claws** on their feet.
	Many goannas have stripes, spots and other **markings** that help to camouflage them.
	The largest species can grow to more than two metres in **length**.

behaviour	All goannas are **daytime hunters**. They **run, climb and swim** well.
feeding	Goannas hunt **small mammals, birds and other reptiles**. They also eat **dead animals**. Smaller goannas eat **insects, spiders and worms**.
breeding	**Male goannas fight** with each other in the breeding season. **Females lay** between two and twelve eggs.

The appearance phase of [4:1] describes parts of goannas, illustrated in Figure 4.1 with the central Australian species *Varanus gigantus*, the one that can grow to more than two metres in length.

Figure 4.1: Goanna species described in text [4:1]

The descriptive phases in [4:1] are common in reports about animal species in biology, but descriptive reports are common across many fields. An example from a very different field is the following text [4:2], from a senior secondary textbook in the field of technology design.

[4:2] **Ergonomics**
Ergonomics can be defined as the design of work so that the best is made of human capabilities without exceeding human limitations.

Standards Association of Australia, *Australian Standard 1837-1976: Ergonomics in Factory and Office Work*, Standards Australia, North Sydney, 1976.

The evolution of a product or design based on ergonomics relates the product or design to the physical needs of the user. These physical needs include not only size and position but other aspects such as floor surfaces, illumination levels, hand grips, switch standards and vision.

Understanding the physical needs of the user allows the designer to cater for individual differences and to create products that cater for the needs of the majority of consumers. Ergonomics is to do with the human body as a whole but it also involves the function of parts of the body and the ease with which humans perform simple tasks.

Warner et al 1995

This report uses a quoted definition for its Classification stage. The phenomenon it describes is not a physical entity as in the zoology report above, but a field of activity - an abstract entity. The Description stage then includes two phases: the first describes the physical needs of users in terms of aspects of a designed product – *size, position* and so on; the second in terms of aspects of the user - *individual differences, the human body as a whole, parts of the body.*

As we saw for stories and history, common stages of a genre may be found across different fields, but phases within each stage are more likely to vary from field to field and text to text.

4.1.2 Classifying reports

While descriptive reports describe characteristics of one class of phenomenon, classifying reports subclassify members of a general class. Crucial to this genre are criteria for classification, and the same phenomena may be classified differently according to various criteria. The following text [4:3] subclassifies groups of organisms according to whether they produce chemical energy, or consume those that do, and this generic organisation is explicitly signalled in the first stage.

[4:3] **Producers and consumers**
We have seen that organisms in an ecosystem are first classified as producers or as consumers of chemical energy.

Producers in ecosystems are typically photosynthetic organisms, such as plants, algae and cyanobacteria. These organisms build organic matter (food from simple inorganic substances by photosynthesis).

Consumers in an ecosystem obtain their energy in the form of chemical energy present in their 'food'. All consumers depend directly or indirectly on producers for their supply of chemical energy.

Organisms that eat the organic matter of producers or their products (seeds, fruits) are called primary consumers, for example, leaf-eating koalas (Phascolarctos cinereus), and nectar-eating honey possums (Tarsipes rostratus).

Organisms that eat primary consumers are known as secondary consumers. Wedge-tailed eagles that prey on wallabies are secondary consumers.

Some organisms consume the organic matter of secondary consumers and are labeled tertiary consumers. Ghost bats (Macroderma gigas) capture a variety of prey, including small mammals.

Kinnear & Martin 2004: 38

The system for classifying phenomena can vary even within a single field. Here organisms are classified as producers or consumers, but they are also classified within biology on various other criteria, such as genetic relations. So classifying reports begin by stating the Classification system, followed by the Types. Within the Types stage, text [4:3] has two layers of classification, including subtypes of *consumers*. Each type and subtype is defined and exemplified as a distinct text phase with its own paragraph, set out below, with types and subtypes in bold and classification criteria marked.

[4:3'] **Producers and consumers**
Classification system

We have seen that organisms in an ecosystem are first classified as producers or as consumers of chemical energy.

Types

type 1 **Producers** in ecosystems are typically photosynthetic organisms, such as plants, algae and cyanobacteria. These organisms (**criteria**) build organic matter (food from simple inorganic substances by photosynthesis).

type 2 **Consumers** in an ecosystem (**criteria**) obtain their energy in the form of chemical energy present in their 'food'. All consumers depend directly or indirectly on producers for their supply of chemical energy.

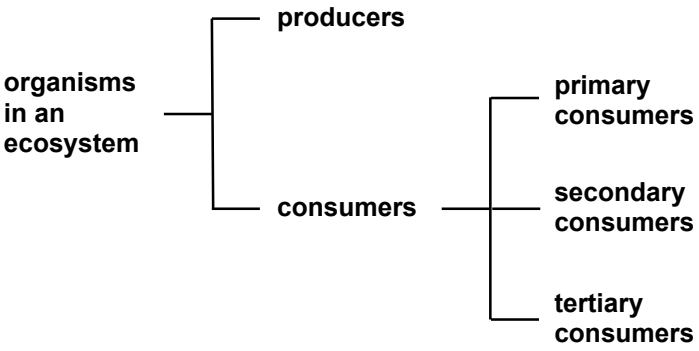
subtype 2.1 Organisms that (**criteria**) eat the organic matter of producers or their products (seeds, fruits) are called **primary consumers**, for example, leaf-eating koalas (Phascolarctos cinereus), and nectar-eating honey possums (Tarsipes rostratus).

subtype 2.2 Organisms that (**criteria**) eat primary consumers are known as **secondary consumers**. Wedge-tailed eagles that prey on wallabies are secondary consumers.

subtype 2.3 Some organisms (**criteria**) consume the organic matter of secondary consumers and are labeled **tertiary consumers**. Ghost bats (Macroderma gigas) capture a variety of prey, including small mammals.

The taxonomy of classification realised in text [4:3] is represented in Figure 4.2. Classification taxonomy diagrams are organised as left-right 'system networks'. Although biologists often use top-down tree diagrams to illustrate such classifying taxonomies, in SFL these are reserved these for compositional taxonomies, to illustrate the relations of whole to their parts, see below.

Figure 4.2: Classification taxonomy in a classifying report



In academic fields that take the form of a "coherent, explicit, and systematically principled structure, hierarchically organised, as in the sciences" (Bernstein 1999), the global structure of textbooks is typically that of classifying reports, of types and their sub-types. That is the field as a whole is organised in textbooks as a taxonomy of types, and the description of each type gives the criteria for its classification within the taxonomy. Bernstein has called these hierarchical knowledge structures. *Genre Systems* is an example of this pattern, which is discussed further below in terms of 'macrogenres'. In fact all fields involve some degree of taxonomic organisation, but this organisation more be more and less elaborate and criteria may not be explicitly stated, as in many fields of everyday activity, or they may be contested by competing interest groups, as in humanities or political fields. The taxonomic organisation of 'vertical' technical fields is the result of research and negotiation over decades or centuries.

4.1.3 Compositional reports

Whereas classifying reports are concerned with membership in classes of phenomena, compositional reports are concerned with another dimension of organisation – parts of wholes. The following report [4:4] about a mangrove forest lists the organisms that compose the forest community. The forest is the whole (illustrated in Figure 4.3), the organisms are its components.

Figure 4.3: Mangrove forest

[4:4] **Mangroves: part of a community**
When you walk into a mangrove forest, you may at first think that grey mangroves are the only living organisms there. However, look and listen and you will find evidence of other living occupants of the forest.

Many different kinds of organisms share the living space with the grey mangroves. Fish and shrimp are found in the brackish waters. At low tide, you may notice small crabs scurrying into burrows in the mud. Even if you miss the crabs you will see evidence of their presence from holes in the mud leading to their burrows.

At low-tide periods, various molluscs, such as snails and whelks, graze on algae that form a green film on parts of the muddy forest floor. Spiders spin their webs between branches of the grey mangroves to catch passing insects. Lichens grow on the trunks of mature mangrove trees. Many bird species feed on the nectar and pollen of the mangrove flowers and on the insects that live in the mangrove trees. At low tide, mudflats on the deepwater side of the mangrove forests are feeding sites for other bird species, such as the striated heron, *Ardeola striatus*, that feeds on snails and crabs. All these different kinds of organisms are part of the living **community** of the mangrove forest.

Kinnear & Martin 2004: 5

Here the first stage classifies the entity to be de-composed, and the compositional organisation is explicitly signalled as *evidence of other living occupants*. The next

stage then sets out the Components of the entity, numbered as follows, with each organism in bold.

[4:4'] **Mangroves: part of a community**
Classification of entity

When you walk into **a mangrove forest**, you may at first think that grey mangroves are the only living organisms there. However, look and listen and you will find evidence of other living occupants of the forest.

Components

1 Many different kinds of organisms share the living space with the **grey mangroves**.
2 **Fish and shrimp** are found in the brackish waters.
3 At low tide, you may notice small **crabs** scurrying into burrows in the mud. Even if you miss the crabs you will se evidence of their presence from holes in the mud leading to their burrows.
4 At low-tide periods, various **molluscs**, such as snails and whelks, graze on algae that form a green film on parts of the muddy forest floor.
5 **Spiders** spin their webs between branches of the grey mangroves to catch passing insects.
6 **Lichens** grow on the trunks of mature mangrove trees.
7 **Many bird species** feed on the nectar and pollen of the mangrove flowers and on the insects that live in the mangrove trees.
8 At low tide, mudflats on the deepwater side of the mangrove forests are feeding sites for **other bird species**, such as the striated heron, *Ardeola striatus*, that feeds on snails and crabs.

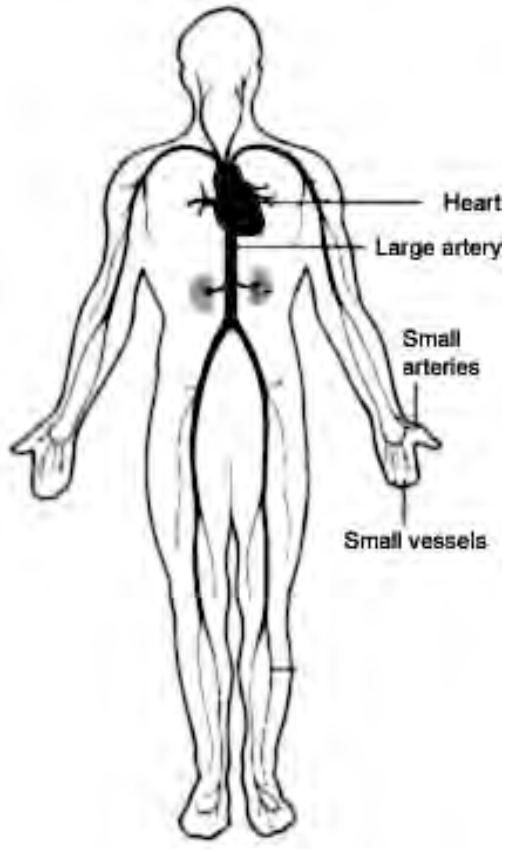
Definition

All these different kinds of organisms are part of the living **community** of the mangrove forest.

Note that each organism is named and their location and/or activities are then given. This is a common pattern in compositional reports, giving entities/parts alongside their activities/functions within the whole. In science textbooks, reports and explanations may finish with a technical definition, as in [4:4] above. The definition distills the detailed information presented, becomes part of the taxonomic organisation of the technical field.

Another common site for compositional reports is in anatomy and physiology. In this field such reports first classify a body system and explain its function. Then the components of the system and their functions are given, then the subcomponents and their functions. Text [4:5] illustrates this pattern for human circulatory system. Figure 4:4 illustrates some components of the system.

Figure 4.4: Human circulatory system



[4:5] **Transport in the body**
Transport systems are need inside the body of all living things. In humans the blood or circulatory system carries digested food and other materials around the body. The blood contains 20 billion tiny cells floating in a liquid called *plasma*. The cells are of two different kinds *red cells* which carry oxygen and *white cells* which attack germs. Platelets which are microscopic discs, help in blood clotting.

Red blood cells are made in bone marrow. They live for about 100 days and then they are destroyed by the liver. The bone marrow makes new cells to replace the destroyed cells. White blood cells protect the body against toxins and infections.

The chemicals into which food has been broken-down are carried to all the body's cells in the blood. Blood also carries waste away from the cells.

The blood moves through a series of tubes called *blood vessels*. The tubes could be compared with the road network of a country. However there are no head-on crashes as the tubes are strictly one-way.

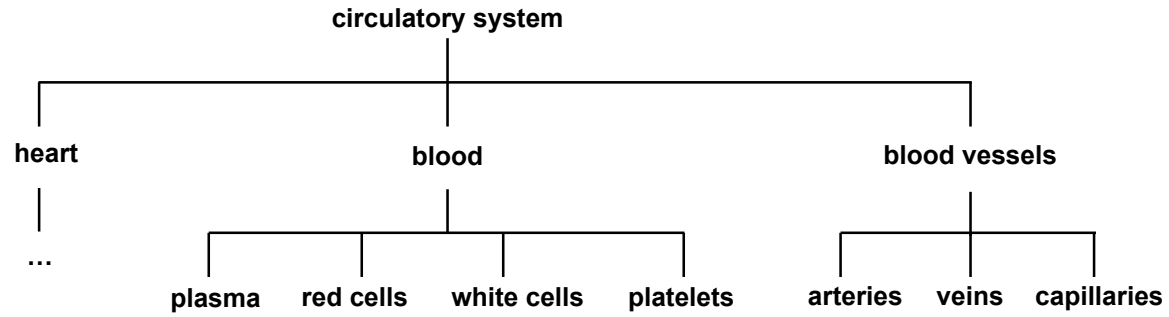
Blood is pumped around the body by the heart. Tubes called *arteries* carry blood away from the heart. Except for the artery to the lungs they carry bright red blood, rich in oxygen. Tubes called *veins* bring blood back to the heart. Except for the vein from the lungs they carry dark red blood, short of oxygen. The smallest arteries and veins are linked by tiny tubes called *capillaries*. Through their fine walls, oxygen and the chemicals from food are delivered to the cells all over the body, and waste products are collected.

Watson 1999:94

The entity here is the circulatory system, and its function is *carries digested food and other materials around the body*. Its parts are given in italics: *plasma, red cells*, *white cells*, *platelets*, *blood vessels*, *heart*, *arteries*, *veins* and *capillaries*, and the function of each is given. The components of this anatomy report are thus structure-&-

function, reflecting the component-&-activity pattern seen in the ecology compositional report [4:4] above. But here the composition is organised in a hierarchy at three levels, a compositional taxonomy. Compositional taxonomies are represented as top-down 'tree diagrams', as in Figure 4.5.

Figure 4.5: Compositional taxonomy in text [4:5]



4.2 Explanations: how processes happen

Explanations are concerned with explaining how processes happen. To this end they imply sequences of causes and effects: process x occurs, so process y results, which in turns causes process z, and so on. This kind of logical pattern has been termed an **implication sequence** (Wignell, Martin & Eggins 1993). The typical structure of explanations is to start by specifying the Phenomenon to be explained, followed by the implication sequence that explains it, the Explanation stage. Explanation genres are of four general types: they may consist of a simple sequence of causes and effects; a **sequential** explanation; they may involve multiple causes, a **factorial** explanation, or multiple effects, a **consequential** explanation; or the effects may vary depending on variable conditions, a **conditional** explanation.

In the sequence of an explanation, logical relations between events are temporal - either succeeding each other in time or happening at the same time. But an effect may be more or less obliged to follow its cause, and a causal event may be more or less likely to occur. In other words, **consequence** modulates a temporal sequence with obligation, there is some reason why an effect must follow its cause. This is the meaning of 'because, so, therefore' and so on. On the other hand **condition** modalises a causal event with probability, a condition may be present, and if it is the effect is obliged to follow. This is the meaning of 'if…then'. Thirdly if an effect should follow another, and for some reason it doesn't, this must be conceded. This is the meaning of 'however, but, nevertheless' and so on. These and related consequential meanings are set out in Table 4.1.

Table 4.1: Some consequential relations and common conjunctions

Cause	expectant	*because, so, therefore*
	concessive	*although, even though, but, however*
Condition	expectant	*if, then, provided that, as long as*
	concessive	*even if, even then*
Means	expectant	*by, thus*
	concessive	*even by, but*

In written explanations, causal relations need not be made explicit. That is the causality may not explicitly realised as causal conjunctions like ‘because, so, therefore’, but can be implicit in the explanation genre. The genre is typically announced in the Phenomenon stage, so the reader can infer causal relations where they are not stated.

4.2.1 Sequential explanations

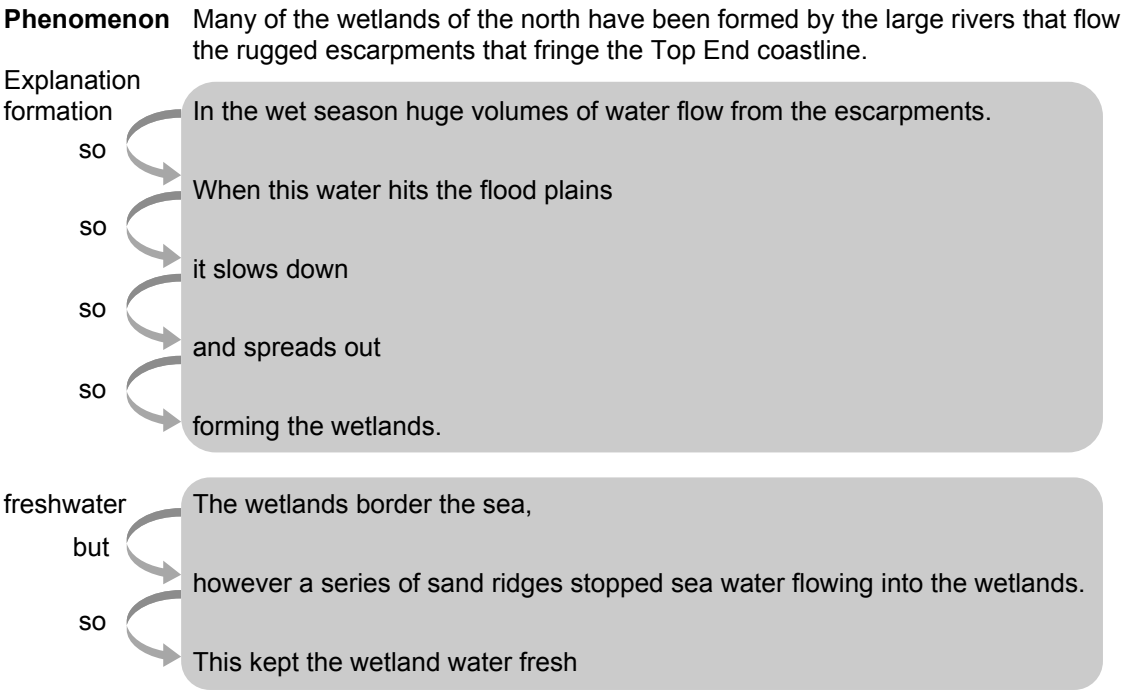
Sequential explanations are typically constructed as a series of events, in which an obligatory causal relation is implied between each event. The following example [4:6] explains how wetlands are formed along the coastline of northern Australia, by water flowing during the tropical wet season. The explanation genre is signalled in the first sentence *Many of the wetlands of the north have been* ***formed***… The Explanation stage answers the question ‘how are they formed?’.

[4:6] **A lowland freshwater wetland – Lower Mary River**
Many of the wetlands of the north have been formed by the large rivers that flow from the rugged escarpments that fringe the Top End coastline. In the wet season huge volumes of water flow from the escarpments. When this water hits the flood plains it slows down and spreads out forming the wetlands. The wetlands border the sea, however a series of sand ridges stopped sea water flowing into the wetlands. This kept the wetland water fresh.

Scott & Robinson 1993: 92

The Explanation here consists of two phases, the first explaining how the wetlands are formed in lowlands and the second explaining how the water is kept fresh. The implication sequence is explicated in Figure 4.6, in which the stages of Phenomenon and Explanation are labelled, relations between events are diagrammed with arrows, and these are glossed with explicit conjunctions.

Figure 4.6: Implication sequence in sequential explanation [4:6]



[**Definition** Wetlands formed in this way are known as **lowland freshwater wetlands**.]

In text [4:6] the technical term for this type of wetland was given in the title. Here we have added a definition phase to exemplify how explanations can either begin or conclude with a technical definition of the explained phenomenon.

Recognising the implied causal relations in [4:6] depends on imagining the geographic field of the Top End topography and climate, and expectancy implicit in each step. Wet season rainfall exceeds 1200mm. The escarpments are high plateaux. So the water is expected to flow rapidly from the escarpments to the flood plains, where it is expected to slow down and spread out on the flat ground. In the last phase, an expectant relation between bordering the sea and sea water flowing in is countered by concessive *however*, so the sand ridges are expected to keep the water fresh. In other words the series of consequential relations glossed here as ‘so’ are implicit in the genre and the field, and must be explicitly countered where required.

Sequential explanations vary widely according to the particular phenomenon being explained. Text [4:7] below explains the role of fire in the growth cycles of the Mallee ecosystem. This cycle is defined partway through as a **succession**. The implication sequence is also followed by an Extension stage that contrasts Aboriginal and European influences on the fire regime.

[4:7] **Fire – a natural process which is now significantly influenced by humans**
Since the advent of the present vegetation pattern around 10,000 years ago, fire has been crucial in modifying the Mallee environment. Regeneration of the Mallee depends on periodic fires. Old mallee produces a build-up of very dry litter and the branches themselves are often festooned with streamers of bark inviting a flame up to the canopy of leaves loaded with volatile eucalyptus oil. A dry electrical storm in summer is all that is needed to start a blaze, which, with a very hot northerly wind behind it will race unchecked through the bush. The next rain will bring an explosion of ground flora; the

summer grasses and **forbs** not able to compete under a mallee canopy, will break out in a riot of colour. New shoots of mallee will spring from the lignotuber and another cycle of **succession** will begin.

The dead branches become hollows for Major Mitchell cockatoos and other birds on whose eggs the goanna feeds. The more open bush provides green 'pick' for kangaroos and emus. The low shrubs give a home for zebra finches, but the abundant litter need by the mallee fowl to build a nest is no longer available.

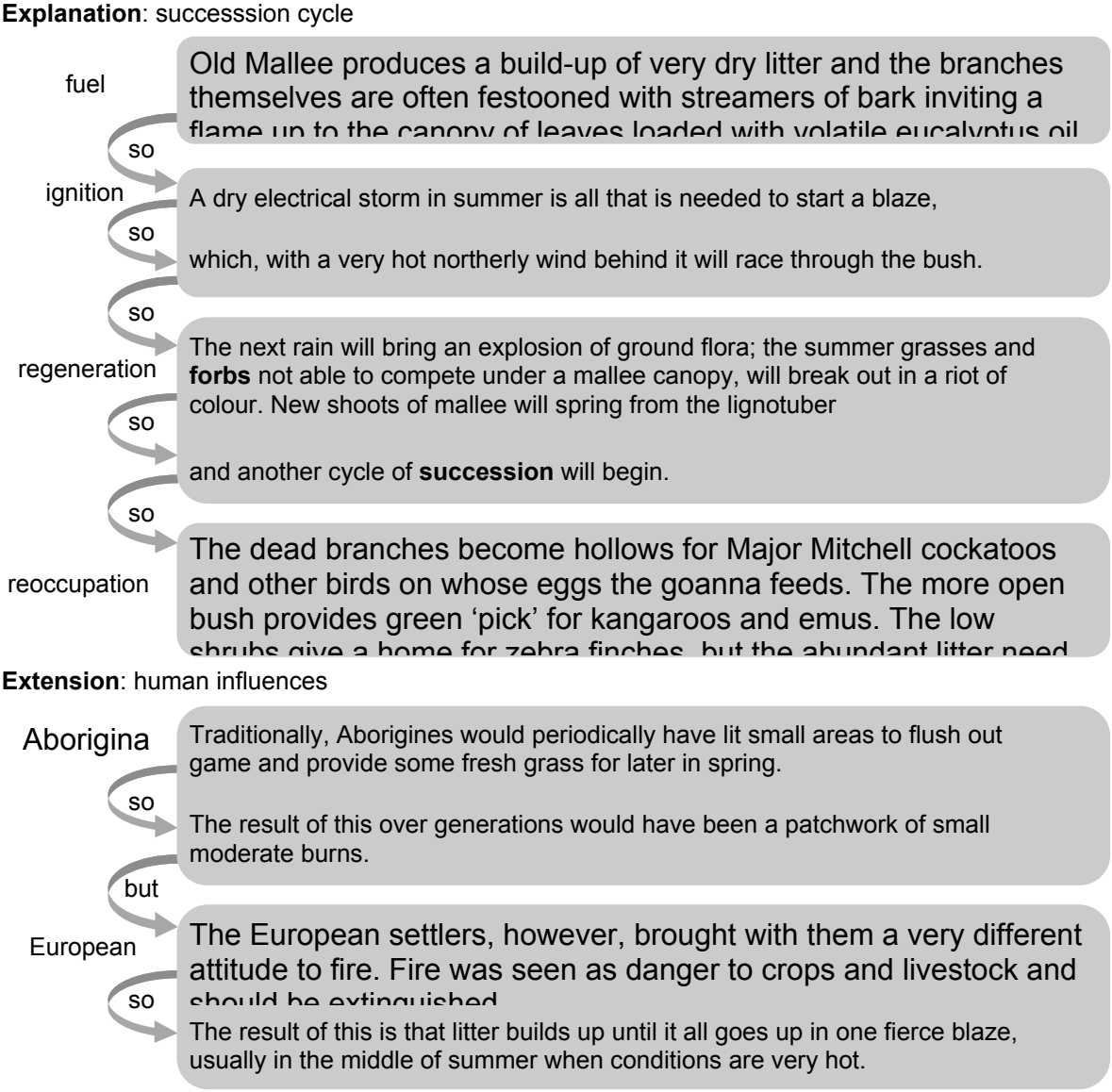
Traditionally, Aborigines would periodically have lit small areas to flush out game and provide some fresh grass for later in spring. The result of this over generations would have been a patchwork of small moderate burns.

The European settlers, however, brought with them a very different attitude to fire. Fire was seen as danger to crops and livestock and should be extinguished if possible. The result of this is that litter builds up until it all goes up in one fierce blaze, usually in the middle of summer when conditions are very hot.

Corrigan et al 1991:100

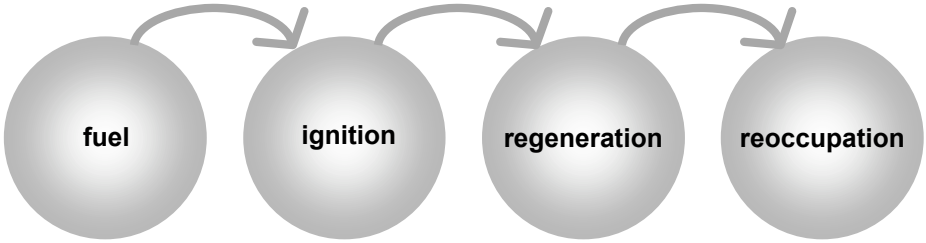
The implication sequences of [4:7] are diagrammed in Figure 4.7. There are four phases in the succession cycle, and two in the Extension stage, contrasting Aboriginal and European influences.

Figure 4.7: Implication sequence of mallee succession [4:7]



This pattern in an implication sequence, of a series of phases succeeding each other, is a common explanation pattern, diagrammed in Figure 4.8. Unsworth 1997, 2001 describes a comparable pattern for explanations of coal formation, for which he terms each phase a 'transformation' and the explanation type 'transformational'. Here we will group these as a variety of sequential explanations. The Extension giving human influences is a feature of the field of geography, and related school sciences. This syndrome is discussed by Veel 1998.

Figure 4.8: Series of phases in sequential explanation [4:7]

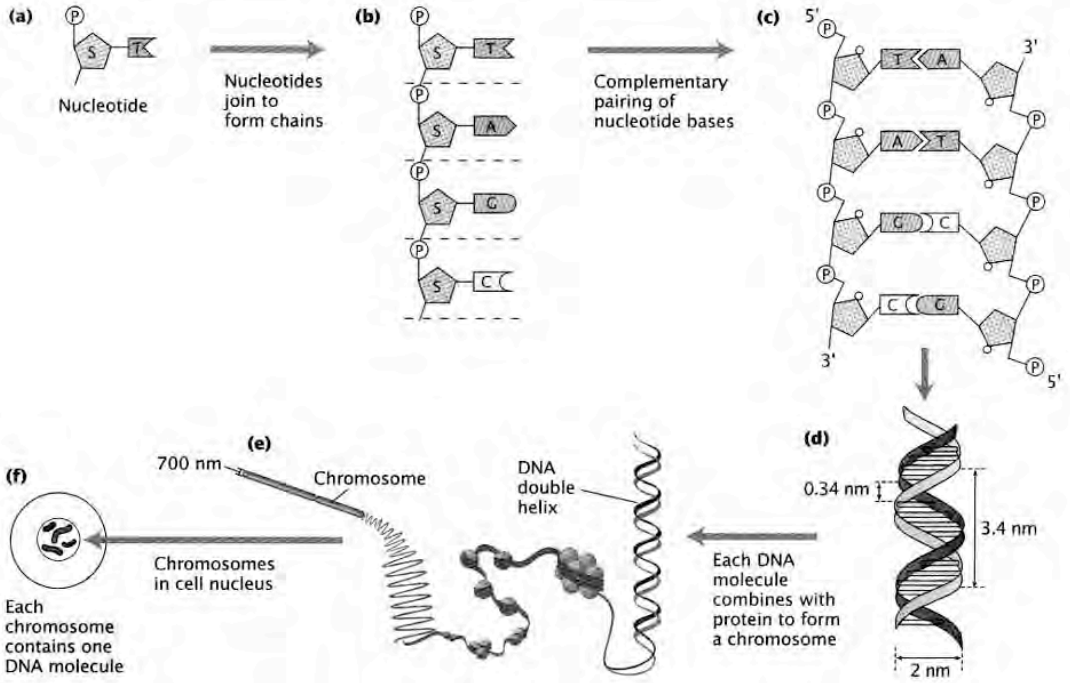


From the macro scale of ecosystems, to the micro scale of cell structures, text [4:8] below explains the formation of DNA in cell nuclei. It begins with a compositional report describing the *nucleotides* that compose DNA, followed by an explanation of how they combine to form the double helix of DNA. The technical density of the text makes it difficult to follow without the accompanying diagram, which in included as Figure 4.9.

[4:8] Deoxyribose nucleic acid
The genetic material deoxyribose nucleic acid (DNA) is a polymer of nucleotides. Each nucleotide unit has a sugar (deoxyribose) part, a phosphate part and an N-containing base. There are four different kinds of nucleotides be cause four different kinds of N-containing bases are involved. The four different N-containing bases are **adenine**, **thymine**, **cytosine** and **guanine** and the four different nucleotides are denoted by the letters A, T, C and G because of the kind of base each contains.

Examine figure [4.9]. The nucleotide sub-units (a) are assembled to form a chain (b) in which the sugar of one nucleotide is bonded with the phosphate of the next nucleotide in the chain. Each DNA molecule contains two chains (c) that bond with each other because the bases in one chain pair with the bases in another. The base pairs between the two strands, namely A with T, and C with G, are said to be complementary base pairs. The two chains form a double-helical molecule of DNA (d) that combines with certain proteins to form a chromosome (e). These chromosomes reside in the nucleus of a cell (f) and the DNA they contain carries the genetic instructions that control all functions of the cell.

Figure 4.9: Deoxyribose nucleic acid

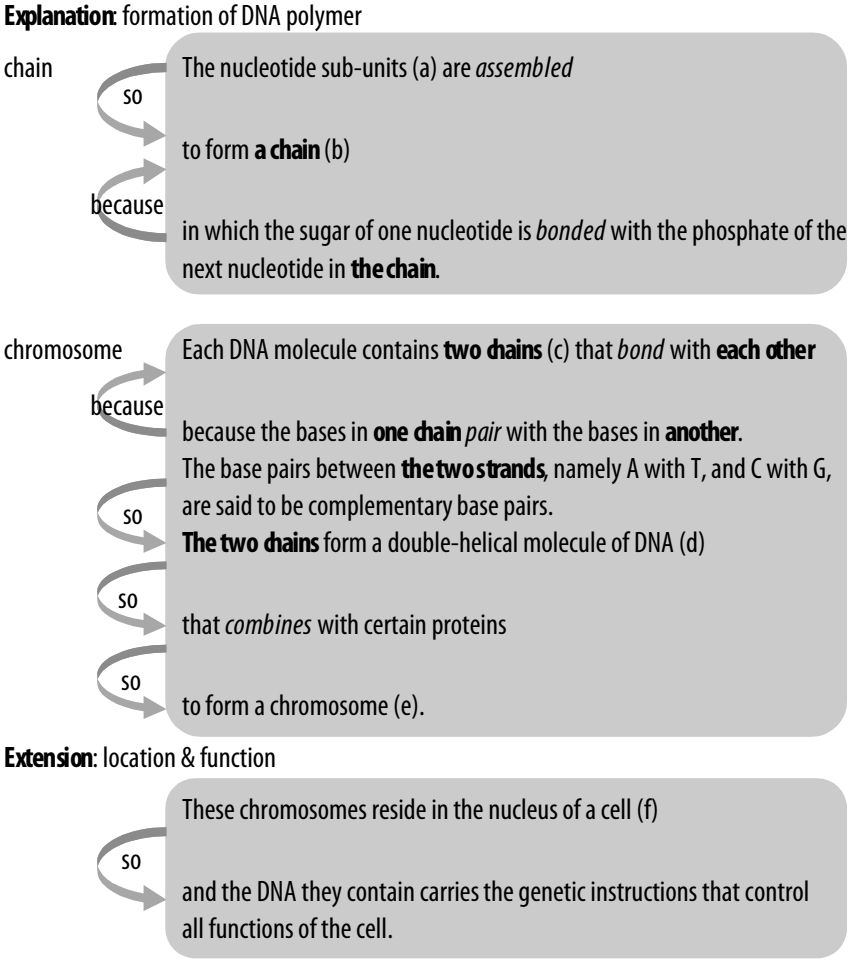


Kinnear & Martin 2004: 99

The compositional report defines DNA compositionally as a *polymer*, i.e. made up of smaller molecules, and then sets out the components. The explanation then explains how the components combine to form the polymer. This implication sequence is diagrammed in Figure 4.10 below, with processes of combining in italics: *assemble, bond, pair, combine*. There are two phases in the Explanation stage, explaining the formation of chains from nucleotides, and the formation of chromosomes from chains, and an Extension giving the location and function of DNA in the cell.

As well as causal links leading from one step to another, glossed with ‘so’, there are also reasons that follow some steps, glossed with ‘because’. However understanding the sequence depends not only logical relations, but on lexical relations. The key lexical item here is **chains**, highlighted in bold.

Figure 4.10: Implication sequence of DNA formation in explanation [4:7]



Here the Extension reflects a syndrome of the physiology field, to give functions for physiological structures, as we saw in the anatomical report [4:x]. It is also noteworthy in this text how a technical term is arrived at in steps, beginning with a process: *the bases in one chain **pair** with the bases in another*, which becomes a nominal group: *the **base pairs***, and is finally defined as a technical term: *said to be **complementary base pairs***.

Another pattern in sequential explanations is described by Unsworth 2001, for explanations of sound waves, exemplified in text [4:9]. Here the implication sequence consists of three phases, compression of air, followed by 'stretching' of air, followed by *a series of compressions and stretchings*.

[4:9] **What causes and transmits sounds?**

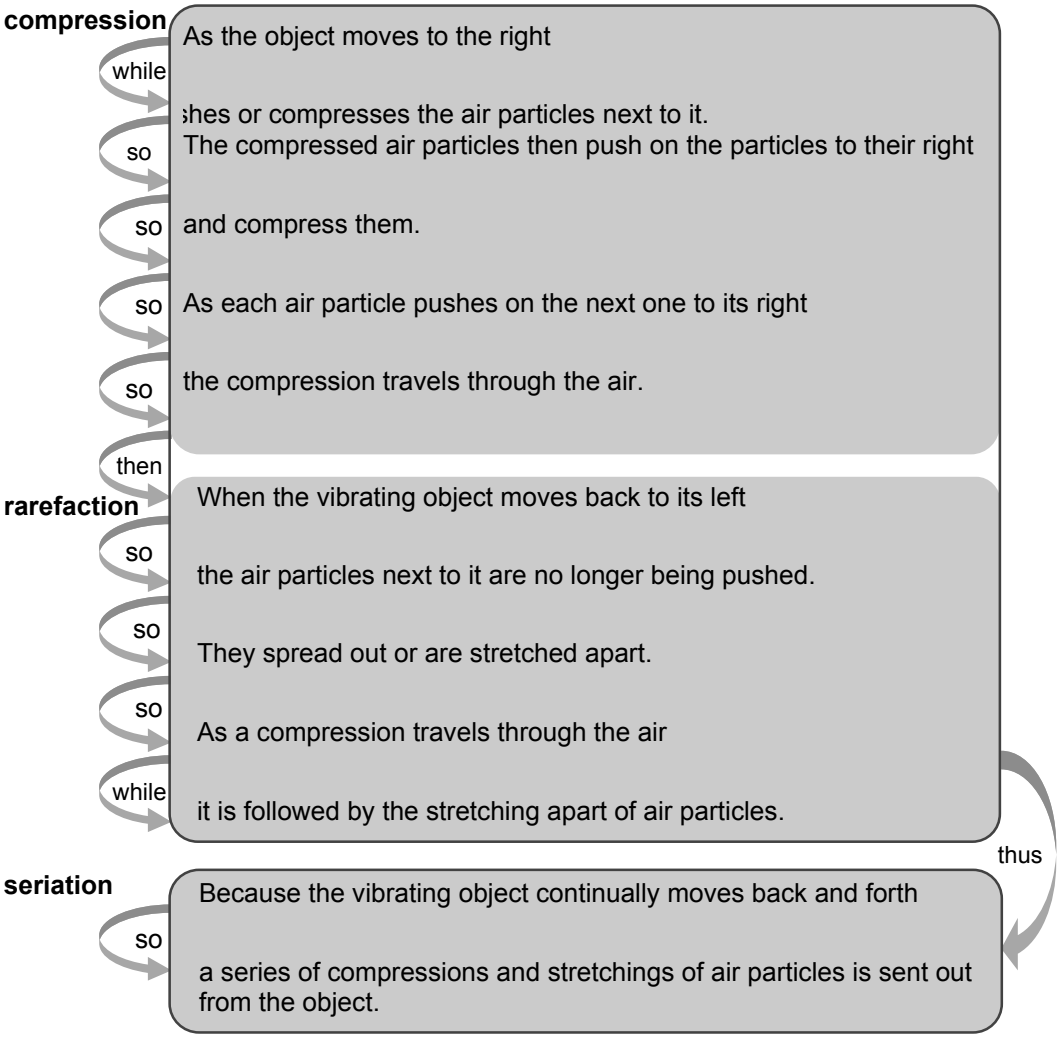
…

Figure 15.1 shows a vibrating object [[producing sound waves]]. As the object moves to the right it pushes or compresses the air particles next to it. The compressed air particles then push on the particles to their right and compress them. As each air particle pushes on the next one to its right the compression travels through the air. When the vibrating object moves back to its left the air particles next to it are no longer being pushed. They spread out or are stretched apart. As a compression travels through the air it is followed by the stretching apart of air particles. Because the vibrating object continually moves back and forth a series of compressions and stretchings of air particles is sent out from the object.

Chapman et al. 1989: 280-281

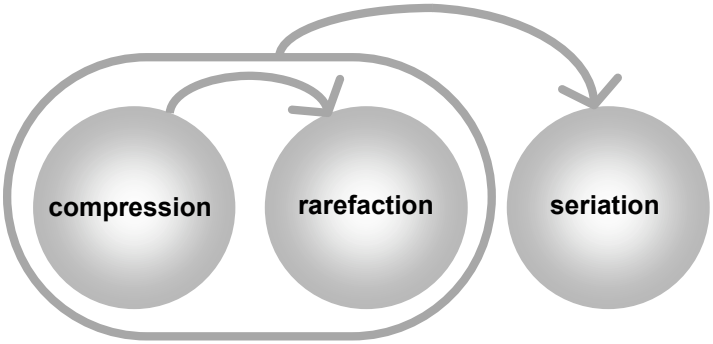
This implication sequence is diagrammed in Figure 4.11. Events in the compression and 'stretching' (i.e. rarefaction) phases are linked by time and cause, but the last phase combines these two into a series. That is it does not follow them in field time; rather it is linked to them by reasoning that is internal to the text, glossed here as 'thus'. As it combines the compression and rarefaction phases into a series, Unsworth calls this phase 'seriation'.

Figure 4.11: Implication sequence of sound waves in explanation [4:7]



This kind of structure is not simply serial, as in the preceding explanations. The compression and rarefaction phases are a series, but the seriation phase is linked to both in an orbital structure, diagrammed in Figure 4.12.

Figure 4.12: Orbital structure of sound explanation



4.2.2 Factorial explanations

We saw in Chapter 3 that historical events may be explained by two or more contributing factors. The same broad pattern is also commonly seen in scientific factorial explanations. The following example [4:10] explains how the Acacia tree species *mulga* survives long droughts by reference to three factors, its shape, its colour, and the food supplied by its own leaves.

[4:10] **The mulga tree**
How can plant life grow so well in such dry, hot and infertile places?

Surviving the long drought
The mulga tree likes long droughts – if it is too wet mulga trees will not grow.

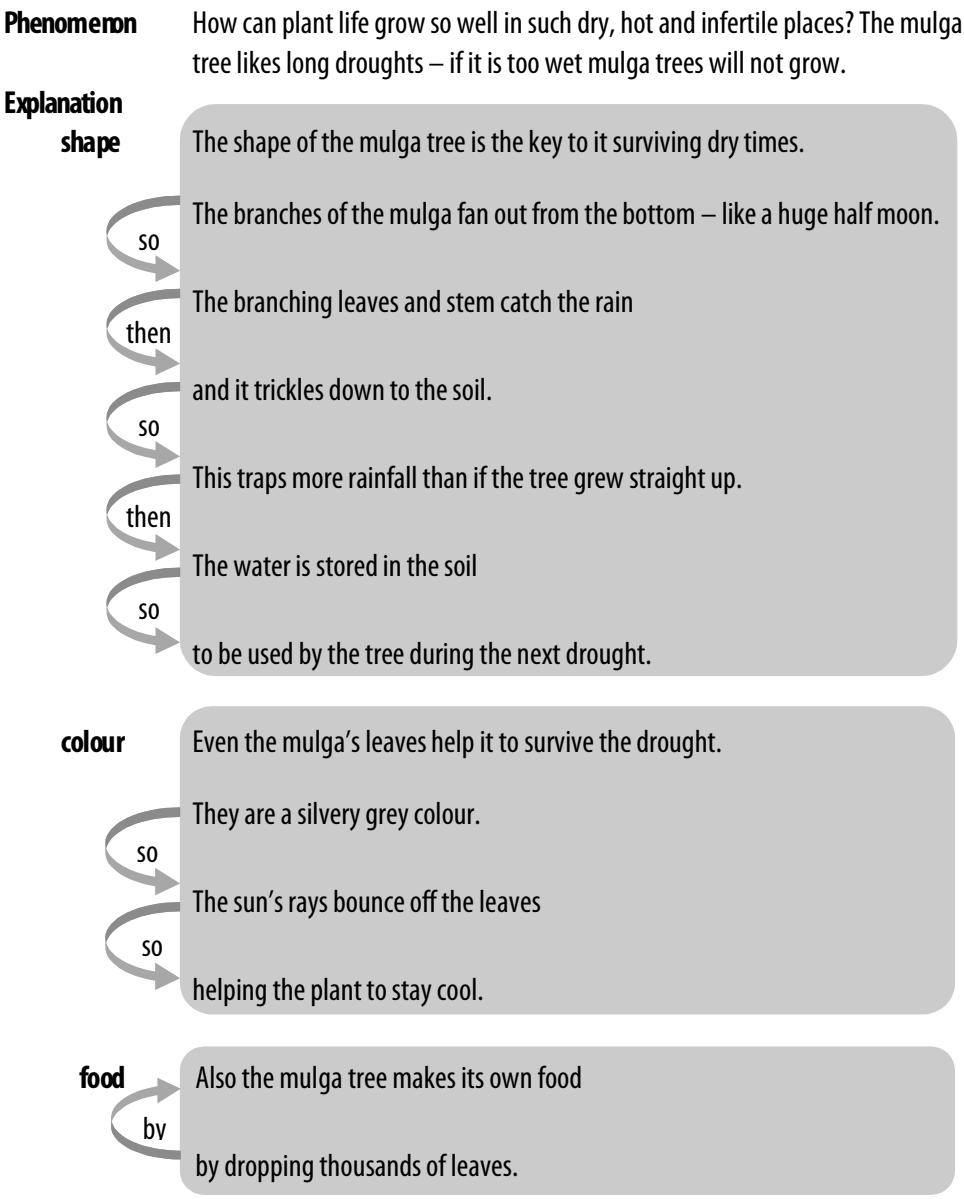
The shape of the mulga tree is the key to it surviving dry times. The branches of the mulga fan out from the bottom – like a huge half moon. The branching leaves and stem catch the rain and it trickles down to the soil. This traps more rainfall than if the tree grew straight up. The mulga catches more water than a gum tree. The water is stored in the soil to be used by the tree during the next drought.

Even the mulga's leaves help it to survive the drought. They are a silvery grey colour. The sun's rays bounce off the leaves helping the plant to stay cool. Also the mulga tree makes its own food by dropping thousands of leaves.

Scott & Robinson 1993: 22

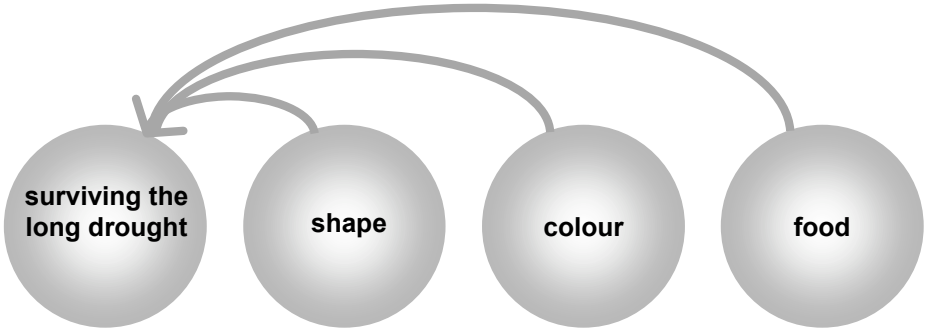
Here the genre is announced in the form of a 'how' question interrogating the Phenomenon. The three factors constitute three phases: since the shape is the 'key' factor it is given a whole paragraph; then colour takes two sentences, and food takes one. The explanation is diagrammed in Figure 4.13, and the three factors are labelled.

Figure 4.13: Implication sequence in factorial explanation [4:10]



Each factor is announced and then explained. In the first phase, relations between events are either causal or simply temporal succession. Firstly because of the shape, the leaves and stem catch the rain, which then trickles down, and so on. In the second phase, specialised field knowledge is required to recognise the implicit causal relation between the leaves' colour and sun's rays bouncing off. The third phase also requires specialised field knowledge to recognise the causal relation between dropping leaves and making food. Here the causal relation is expressed as means 'by', in order to thematise the factor in a single complex sentence. As each factor contributes independently to the effect, factorial explanations have an orbital structure, with the effect as nucleus, diagrammed in Figure 4.14.

Figure 4.14: Orbital structure of factorial explanation [4:10]



4.2.3 Consequential explanations

As with history's consequences for society, a single event may have two or more consequences in the natural world. Text [4:11] explains three consequences of clearing the woodlands of southern Australia: death of remaining trees, erosion of land, and destruction of habitat.

[4:11] **Woodlands of the south**
In southern Australia the woodlands have been cleared to plant crops like wheat and other cereals. Sheep and cattle are grazed on introduced pastures. When the land was first cleared small clumps of trees or single trees were left for shade. Today these trees are reaching the end of their lives and dying.

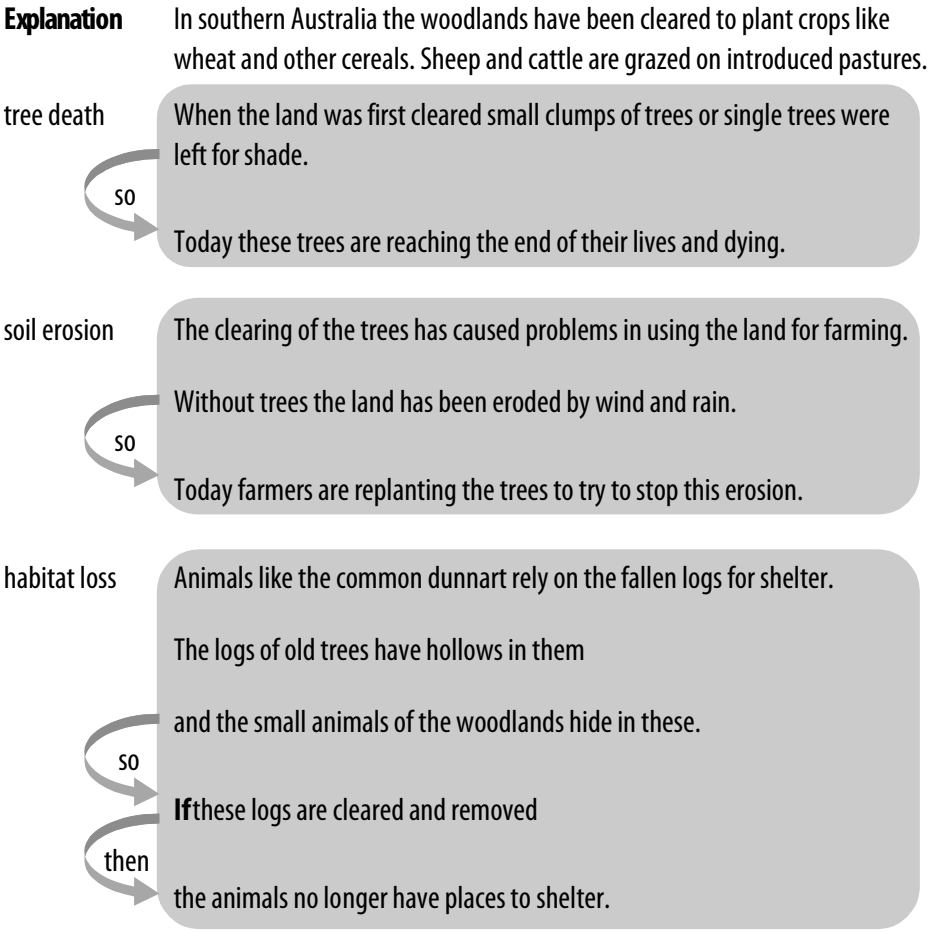
The clearing of the trees has caused problems in using the land for farming. Without trees the land has been eroded by wind and rain. Today farmers are replanting the trees to try to stop this erosion.

Animals like the common dunnart rely on the fallen logs for shelter. The logs of old trees have hollows in them and the small animals of the woodlands hide in these. If these logs are cleared and removed the animals no longer have places to shelter.

Scott & Robinson 1993: 114

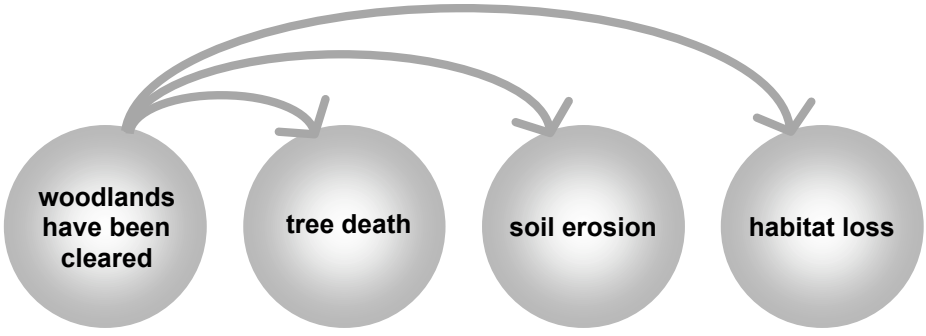
Each consequence is a phase here. The first is announced by time *When the land was first cleared….* The second and third are given their own paragraphs. The phasal structure and causal relations are diagrammed in Figure 4.15.

Figure 4.15: Implication sequence in consequential explanation [4:11]



Here the Phenomenon is not an effect, as we have seen in other explanations, but the cause of three effects. In the first and second phases of the explanation, consequential relations are implicit in the field, i.e. that clearing occurred many decades ago, and that stopping erosion is in farmers' interest. The causal relation between clearing and erosion is realised within one sentence as a phrase *without trees*. In the third phase, the field is made very explicit, and the consequential relation is modalised as conditional 'if'. As each consequence follows independently from the cause, consequential explanations have an orbital structure, with the cause as nucleus, diagrammed in Figure 4.16.

Figure 4.16: Orbital structure of consequential explanation [4:11]



4.2.4 Conditional explanations

Like other types of explanations, conditional explanations imply obligatory relations between events, but they construe effects as contingent on variable factors. Text [4:12] explains what happens to animal populations under three conditions: if predators are absent, if prey are too few, and if numbers of both predator or prey fall and build up again.

[4:12] **Predator and prey population numbers**
Population size of one species can be affected by the size of the population of another species. This is true in the case of a predator species and the prey species on which it feeds. Over time, several outcomes are possible:

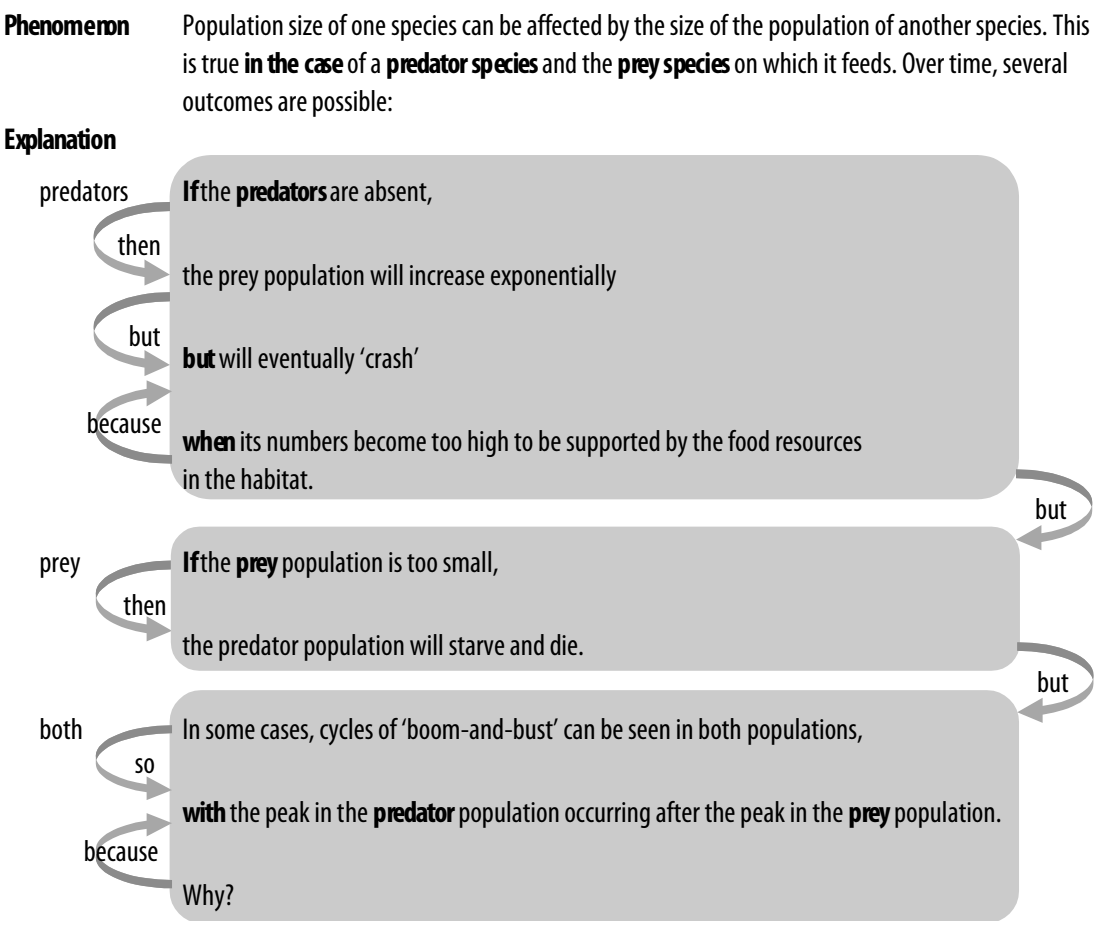
- If the predators are absent, the prey population will increase exponentially but will eventually 'crash' when its numbers become too high to be supported by the food resources in the habitat.
- If the prey population is too small, the predator population will starve and die.

In some cases, cycles of 'boom-and-bust' can be seen in both populations, with the peak in the predator population occurring after the peak in the prey population. Why?

Kinnear & Martin 2004: 15

In conditional explanations the Phenomenon typically generalises the variability of causation, as in *can be affected*, and the contingency of effects is often explicit, as in *several outcomes are possible*. Here the first two conditional phases are demarcated as dot points, while the third asks student readers to hypothesise the condition for the *'boom-and-bust'* effect. Phases and relations are set out in Figure 4.17.

Figure 4.17. Implication sequence in conditional explanation [4:12]



Here we have interpreted the relation between each condition as internal contrast, glossed with 'but'. The relation between these and the generalisation is lexical: ***in the case of*** *a* ***predator*** *species and the* ***prey*** *species* is repeated as ***If*** *the* ***predators*** and ***If*** *the* ***prey***. In the first Explanation phase, the chain of reasoning involves three causal steps following the condition, the obligatory 'then', concessive 'but' and consequential 'because'. Likewise the second phase involves obligatory 'then' following the condition. The third phase presents a possible effect *In some cases*…, and asks the student reader to imagine a condition.

Conditional explanations are found across all technical fields in varying forms. Another illustration, text [4:13] is from secondary school physics, explaining why objects sink or float in fluids.

[4:13] **Buoyancy and Density**

If the object is completely submerged it displaces its own volume of fluid. The weight of displaced fluid, and therefore the upthrust, will depend on the density of the fluid.

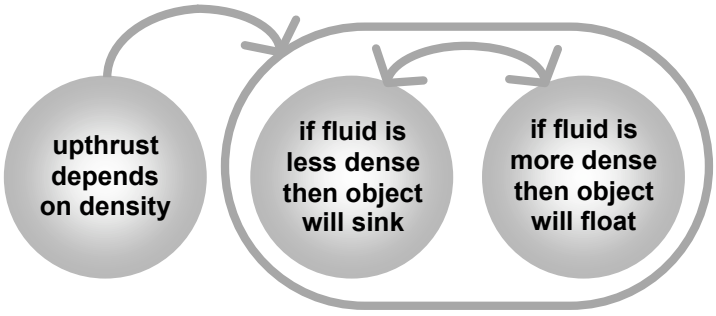
If the density of the fluid is less than the average density of the object, the weight of the displaced fluid will be less than the weight of the object and the object will sink.

If, on the other hand, the density of the fluid is greater than the average density of the object, the weight of the displace fluid will therefore exceed the weight of the object. The net upward force will then cause the object to rise to the surface where it will float.

Heading 1967

Here the Phenomenon is a general condition for buoyancy, *upthrust will depend on the density*. The Explanation then specifies two possible conditions, less or greater density, causing two possible buoyancy effects, sinking or floating. The contrast between the conditions is made explicit as *on the other hand*. As the conditions together specify the generalisation, conditional explanations also have an orbital structure, with the generalisation as nucleus, diagrammed in Figure 4.18.

Figure 4.18: Orbital structure of conditional explanation [4:13]



A comparable generic structure is described by Unsworth 1997 for explanations of the seasons. One such implication sequence is extracted as text [4:14].

[4:14] **Seasons of the Earth**

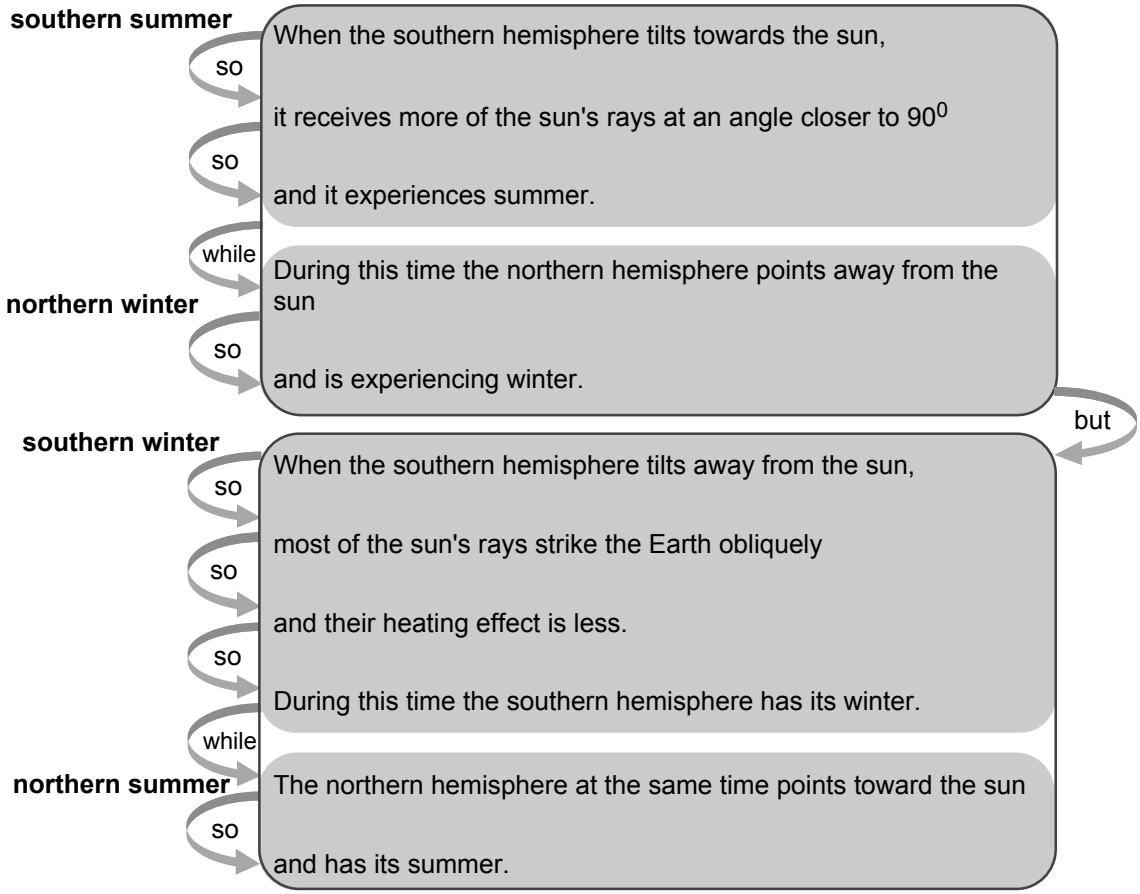
…

As a result of the tilt of the Earth's axis the southern hemisphere is inclined towards the sun in December and away from the sun in June. When the southern hemisphere tilts towards the sun, it receives more of the sun's rays at an angle closer to 90^0 and it experiences summer. During this time the northern hemisphere points away from the sun and is experiencing winter. When the southern

hemisphere tilts away from the sun, most of the sun's rays strike the Earth obliquely and their heating effect is less. During this time the southern hemisphere has its winter. The northern hemisphere at the same time points toward the sun and has its summer.

This implication sequence is diagrammed in Figure 4.19. The two conditions are the southern hemisphere tilting towards or away from the sun, and the effects are summer or winter. Each is also expanded with the effect on the northern hemisphere. Again we have interpreted the relation between the two as contrast with 'but', and again their relation to the generalisation is lexical.

Figure 4.19. Implication sequence of seasons explanation [4:14]



4.2.5 Technological explanations

Explanations are not only used in science for explaining natural process; they are also common in industry for explaining technological processes, and follow very similar discourse patterns. The following [4.15] is a technological explanation from a manual for operating part of a blast furnace in a steel mill. Steel is produced by burning massive quantities of coal, and hot combustible gas is discharged in this process. A large chamber called a brassert is used to cool and clean the gas so it can be used in other activities of the steel mill.

[4:15] Brassert
The main function of the brassert is to cool down the blast furnace gas discharged from the furnace and to also partially remove dust and grit from the gas. To achieve this increased gas cleanliness, the

gas must pass through the brassert at a reasonably slow velocity. Thus, the semi clean gas enters the bottom section of the brassert via a main from the dustcatcher.

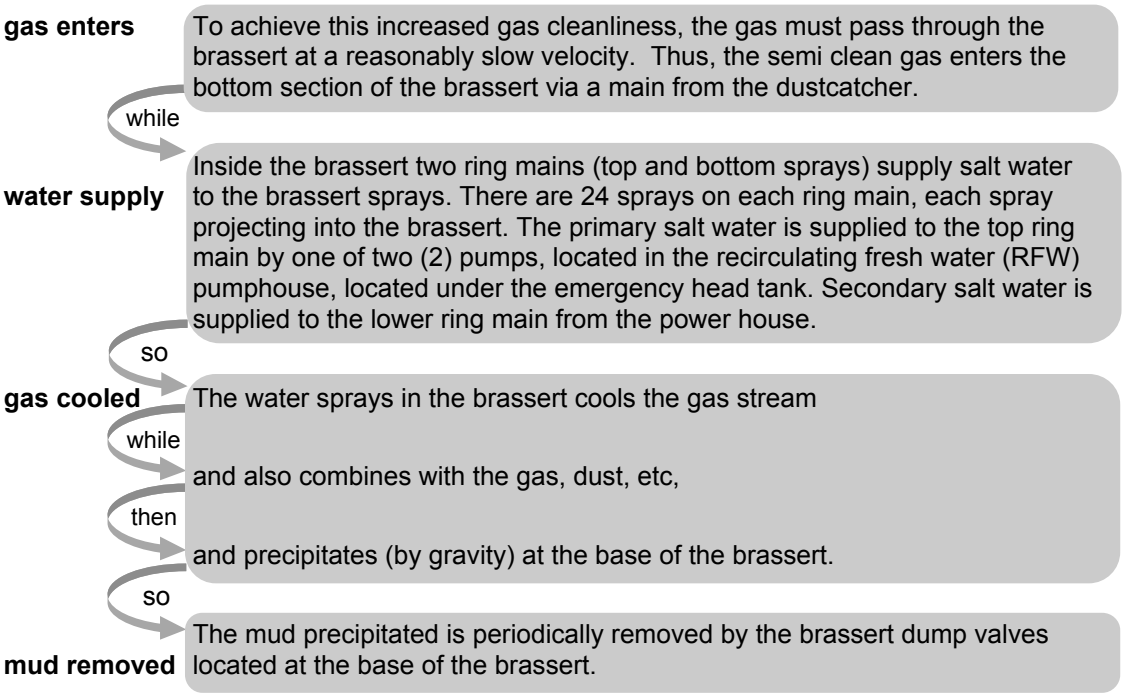
Inside the brassert two ring mains (top and bottom sprays) supply salt water to the brassert sprays. There are 24 sprays on each ring main, each spray projecting into the brassert.

The primary salt water is supplied to the top ring main by one of two (2) pumps, located in the recirculating fresh water (RFW) pumphouse, located under the emergency head tank. Secondary salt water is supplied to the lower ring main from the power house. The water sprays in the brassert cools the gas stream and also combines with the gas, dust, etc, and precipitates (by gravity) at the base of the brassert. The mud precipitated is periodically removed by the brassert dump valves located at the base of the brassert.

Abeysingha 1991

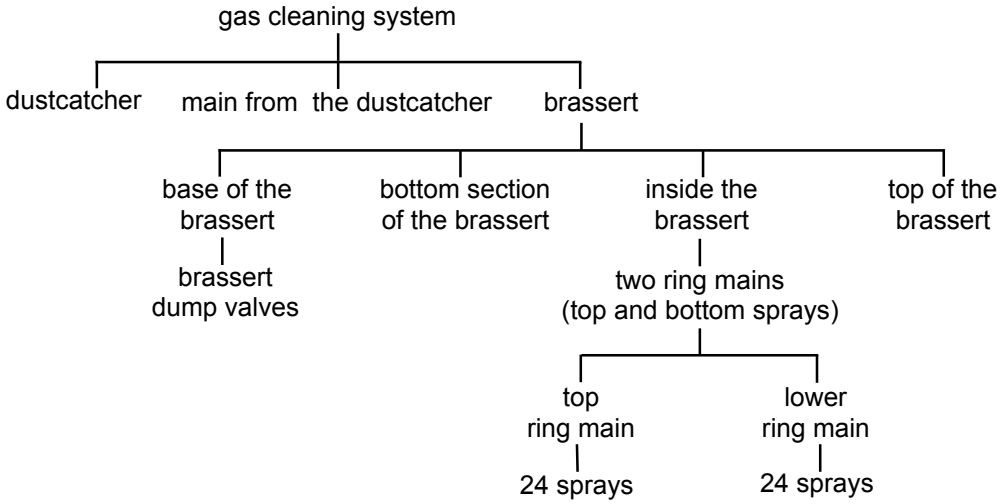
Here the Phenomenon is the function of the brassert. The Explanation involves four phases, entry of the gas, supply of salt water, cooling of the gas, and removal of mud. Logical relations between and within phases are shown in Figure 4.20. Here temporal relations also include simultaneous time, glossed as 'while'.

Figure 4.20. Implication sequence in technological explanation [4:15]



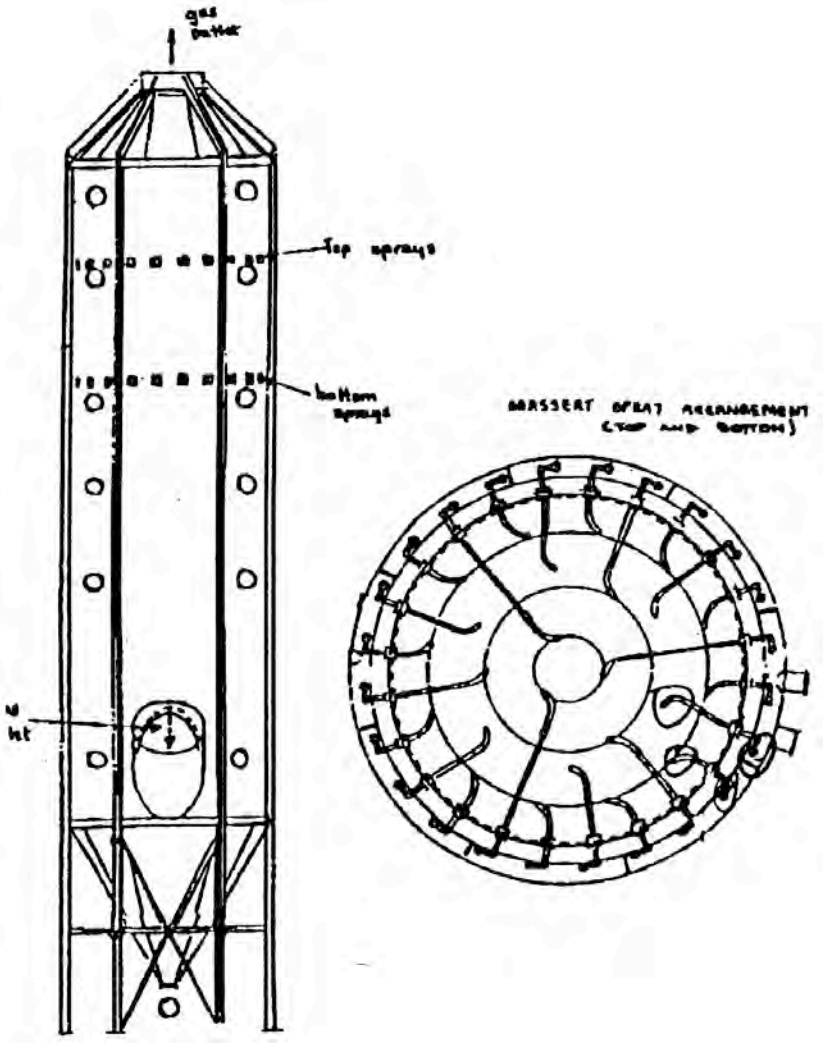
This technological explanation displays similar discourse patterns to the geography explanation of wetland formation [4:6]. It is sequential, and causal and temporal relations are often implicit. Furthermore in both the geography and technology explanations, substances move through a series of locations. In [4:6] water was associated with the escarpments, flood plains, sand ridges and wetlands. Here gas, water and mud pass through various locations within and outside the brassert. As the explanation of lowland freshwater wetlands was embedded in the Top End topography, here the explanation of gas cooling in the brassert is embedded in the topography of the blast furnace, and realises a composition taxonomy of its components, shown in Figure 4.21

Figure 4.21: Composition taxonomy realised in technological explanation



The composition of the gas cleaning system realised in the explanation is re-expressed as a series of diagrams in the operating manual, one of which is shown in Figure 4.22. On the left the tall brassert structure is shown in a cut-away elevation view, with the *gas outlet* labelled at the top, then the *2 ring mains*, labelled as *top sprays* and *bottom sprays*, then the gas inlet (*from the dustcatcher*) in the *bottom section*, with the *dump valve* at the *base of the brassert*. On the right is a plan view of the *brassert spray arrangement*, showing the *24 sprays* of the *top ring main* and *lower ring main*.

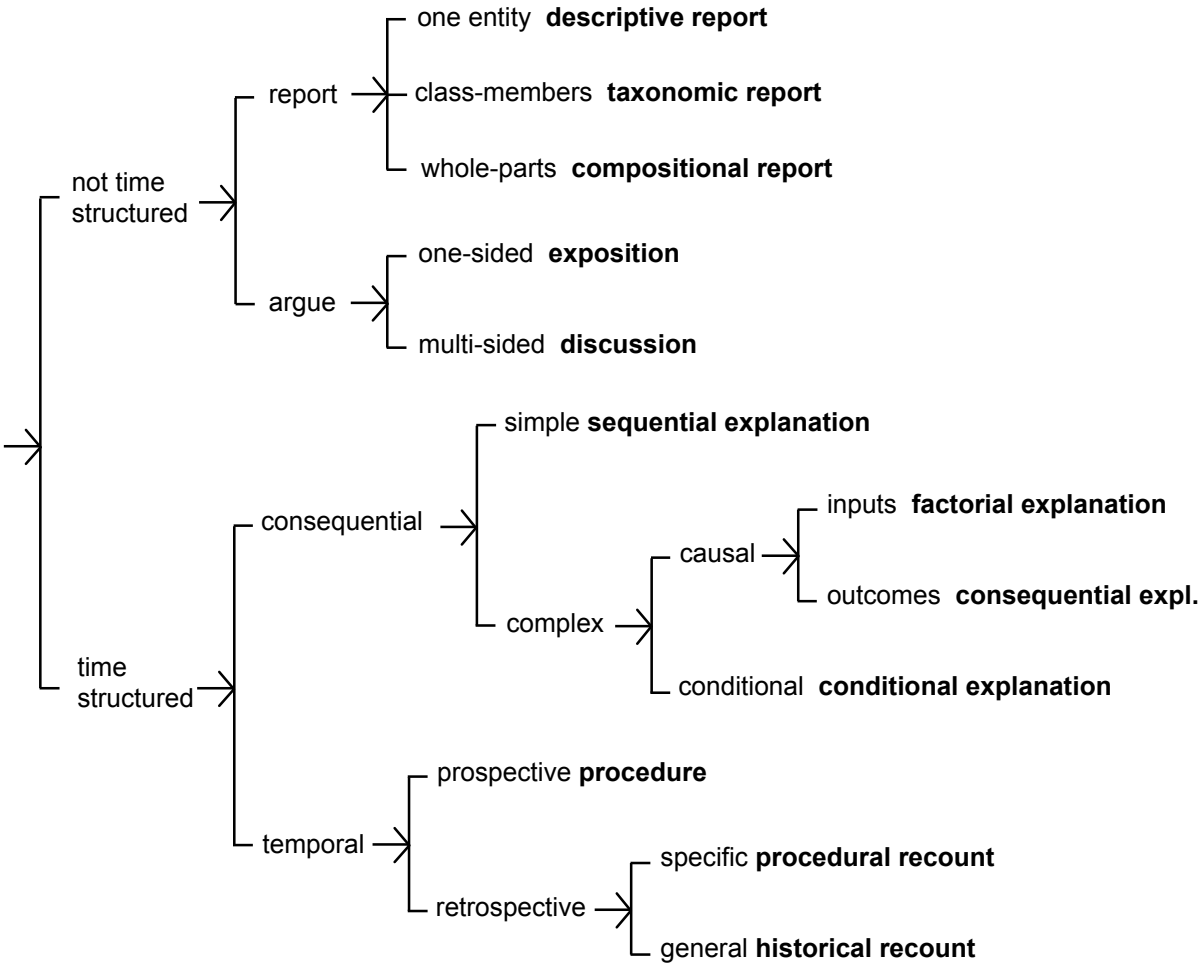
Figure 4.22: Brassert spray arrangement



4.3 Science genres

Although the focus of this chapter has been on reports and explanations, we have been particularly interested in their roles in science, and have also introduced some other genres used in science. As we did for history, we can construct a typology of these genres, but this time on criteria most relevant to the field of science. A key difference between reports and explanations is the role of time in their structuring: explanations construe sequences of activities, while reports are focused on entities, organised by classification and composition, rather than unfolding time. This structuring principle can also be extended to other genres used in science: time structured genres also include procedures, and procedural and historical recounts; non-time structured genres also include expositions and discussions. This typology of genres in science is set out in Figure 4.16.

Fig. 4.16: A typological perspective on relations between genres in science



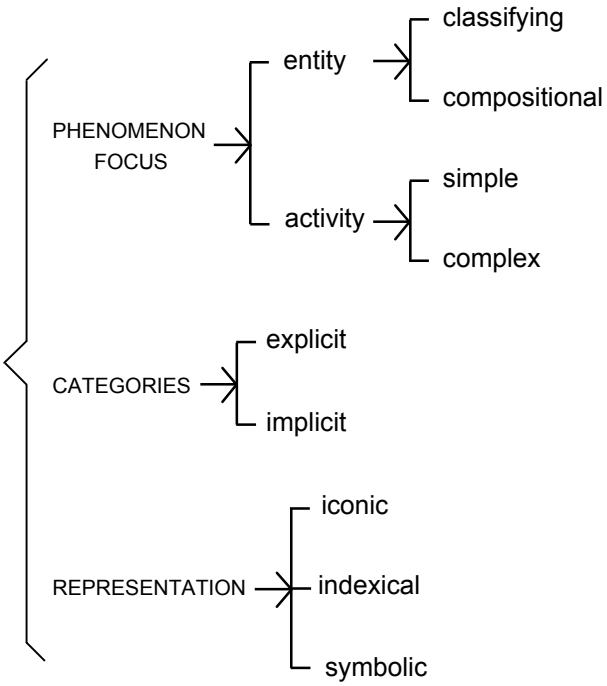
4.4 Multimodal reports and explanations

Written reports and explanations in science and technology fields are rarely found without accompanying illustrations in the form of diagrams, charts, photographs, line drawings and maps, that support the reader to interpret the verbal text. Conversely, such visual supports can rarely stand alone without verbal text to explain them. In any textbook there is a complex set of relations between verbal and visual components of such multimodal texts, that may be left implicit for the reader to infer. In this section we will describe multimodal reports and explanations from three perspectives: firstly types of ideational meanings construed by visual images (following Kress & van Leeuwen 1996, O'Toole 1994, Unsworth 2001a); secondly types of textual organisation characteristic of visual images (following Kress & van Leeuwen 1996), and thirdly types of relations between visual and verbal genres in multimodal texts, using Halliday's 2004 logicosemantic categories. As reports and explanations are focused on technical fields, we have set aside interpersonal meanings enacted by technical images at this point (cf Martin 2001c, 2004c for discussion).

4.4.1 Ideational meanings construed by visual images

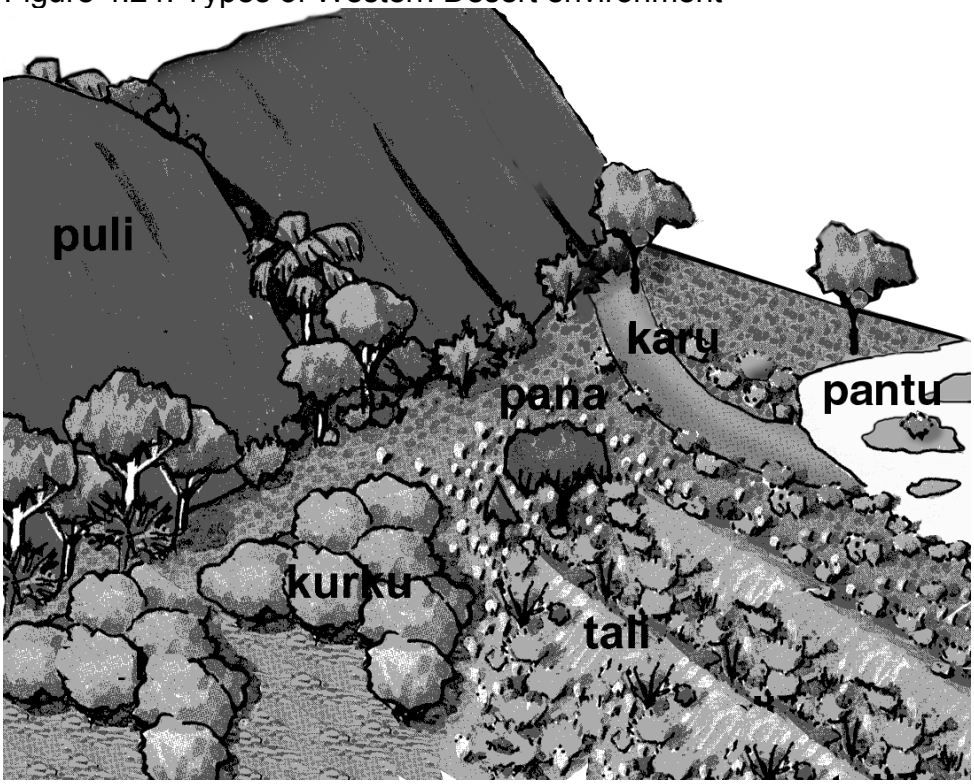
In the terms developed in this chapter, the focus of visual images in scientific texts is either on entities - classifying or de/composing them, or on activities - either a single activity (simple) or a sequence (complex). Categories within an image may be either explicitly labelled, or implicit for the reader to infer - from the accompanying verbal text or assumed knowledge of the field. Images may also be relatively iconic representations of an entity or activity, such as a photograph or realistic drawing, or they may be symbolic representations such as diagrams. In between, indexical images, such as outline drawings, are neither realistic icons, nor purely symbolic, but indicate some recognisable features of the represented entity or activity.[42] These three sets of features give the options in Figure 4.23.

Figure 4.23: General options in technical images for ideational meanings



A classifying image that is explicit and iconic is Figure 4.24, which classifies types of environment in Australia's Western Desert, with realistic drawings. Each landscape type is labelled with its Pitjantjatjara name: *puli* (rocky ranges), *kurku* (mulga plains), *pana* (grass plains), *tali* (sand ridges), *karu* (creeks and rivers) and *pantu* (salt lakes).

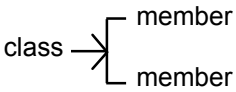
Figure 4.24: Types of Western Desert environment



from Rose 2001a

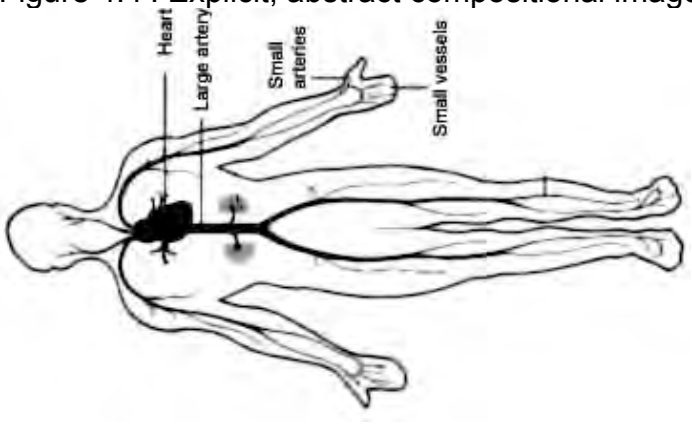
This iconic classifying image can be contrasted with symbolic classifying images such as the system networks in Figure 4.23, and those used throughout *Genre Relations* to classify genres. In these diagrams, a single left entry condition with multiple right exit features symbolises the relation of class to members, as shown in Figure 2.25.

Figure 2.25: System network: an explicit symbolic classifying image



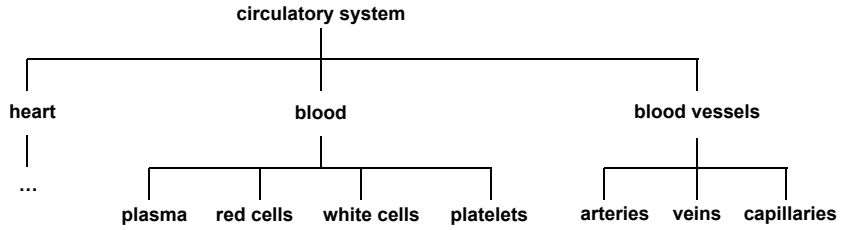
A compositional image which is explicit and indexical is Figure 4.4, reproduced here, that indicates parts of the human circulatory system in outline form, with labels for the heart and blood vessels. Another is Figure 4.22 above, that indicates the parts of the brassert spray arrangement as a cutaway diagram, with labels for the various sprays.

Figure 4.4': Explicit, abstract compositional image



A compositional image which is explicit and symbolic is the compositional taxonomy of parts of the circulatory system in Figure 4.5, reproduced here. In this tree diagram, a single top entry point with multiple lower features symbolises the relation of whole to parts.

Figure 4.5': Compositional taxonomy in text [4:5]



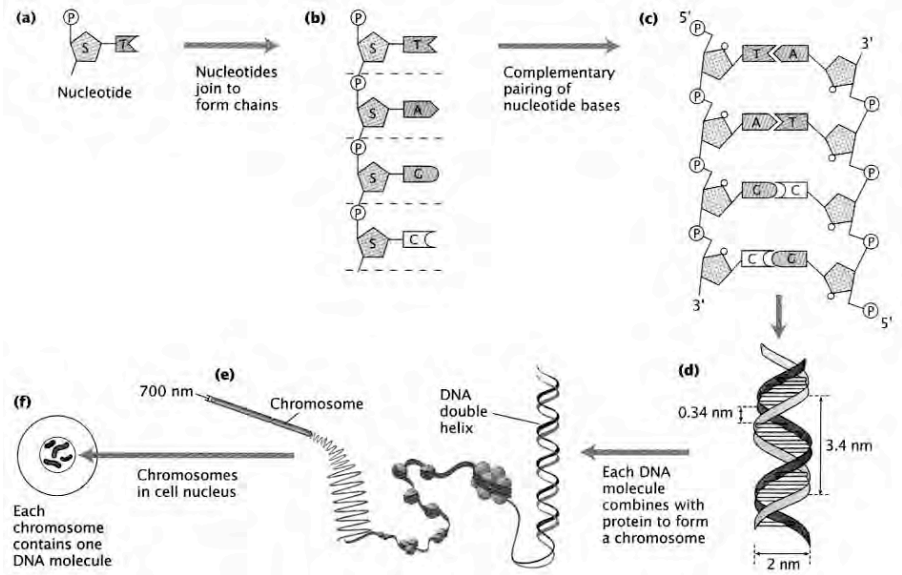
An implicit iconic compositional image is Figure 4.1, reproduced here, which displays the parts of a goanna in pictorial form without labels; rather each part is assumed from the associated verbal descriptive report [4:1]. Another implicit iconic compositional image is Figure 4.3 above, that displays components of the mangrove forest without labels, specifically the grey mangrove trees that are identified in the associated verbal report.

Figure 4.1': Goanna species described in text [4:1]

Activities are construed in technical images by means of vectors. These are made explicit in technical diagrams with lines and arrows with labels. A complex activity image that is explicit and symbolic is the explanation of DNA formation in Figure 4.9, reproduced here, in which four labelled vectors indicate chemical activities that produce each structure in the sequence. In addition all of the diagrams we used to illustrate the structures of explanations, in section 4.2 above, are explicit symbolic

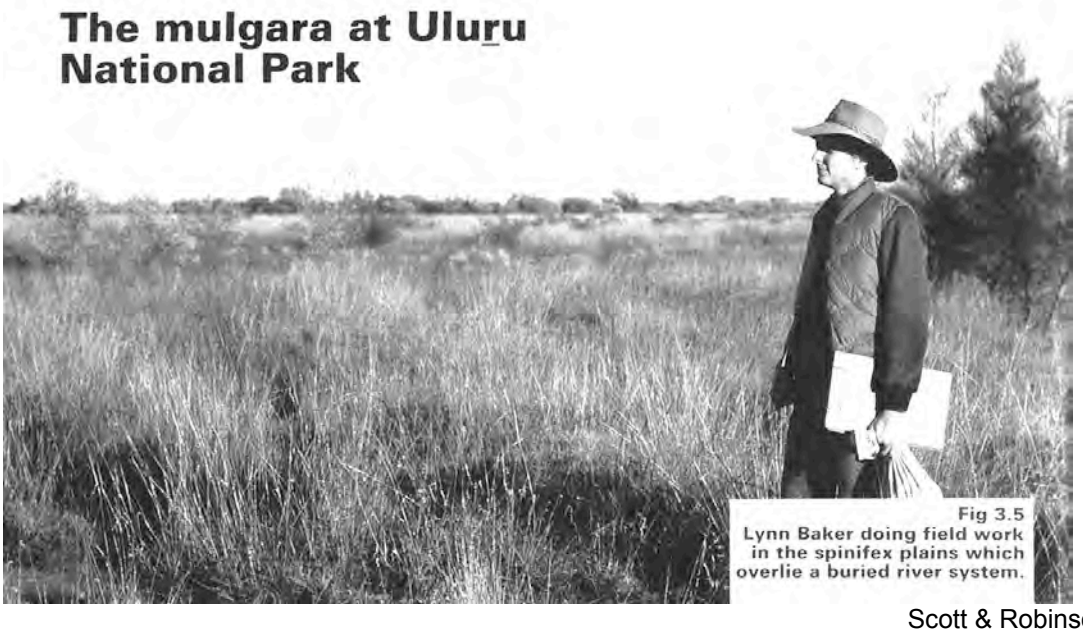
complex activity images. Vectors in these diagrams include logical relations between activities, as well as serial and orbital relations between genre stages.

Figure 4.9': Deoxyribose nucleic acid



Vectors may be implied by the direction of a body or gaze. For example, in Figure 4.26 from a geography textbook, a researcher's gaze is directed towards the spinifex grass plain lying before her. The accompanying verbal text explicates this gaze as the activity of field work. As it construes a single activity this photograph is a simple activity image that is implicit and iconic.

Figure 4.26: Implicit vector indicated by gaze

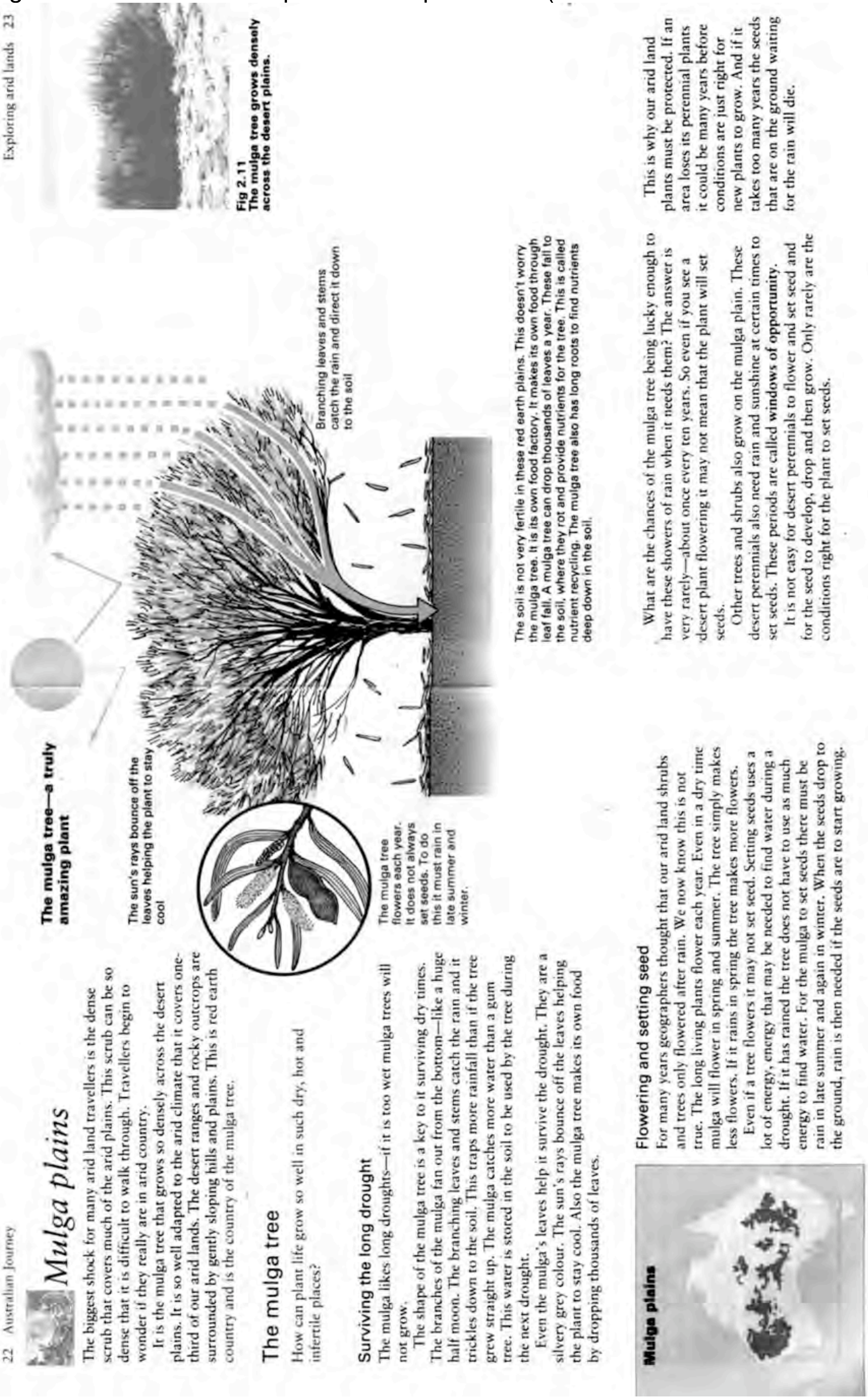


Scott & Robinson 1993:54

Images need not be exclusively focused on either entities or activities, as verbal texts can include elements of both, such as the anatomy report [4:5], that describes both structures and functions of the circulatory system. For example, the following double page spread from a science textbook (Figure 4.27) includes a diagram explaining

how the mulga tree survives doughts; this is a complex activity, represented iconically as a realistic drawing, and is explicitly labelled (it also includes indexical elements such as sunray and water vectors). But within this global activity focus it also displays the components of the mulga tree relevant to these activities, including its leaves, flowers, seeds, and the shape of its branches. Furthermore Unsworth 2001a points out that insets are commonly used to enlarge components of an image, as is exemplified for the seeds and flowers in Figure 4.26.

Figure 4.27: Multimodal reports and explanations (Scott & Robinson 1993: 21-2)



22 Australian Journey

Mulga plains

The biggest shock for many arid land travellers is the dense scrub that covers much of the arid plains. This scrub can be so dense that it is difficult to walk through. Travellers begin to wonder if they really are in arid country.

It is the mulga tree that grows so densely across the desert plains. It is so well adapted to the arid climate that it covers one-third of our arid lands. The desert ranges and rocky outcrops are surrounded by gently sloping hills and plains. This is red earth country and is the country of the mulga tree.

The mulga tree

How can plant life grow so well in such dry, hot and infertile places?

Surviving the long drought

The mulga likes long droughts—if it is too wet mulga trees will not grow.

The shape of the mulga tree is a key to it surviving dry times. The branches of the mulga fan out from the bottom—like a huge half moon. The branching leaves and stems catch the rain and it trickles down to the soil. This traps more rainfall than if the tree grew straight up. The mulga catches more water than a gum tree. This water is stored in the soil to be used by the tree during the next drought.

Even the mulga's leaves help it survive the drought. They are a silvery grey colour. The sun's rays bounce off the leaves helping the plant to stay cool. Also the mulga tree makes its own food by dropping thousands of leaves.

Flowering and setting seed

For many years geographers thought that our arid land shrubs and trees only flowered after rain. We now know this is not true. The long living plants flower each year. Even in a dry time mulga will flower in spring and summer. The tree simply makes less flowers. If it rains in spring the tree makes more flowers.

Even if a tree flowers it may not set seed. Setting seeds uses a lot of energy, energy that may be needed to find water during a drought. If it has rained the tree does not have to use as much energy to find water. For the mulga to set seeds there must be rain in late summer and again in winter. When the seeds drop to the ground, rain is then needed if the seeds are to start growing.

What are the chances of the mulga tree being lucky enough to have these showers of rain when it needs them? The answer is very rarely—about once every ten years. So even if you see a desert plant flowering it may not mean that the plant will set seeds.

Other trees and shrubs also grow on the mulga plain. These desert perennials also need rain and sunshine at certain times to set seeds. These periods are called **windows of opportunity**.

It is not easy for desert perennials to flower and set seed and for the seed to develop, drop and then grow. Only rarely are the conditions right for the plant to set seeds.

This is why our arid land plants must be protected. If an area loses its perennial plants it could be many years before conditions are just right for new plants to grow. And if it takes too many years the seeds that are on the ground waiting for the rain will die.

Exploring arid lands 23

Fig 2.11
The mulga tree grows densely across the desert plains.

4.4.2 Textual organisation of images

Kress & van Leeuwen 1996 identify five types of structures that can contribute to the textual organisation of images, and form the basis of our framework here (with some fine-tuning of interpretation and terms).[43] Firstly the centre-margin axis may indicate the relative relevance of elements; the more central the image, the more relevant it may be to the text as a whole. Secondly, the left-right axis of an image may indicate whether the information it presents is given or new, where given means that some aspect of the image is presumed from the preceding text or the context (e.g. reader's field knowledge), and new means the information may be unknown to the reader. Thirdly the top-bottom axis may indicate whether the substance of an image is more ideal or more real, where the ideal can mean a generalised 'essence', while real is more specific, down-to-earth or practical. Fourthly, the strength of boundaries between image and text may indicate stronger or weaker classification of meanings. And fifthly, the relative salience of images on a page, that draws readers' attention to one image before another, may be indicated by a number of factors, including size, colour intensity, the strength of vectors, as well as centre-margin, left-right, top-down positions. These options in textual organisation are set out in Figure 4.28, and restated in Table 4.2.

Figure 4.28: Options for textual organisation of images

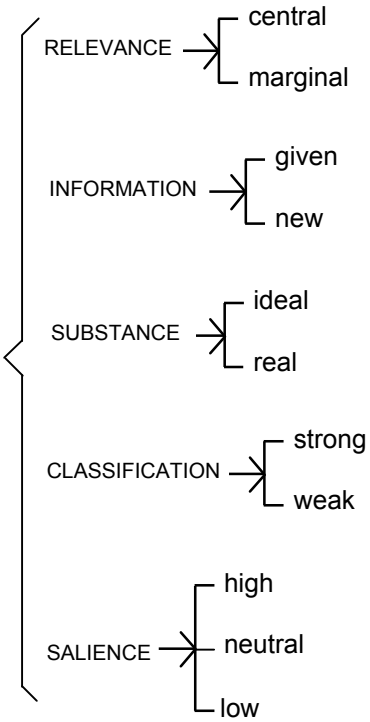


Table 4.2: Options for textual organisation of images

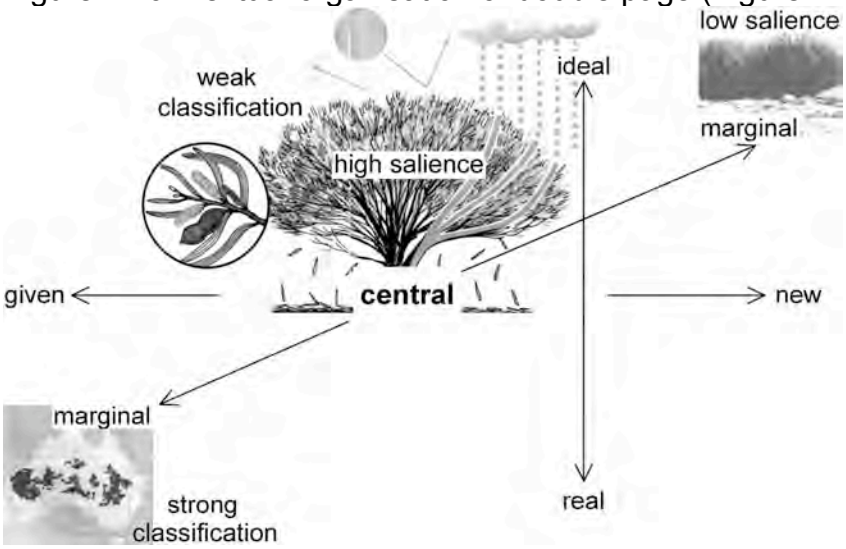
RELEVANCE	central	more relevant to text as a whole
	marginal	relevant to few elements of text
INFORMATION	given	presumed from preceding pages or context
	new	unknown to the reader
SUBSTANCE	ideal	generalised essence of information
	real	specific, down-to-earth or practical information
CLASSIFICATION	strong	visual text strongly bounded from verbal text
	weak	elements of visual text intrude into verbal text
SALIENCE	high	atttracting attention before other elements
	neutral	equal prominence with other elements
	low	other elements attract attention first

We can illustrate each of these axes with respect to the double page spread in Figure 4.27 above. Firstly the relation between the large central and small marginal images is clearly one of relative salience. The reader's attention is drawn first to the central diagram, which is given maximal salience by its large size and central positioning, as well as colour intensity and vector strength, while the map and photograph are small, marginal, low key, and so less salient. In terms of relevance, the central diagram has by far the greatest relevance, as it restates four factors of the verbal explanations (sun rays, catching rain, falling leaves, flowers and seeds), whereas the marginal map and photograph are only relevant to one element each of the verbal report (further discussion below).

In terms of information, the map at lower left is a repeated motif in each section of this textbook on Australian landscapes, so in this respect it is given information. In contrast the photograph on the top right is probably the first image that many students have seen of mulga trees in arid lands, so is presented as new information. Perhaps because the map is given, it has a title but no caption, so that its relation to the verbal text must be inferred, whereas the photograph has a caption that explicitly reiterates the verbal text.

In terms of substance, the central diagram is also positoned at the top of the page. It is an ideal set of meanings, in that it construes a relatively abstract set of relationships not accessible to commonsense observation. However the top-bottom positioning of the smaller images appears to be dictated more by marginality than a real-ideal contrast, since if anything the photograph may be considered more 'real' than the map. And finally in terms of classification, boundaries between visual and verbal texts are generally strong, except for the inset showing flower and seeds, which intrudes into the text, drawing attention to its relation to the relevant explanation below. The values in these axes are summarised in Figure 4.29.

Figure 4.29: Textual organisation of double page (Figure 4.27)



4.4.3 Logical relations between visual and verbal texts

Multimodal texts such as Figure 4.27 consist of a set of smaller verbal and visual texts, of varying genres. There are three visual components: a map, a diagram and a photograph, with accompanying verbal captions. The map is an explicit indexical compositional image, showing mulga plains as a component of the Australian continent. The photograph is an implicit iconic classifying image showing the species of mulga trees. The diagram, as we have discussed above, is an explicit complex activity image explaining how the mulga survives droughts.

And there are three verbal texts. The first is a descriptive report headed *Mulga plains that* describes the salient features of this landscape type; the second headed *The mulga tree* is a factorial explanation (analysed as text [4:10] above); and the third *Flowering and setting seed* is a conditional explanation that explains the conditions under which the mulga will reproduce. Each of these verbal and visual texts are related to each other by logicosemantic relations of expansion or projection (see section 1.5.3 in Chapter 1). To begin with relations between the verbal texts: the report *Mulga plains* is enhanced by the explanation *The mulga tree* by explaining how mulga survives; and *Flowering and setting seed* adds a further explanation. (It could have been explicitly added with the conjunction ‘furthermore’.)

On the other hand, the visual texts elaborate the verbal texts, restating (in another form) summarising (in less detail), specifying (in more detail) or repeating certain meanings. The quality ‘mulga tree grows so densely’ in the verbal report *Mulga plains* is specified by the photograph, showing exactly what it looks like, which is in turn summarised by its caption ‘The mulga tree grows densely across the desert plains;. The lexical repetition between verbal report and image caption also contributes to the cohesion of the multimodal text as a whole. Secondly, the spatial extent ‘covers one third of our arid lands’ in the descriptive report *Mulga plains* is specified by the map, that shows exactly which third it covers, and this is summarised by the map’s title *Mulga plains*.

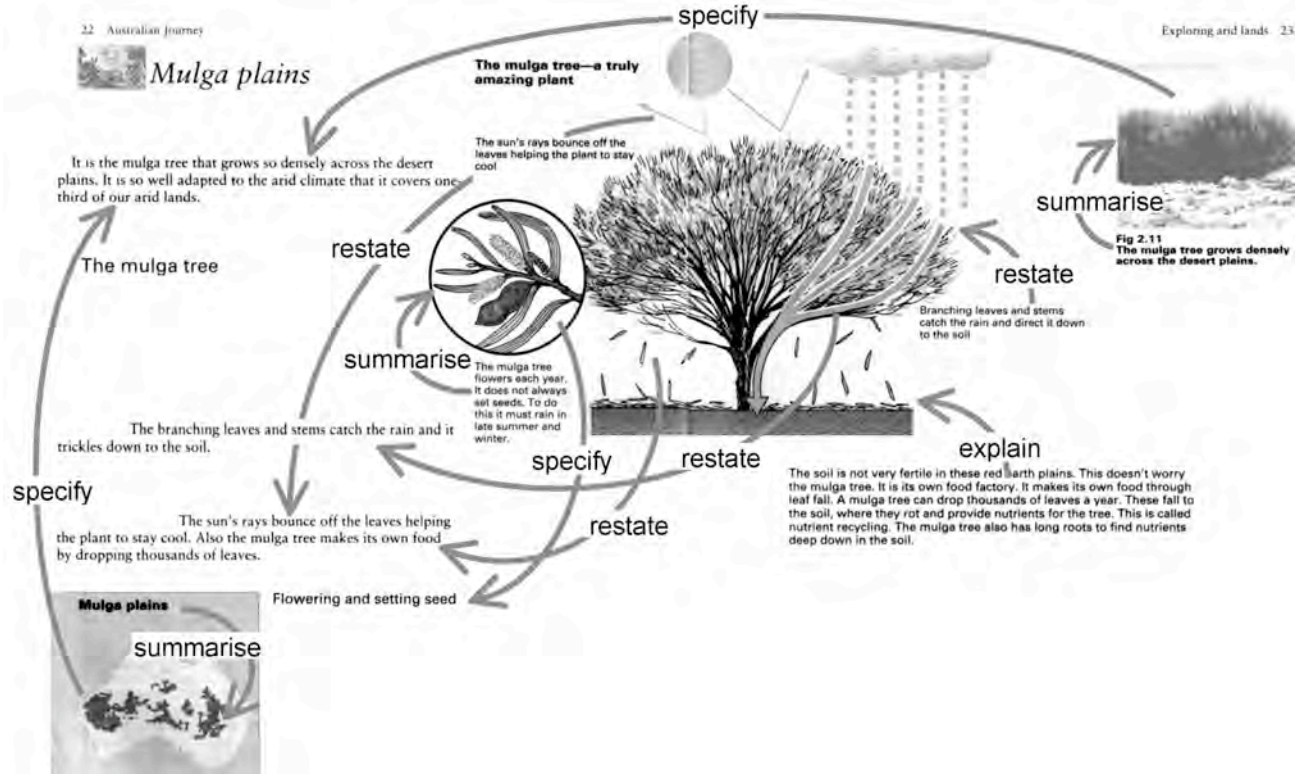
Thirdly several factors in the explanation *The mulga tree* are elaborated in the central diagram. At the top, vectors between the sun and tree restate the activity 'sun's rays bounce off the leaves', and these words are repeated in the caption to left of the diagram. At the right, the vectors from schematised clouds to branches to ground restate the activity 'branching leaves and stem catch the rain and it trickles down to the soil'. Again these words are repeated in the caption to the right of the diagram. At the bottom, the implicit vector of falling leaves restates the activity 'dropping thousands of leaves'. This factor is then explained in greater detail in the caption at bottom.

And fourthly, the activities of 'flowering and setting seed' in the next verbal explanation are specified by the inset image, and summarised in the associated label. So logical relations between verbal and visual texts are elaborating (restating, summarising, specifying or repeating). The captions attached to images further elaborate the image in these ways, or enhance it by explaining, and captions may also repeat elements of the associated verbal texts. These relationships are summarised in Table 4.3, and diagrammed in Figure 4.30.

Table 4.3: Logical relations between verbal and visual texts in Figure 4.27

verbal text		**visual text**	**caption**
Descriptive report *Mulga plains*			
dense scrub	= specify	photograph implicit iconic	= summarise
covers one third of our arid lands	= specify	map implicit idexical	= summarise
x (explaining causes)			
Factorial explanation *The mulga tree*		diagram	
sun's rays bounce off the leaves	= restate	vectors explicit symbolic	= restate
branching leaves and stem catch the rain and it trickles down to the soil	= restate	vectors explicit symbolic	= restate
dropping thousands of leaves	= restate	vectors implicit iconic	x explain
+ (adding another factor)			
Conditional explanation *Flowering and setting seed*			
flowers and seeds	= specify	inset drawing implicit iconic	= summarise

Figure 4.30: Logical relations between verbal and visual texts (in Figure 4.27)



This has not been an exhaustive survey of possible logicosemantic relations between visual and verbal texts. For example, relations may also include extension (and/or), as well as other kinds of enhancement (time/manner/place). Rather the aim here has been to illustrate the potential for analysis using the criteria we have developed in this section.

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[41] In the history of sciences, theories explaining causes commonly have one or more false starts, that are nevertheless widely accepted, such as the pre-Darwinian theory of of the 'great chain of being' in biology, or 'phlogiston' in physics. A comparable false start in linguistic theory may be Chomsky's attempt to explain linguistic variation as deep-surface structure transformations, 'hard-wired' in the human brain.

[42] Kress & van Leeuwen 1996 and Unsworth 2001a classify images by analogy with grammatical process types rather than discourse semantics, using terms partly derived from functional grammar and partly invented anew. In keeping with the discourse oriented approach here, and to keep labels more manageable, we have used the same terms as for verbal texts wherever possible. For example, where Kress & van Leeuwen use the cryptogrammatical terms 'overt/covert', we use 'explicit/implicit'; and where Kress & van Leeuwen use polysemous terms 'concrete/abstract', we prefer the semiotic terms 'iconic/indexical/symbolic'.

[43] Kress & van Leeuwen 1996 use the term 'framing' to refer to boundaries between visual and verbal texts, presumably adapted from commonsense 'picture framing', but this usage conflicts with Bernstein's technical use of 'framing' to refer to relative control of interactants in an exchange. We prefer CLASSIFICATION to refer to boundary strength, consistent with Bernstein's usage. Kress & van Leeuwen do not offer general terms for the ideal-real and centre-margin contrasts, where we have used SUBSTANCE and RELEVANCE, and the interpretation of the central-marginal contrast as relevance is our own. 'Salience' is used by Kress & van Leeuwen, but the values of high/neutral/low are our own.

Chapter 5 Procedures and procedural recounts

While Chapter 4 was concerned with genres that describe and explain the world, here we are concerned with genres that direct us how to act in it. Procedures are a central feature of many contexts: domestic, recreational, educational, scientific and industrial. We will illustrate a few of these variations here, but our particular concern is with procedures and procedural recounts used in the workplace, and their relationships to education. This focus emerges from a major research project on literacy in science and science based industries, which mapped relations between writing at each level of industry, from the factory floor to research laboratories, with writing at each stage of the science educational sequence, from primary school to doctoral research (Rose 1997, 1998, Rose et al 1992, Veel 1997, 1998). After grounding the discussion in some procedures of the household, recreation and school, including Indigenous Australian contexts, we will trace this industrial hierarchy, from simple to increasingly more complex operating procedures in industry, and then to the procedural recounts that technicians and scientists use to effect changes in scientific knowledge and its applications.

The texts we use to illustrate this journey are from the steel mills of Australia's biggest company, BHP. At the time of the research in the early 1990s, BHP steel manufacturing was engaged in a huge program of restructuring and retraining of its workers. Thousands of jobs that had hitherto been learnt through demonstration and practice were now being codified in manuals, and workers who had immigrated over preceding decades, from poor agricultural backgrounds with minimal education, now had to learn to read these manuals to keep their jobs. This was part of larger national and global process of industry restructuring, which is having far-reaching effects on education, from vocational strands in secondary schools, to an upwards shift in qualifications at all levels of vocational and professional training (e.g. Bernstein 1996, 2000, Harvey 1989, Gee et al. 1996, Golding et al 1996, Lankshear et al. 1997, Muller 2000, National Training Board 1991, Taylor et al 2000). After spending millions of its own and taxpayers money on retraining its workers, BHP has now retrenched most of them and moved their work overseas where manual labour is cheaper and the profits larger. But the pedagogising of work, the shift from hands-on to formal training, continues across the world, and with it grows the need to read the genres illustrated here.

5.1 Procedures: directing specialised activities

Procedures are pedagogic texts in that they teach the reader how to perform a specialised sequence of activities in relation to certain objects and locations. This activity sequence has a specialised function in the culture - instrumental or ritual - and requires esoteric knowledge to be performed - expert mentoring is required. Some procedures can in principle be demonstrated without a verbal text, simply by performing each step while the learner watches. But in practice, demonstrations are almost always accompanied by verbal instruction. If we think of any activity we have shown to others, or been shown ourselves, we will be hard pressed to think of one without verbal accompaniment (see Painter 1984, 1998) Written procedures go a step further than this to mediate the author's expertise, directing the learner what to do at each step, in relation to explicitly named objects and locations. Oral procedures

accompanying an activity need not be so explicit, as processes, objects, locations and the sequence itself can be indicated with reference items, ‘now do this here’.

5.1.1 Everyday procedures

Procedures accompanying an activity are the principal way in which learners are instructed by experts to perform specialised activities across cultures. The pedagogic relation is direct, personal, here and now (see Gamble 2004 on craft pedagogies). The following example, text [5:1], is from the Indigenous hunting-gathering culture of Australia’s Western Desert. The language is Pitjantjatjara and the speaker is instructing a learner how to dig out the nests of *tjala* honey ants, shown in Figure 5.1. This species stores honey in the distended abdomens of certain individuals in chambers a metre or more underground. To find the chamber the digger must recognise and follow a tiny tunnel that twists and turns, and dig and place the earth very carefully, and it is these activities that require expertise. In [5:1] the speaker directs the learner where to dig and place earth, and how to recognise the ants’ tunnel. Objects and locations are not named but indicated with reference items, in bold in both the Pitjantjatjara and English translations.

Figure 5.1: *tjala* honey ant

[5:1] **Digging for *tjala***

piruku	*wati-wani*	***nyangatja***
more	across-throw-!	here

Again throw (the earth) **over here**!

palatja	*kura-ring*
that	bad-become

That's no good.

nya-wa	***nyangatja***	*wirunya*
look-!	this	good

Look, **this** is good.

nyaratja-lta	*nyina-nyi*	***paluru***
yonder-at.that	sit-PRES	it

There **it** is, **over there**.

munkarra	*ma-tjawa*
other side	away-dig-!

On the **other side**, dig **over there**.

nyangatja	*katja*
here	son

Here, son.

tjinguru	***nyarangka***	*nyina-nyi*	*urilta*
maybe	yonder	sit-PRES	outside

Maybe it's **over there**, on the **outside**.

uwa	*ala palatja*	***pala palu-la***	*arka-la*
yes	'as I said'	there that-at	try-!

Yes, you see, try **that there**!

from Rose 2001

In this sequence, activities are directed with imperative commands (marked with -!), and evaluations are given (*that's bad, this is good*) and attention directed (*there it is, maybe it's over there*) with statements. An advantage of oral instruction accompanying activity like [5:1] is that the procedure can be continually adjusted to match the particular condition of each step of the activity, and the learner's actions can be directed, monitored and corrected as required. A disadvantage with such instructions is that they can only be given as the activity is performed. There is no way we could interpret the activity simply from the transcription here. Written procedures overcome this limitation, but the cost is that at each step, the process, objects, and locations must be explicitly named, and the activity must follow a specific sequence.

Perhaps the most widely experienced written procedures are cooking recipes, which import the specialised context of culinary arts into the domestic kitchen. These consist of two stages, typically titled Ingredients and Method or Instructions. The following example [5:2] instructs the kitchen gourmet in how to cook kangaroo meat.

[5:2] **Kangaroo Fillet With Redcurrant Reduction Sauce**

Ingredients

100 - 130g (3 - 4 oz) kangaroo fillet (or strip loin) per person
1 tsp (1/6oz) olive oil
2 cups (16oz) low-salt (gluten-free) beef stock
1 cup (8oz) red wine
3–4 tsp (1/2oz) redcurrant jelly

Instructions

1. Brush kangaroo with olive oil
   and pan-fry over high heat to seal until brown on all sides.
2. Place on a baking tray
   and roast at 200 C (375 F) for 5 minutes.
3. Meanwhile pour remaining ingredients into frying pan
   and boil over high heat until reduced to a thick and syrupy sauce.
4. Remove kangaroo from oven,
   cover with foil
   and rest for 10 minutes.

To serve: Slice kangaroo and spoon over sauce.
Serve with sliced potatoes cooked in the oven until crunchy and a steamed green vegetable such as asparagus.

Milan 1999

Like the instructions for finding *tjala*, this recipe entails a sequence of imperative commands for acting on various objects in a series of locations. All these elements must be made explicit for the novice kangaroo cook. In Indigenous Australian cultures preparation of kangaroo meat is equally prescribed, by religious tradition rather than culinary authority (cf Levi-Strauss 1978); but it is learnt like the *tjala* activity, by repeated modelling and instruction in context, as the child is learning in Figure 5.2.[44]

Figure 5.2: Step 1 in kangaroo cooking: burn off the fur

photograph J.P. Reser in Horton 1994:532

Another common context for procedures is tourist guides and promotions, that lead the reader through a series of locations. This group of procedures has been termed **topographic procedures**. The following example [5:3] from a tourist promotion uses the procedure patterns of activities, things and places to tell us what to expect on a tour at Uluru (Ayers Rock). The series of locations is in bold.

[5:3] **Uluru Sunrise Climb and Base Tour**
Rise early this morning to travel **to the Uluru sunrise viewing area**.
Watch the first rays of dawn set the Red Centre alight whilst enjoying a warming cup of tea or coffee.
After the sun has risen you will be transferred **to the base of the Uluru climb**…
After the climb, join your AAT Kings Driver/Guide for a tour **around the base of Uluru**.
Travel by coach to the Mutitjulu Walk where you will be escorted **into the beautiful Mutitjulu Waterhole**.
View Aboriginal rock art and learn about the area as your Driver/Guide points out some native flora…
Travel **around the base of Uluru** in the comfort of the coach…
Visit **the Uluru-Kata Tjuta Cultural Centre**, where you can learn about Aboriginal culture…,
before returning **to Ayers Rock Resort**.

traveloneline.com 2004

This is of course a somewhat different experience of central Australia than that of the learner down a hole digging for *tjala*!

Closely related to the recipe genre are procedures for conducting science experiments and observations in schools. These typically include the stages **Equipment & materials** and **Method**. The following example [5:4] initially seems very close the recipe genre, as the first phase involves cooking.

[5:4] **Chicken neck**
For this exercise you will need the neck of a cooked chicken. Place the neck in a saucepan. Cover it with water. Add 3 tablespoons of vinegar or a teaspoon of detergent to the water. This should help you to loosen the meat on the neck.

When the water is cool remove the neck. Carefully take away as much of the meat as you can. You may need tweezers to help you. Wash the neck bones. Then gently dry them with tissue paper.

Now you can observe the chicken neck vertebrae. In your notebook write down what a vertebra looks like. Draw a picture of a vertebra.

Grossbard & 1978:36

Here the **Equipment & materials** stage is realised by the first line, followed by a series of steps in the **Method**. However the Method includes three phases distinguished by paragraphing, as follows:

[5:4']
Equipment & materials
For this exercise you will need the neck of a cooked chicken.
Method
cook Place the neck in a saucepan.
Cover it with water.
Add 3 tablespoons of vinegar or a teaspoon of detergent to the water. This should help you to loosen the meat on the neck.
prepare When the water is cool
remove the neck.
Carefully take away as much of the meat as you can. You may need tweezers to help you.
Wash the neck bones.
Then gently dry them with tissue paper.
observe Now you can observe the chicken neck vertebrae.
In your notebook write down what a vertebra looks like.
Draw a picture of a vertebra.

In the cooking phase, [5:4] resembles a domestic recipe, but then the bones are prepared rather than the meat, using tweezers and tissues, and the last phase is clearly scientific experiment, both in the processes *observe, write, draw* and in the technical term *vertebrae*. In this it converges with the following procedure [5:5] from a geography textbook.

[5:5] **Observing desert ranges**
…
Step 1 Carefully observe Fig 2.8. Identify its main features. Write these down.
Step 2 Select a full page in your notebook…
Step 3 Look at Fig 2.8 again…Look carefully at the features…
Step 4 Use a pencil to sketch the important features you can observe in the background…
Step 5 Now sketch the important features you can observe in the middle ground…
Step 6 Now sketch the important features you can observe in the foreground…
Step 7 Line drawings are a summary of the observations you make. It is also important to make a summary of the major features in note form. This can be done by making notes around the line drawing…The headings which should appear on your page are Landforms, Vegetation, Soil and Refuge Islands.

Scott & Robinson 1993:21

Clearly 'observing, drawing and writing' are key processes in scientific activity, and scientific procedures function to direct learners to do them. As much as in the oral procedure [5:1], domestic recipes and so on, they are directed through a series of imperative commands, together with statements that classify and evaluate. But in Step 7 of [5:5] the imperative pattern shifts to a declarative pattern *It is also important to make a summary…, This can be done…, The headings which should appear*… Why? Because there is more than one possible course to follow, like the conditional explanations we saw in Chapter 4; so commands must be modulated to allow for

these other possibilities. This problem and strategies for its solution recur throughout the following sections.

As we move up the educational and occupational hierarchy, from the factory floor to the research laboratory, workers' choices for actions diversify and more information is required to make decisions. All procedures dictate a sequence of activities, in relation to objects and locations, but sequences complexify, demanding action gives way to presenting information, and specialised tools give way to technical abstractions. These changing patterns are tracked in the following sections.

5.1.2 Operating procedures - steps in a specialised activity

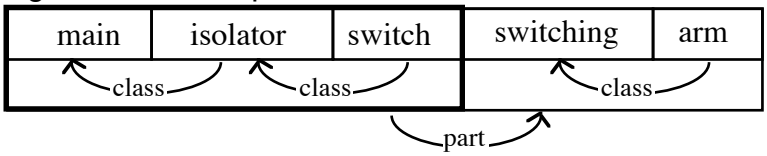
Each of the texts we have show so far are varieties of simple procedures. Like recounts or sequential explanations they consist of a sequence of steps following each other in time. Likewise, at the lowest levels of the workplace hierarchy, simple procedures direct workers to operate technology. Minimal information is given about the technology; either workers do not need to know this information, or it is assumed that they already know it. These types of procedures are very common at the basic operator level of manufacturing, in the 'Standard Operating Procedures' (SOPs) written for process workers. In common with more complex procedures, simple procedures typically begin with a Statement of Purpose. This may be simply a title for the activity sequence, which embodies the purpose of the procedure as follows in [5:6].

[5:6] **TO ISOLATE PRECIPITATOR ELECTRICALLY**
Move the main isolator switch (CFS) in the precipitator switch room to the OFF position
and tag, "OUT OF SERVICE".
Lock the main isolator switch switching arm using "Castell Key 2"
Remove the "Castell Key 2"
and attach an "OUT OF SERVICE" tag to the key identifying No 12 Tar Precipitator.
Place the "Castell Key 2" in the shift supervisor's office.

Coke Ovens By Products Department 1991

This simple procedure involves six steps. It is written for workers in a blast furnace of a steel mill. The workplace hierarchy is explicit in two ways: in the explicit detail for each step of the safety procedure, allowing no options for decision making, and in the last command to place the key *in the shift supervisor's office.* It differs from domestic procedures in the density of specialised terms associated with the technology. Such specialised terms can become quite complex, but the principles of their construction are regular. Each component of the technology is a member of a class of items, and is subclassified to the left of the item, such as *main isolator switch*. And each item can also include subcomponents, and these parts are de-composed to the right of the item, such as the *arm* of the *switch*. These patterns of classifying to the left and composing to the right are shown in Figure 5.3.

Figure 5.3: How specialised terms are constructed



There is a tension in such specialised terms between grammatical and discourse semantic patterns. Grammatically, everything preceding the last item *arm* classifies it (i.e. Which arm? - *switching arm*, Which switching arm? - *main isolator switch switching arm)*. But from a discourse semantic perspective, the *switching arm* is a part of the *main isolator switch*. Technological discourse exploits and amplifies this discourse semantic potential for classifying and composing in nominal groups, to build complex terms that can refer explicitly and precisely to the parts of machinery (cf Figure 5:13 below).

Operating procedures are also very comon in domestic contexts for using domestic technology, including the ubiqitous VCR instruction manual as in [5:7].

[5:7] **Basic Connections**
It's essential that your video recorder be properly connected. Follow these steps carefully. THESE STEPS MUST BE COMPLETED BEFORE ANY VIDEO OPERATION CAN BE PERFORMED.

1 CHECK CONTENTS
Make sure the package contains all of the accessories listed in "Specifications" (pg. 47).

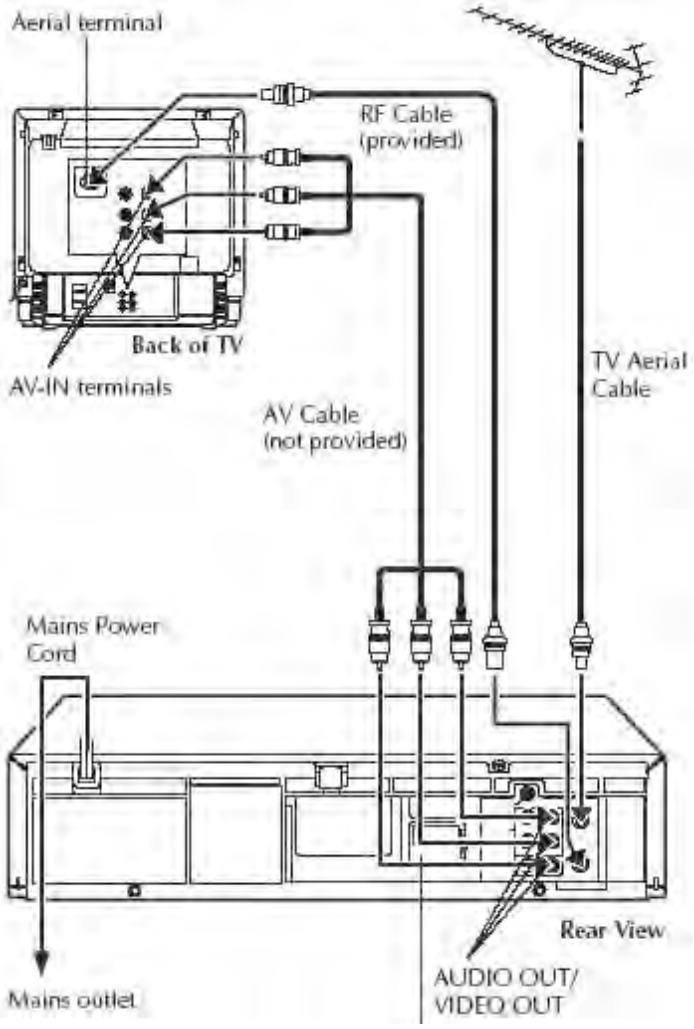
2 SITUATE RECORDER
Place the recorder on a stable, horizontal surface.

3 CONNECT RECORDER TO TV
The connection method you use depends on the type of TV you have.
RF CONNECTION
• To Connect To A TV With NO AV Input Terminals . . .
a Disconnect the TV aerial cable from the TV.
b Connect the TV aerial cable to the ANT. IN jack on the rear panel of the recorder.
c Connect the provided RF cable between the RF OUT jack on the rear panel of the recorder and the TV's aerial terminal.

JVC 2000

Like the workplace procedure, the VCR instruction manual begins with a Purpose (*your video recorder be properly connected*), here also with a warning, and its Method includes a multitude of specialised terms within series of procedural steps (*RF connection, AV Input Terminals, TV aerial cable, ANT. IN jack, RF cable, RF OUT jack, aerial terminal*). Some of these specialised terms are defined visually by the accompanying diagram, Figure 5.4, and steps in the connection procedure are reiterated as vectors in the diagram. The complementarity here between the verbal and visual texts illustrates the point made in 4.4 above, that each may be required to successfully read the other. For the average reader, procedure [5:7] is not comprehensible without the accompanying diagram. Insofar as it explains the connection procedure by means of labelled vectors, the image is an explicit indexical complex activity. But it also includes compositional images of the technology, which are presented as iconic drawings, in order to be recognisable for laypeople.

Figure 5.4: Connection diagram for VCR (JVC 2000)



5.1.3 Cooperative procedures: assigning responsibility in teamwork

Cooperative procedures differ from simple procedures in that the task prescribed require more than one operator to carry out, and each operator must be identified, as well as what is being acted on. In order to do this, cooperative procedures use a range of strategies to make various people and things explicit at the start of each command. Text [5:8] follows the technological explanation we saw in Chapter 4, about how gas is cooled and washed in the 'brassert washer' of a steel mill blast furnace [4:11]. That text finished with the statement *The mud precipitated is periodically removed by the brassert dump valves located at the base of the brassert*. Procedure [5:8] now directs workers to manually dump the brassert. As in the simple operational procedure [5:6], the first stage is also Purpose, explicitly labelled here, together with the 'scope' and 'definition' of the activity. The Method stage (labelled here as *5.0 Procedure*) is concerned with the technology and its operators, and these are identified at the beginning of each sentence, shown here in bold.

[5:8] **Dumping Brassert Washer**

1.0 Purpose

The purpose of this procedure is to establish or outline the steps required in dumping the brassert washer under normal conditions.

2.0 Scope

This procedure will apply to No 4 Blast Furnace

3.0 [omitted]

4.0 Definitions

Dump - remove some of the water seal from the brassert.

5.0 Procedure

5.1 Philosophy

The brassert washer is the second mechanism in the gas cleaning plant at No 4 BF. **The water sprays** used in the gas cleaning process cause dust particles to precipitate out of the gas and form a sludge at the base of the brassert. **Some of this sludge** is not removed by the normal flushing process. **Dumping of the brassert** flushes this sludge out of the base, therefore preventing build up.

5.2 **Two trained people** are required to safely dump the brassert (one operator and one gas watcher).

5.3 **Operators** should liaise with the general supervisor to ensure the furnace is casting, in case difficulties arise in shutting the slide valves at the base of the brassert, resulting in an unscheduled furnace stop.

5.4 **Control room attendant** should be notified about intentions (for possible alarm).

5.5 **One of the operators** should equip himself with a CO monitor.

5.6 **Ensure no personnel** are in the immediate area, such as staves platform and ground level around brassert sump (possibility of gas below).

5.7 **Bottom slide valve** on brassert cone to be opened fully and then closed (reason, to depressurise area between valves).

5.8 **Top slide valve** on brassert cone should be opened fully and then closed immediately.

5.9 **Bottom slide valve** on brassert cone should be opened fully until a turbulence is noted in the brassert sump and then closed immediately.

5.10 **Ensure both valves** are completely closed.

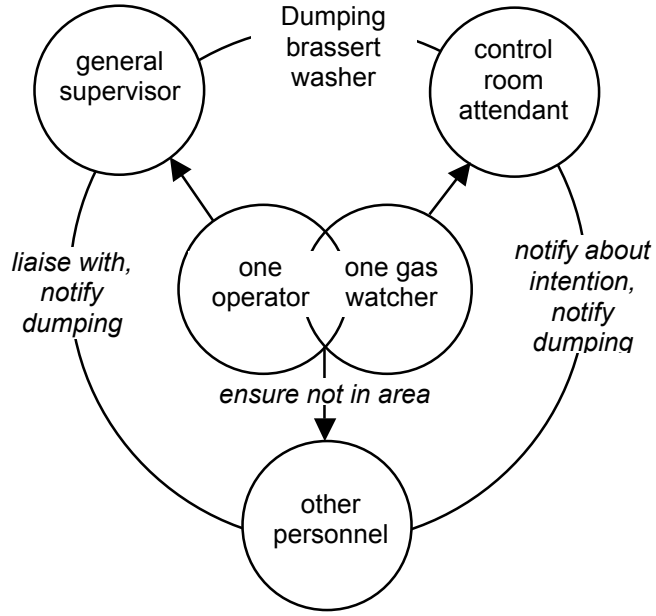
5.11 **Notify general Supervisor** and control room attendant that dumping has been completed.

Abeysingha 1991

The Method stage (*5.0 Procedure*) includes three phases: *5.1 Philosophy* is a brief implication sequence that recaps and extends the explanation of how the mud accumulates; then 5.2-5.6 is a series of safety procedures; and finally 5.7-5.11 is the step-by-step procedure for dumping the brassert.

Unlike simple procedures, which tend to start each step with the activity to be performed, the starting point for most of the sentences here is with the technology or its operators. In the explanation phase it is the technology that produces the mud. In the safety procedure phase it is the workers: *Two trained people (one operator and one gas watcher), Operators, Control room attendant, One of the operators, no personnel, the general Supervisor*. This is the primary meaning of a cooperative procedure - it is a procedure which involves a team of workers at various levels. In the final phase it is the technology that is operated on: *Bottom slide valve, Top slide valve, both valves*. The cooperative procedure represents part of the communication network of a workplace, specifically those communications involved in performing a particular task. The diagram in Figure 5.5 models the communication network in text [5:8].

Figure 5.5: Communication network for dumping brassert



Another feature of cooperative procedure [5:8] is that many or most of the commands are followed by reasons for carrying out the commands. At this level of the workplace hierarchy, operators need to know these reasons in order to make independent decisions while carrying out the procedure, shown here in bold:

5.3 Operators should liaise with the general supervisor to ensure the furnace is casting, **in case difficulties arise in shutting the slide valves at the base of the brassert, resulting in an unscheduled furnace stop**.
5.4 Control room attendant should be notified about intentions (**for possible alarm**).
5.6 Ensure no personnel are in the immediate area, such as staves platform and ground level around brassert sump (**possibility of gas below**).
5.7 Bottom slide valve on brassert cone to be opened fully and then closed (**reason, to depressurise area between valves**).

In each of these clause complexes, the command comes first and the explanations follow. For reasons of space these explanations are very compressed. This textual pattern is maintained by the use of ideational metaphors. That is activities are re-expressed as nouns or phrases, and causal relations as verbs. For example 5.3 compresses a complex logical sequence into one sentence, in which 'difficulties arise' and 'unscheduled furnace stops result'. In order to unpack it to a more spoken form, the sequence must be reversed as follows (logical linkers in **bold face**):

Operators should liaise with the general supervisor
***to** ensure the furnace is casting,*
***in case** difficulties arise in shutting the slide valves*

***resulting** in an unscheduled furnace stop.*

'If it is difficult to shut the slide valves
the furnace might stop unexpectedly
so operators should liaise with the general supervisor
to ensure the furnace is casting'

In order to understand and act on this cooperative procedure, operators must be able to unpack this kind of complexity, a literacy skill of a relatively high order.

5.1.4 Conditional procedures - making choices

Written procedures in the workplace can become very complex when the operator needs to make choices about a course of action. These decisions depend on what is happening in the manufacturing process, so at each point there are a number of possible decisions to take. We call this type of procedure a **conditional procedure.**

Text [5:9] is from another operating manual in the same steel mill blast furnace. The title gives its Purpose: *stop gas flow through precipitator.* As gas is produced from burning coal it contains tar, which is precipitated out as the gas cools. The pressure of the gas in the precipitator must be in a certain range for safe operation, and this pressure varies. To manage the pressure, workers have to operate three gas valves: a *bypass gas valve*, an *inlet gas valve*, and an *outlet gas valve*. What they do with them depends on the gas pressure, and the number of tar precipitators in operation.

[5:9] **STOP GAS FLOW THROUGH PRECIPITATOR**

1 Check the number of the tar precipitators on line to assure an uninterrupted gas flow. Currently four (4) tar precipitators are the minimum number that have to be on line to maintain an acceptable back pressure range of 8-14 kPa.
If after this precipitator is isolated:
   i. There will be fewer than four (4) tar precipitators in operation, go to step 2.
   ii. There are four (4) or more tar precipitators in operation, go to step 3.
2 Open tar precipitators bypass gas valve (5 or 6 turns).
3 Close the inlet gas valve slowly, and tag, "OUT OF SERVICE" in two positions:
   - Rotork isolator with the lugs tied together,
   - Manual valve handle.
4 Exhauster driver to monitor back pressure which must be in the acceptable range if enough precipitators are on line (Range 8-14 kPa).
If when the precipitator by pass gas valve is open:
   i. Pressure range is OK, go to step 7
   ii. Pressure range is too high, go to step 5
   iii. Pressure range is too low, go step 6.
5 Open the precipitator by pass gas valve until exhauster back pressure is in range.
6 Close tar precipitator by pass gas valve until exhauster back pressure is in range.
7 Close the outlet gas valve slowly, and tag, "OUT OF SERVICE" in two positions:
   - Rotork isolator with the lugs tied together,
   - Manual valve handle.

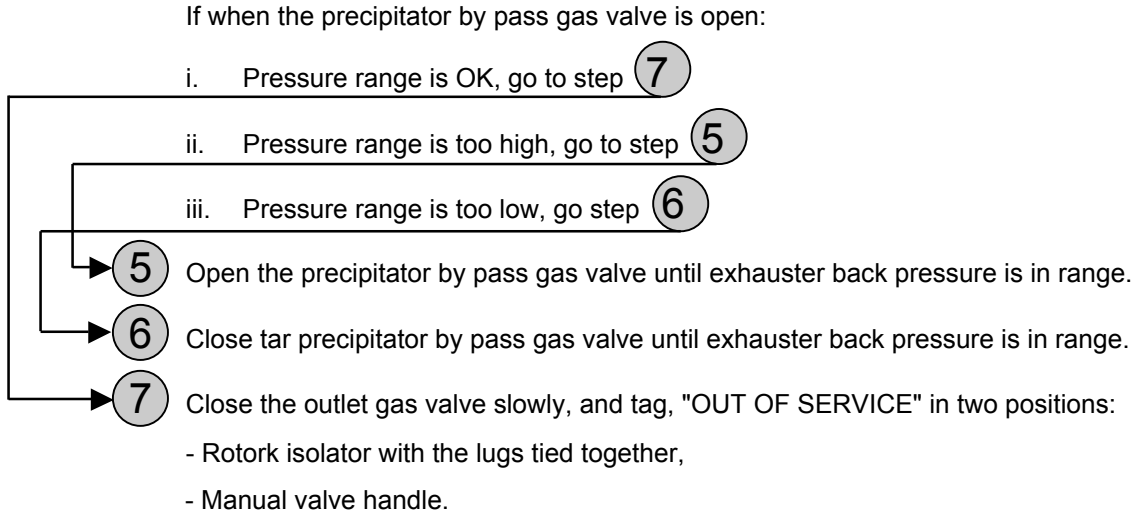
Abeysingha 1991

While the title is the Purpose, the Method stage of [5:9] includes two phases: 1-3 are actions depending on the **number of tar precipitators**; 4-7 are actions depending on the **back pressure** that the exhauster driver has to monitor. The complex relations between the possible conditions in each phase and the alternative actions to take are managed by numbering.

In the simple operating procedure [5:6], numbering referred to temporal succession - each step was numbered and followed each other one after another. In the conditional procedure however, numbers do not refer steps in a sequence but rather to choices for action. The numbered steps *2-3 and 5-7* refer to commands that are not steps in a sequence but are **alternative** actions depending on the conditions. By referring to each of these alternative actions as a number, the commands within the preceding **conditional** sentences can be kept simple and regular - *(either) go to step 5... (or) go to step 7.* By this means, the conditional sentences focus on the decision

to be made, while the following action sentences focus on each of the alternative tasks. These patterns are illustrated in Figure 5.6.

Figure 5.6: Relations between conditions and actions managed by numbering



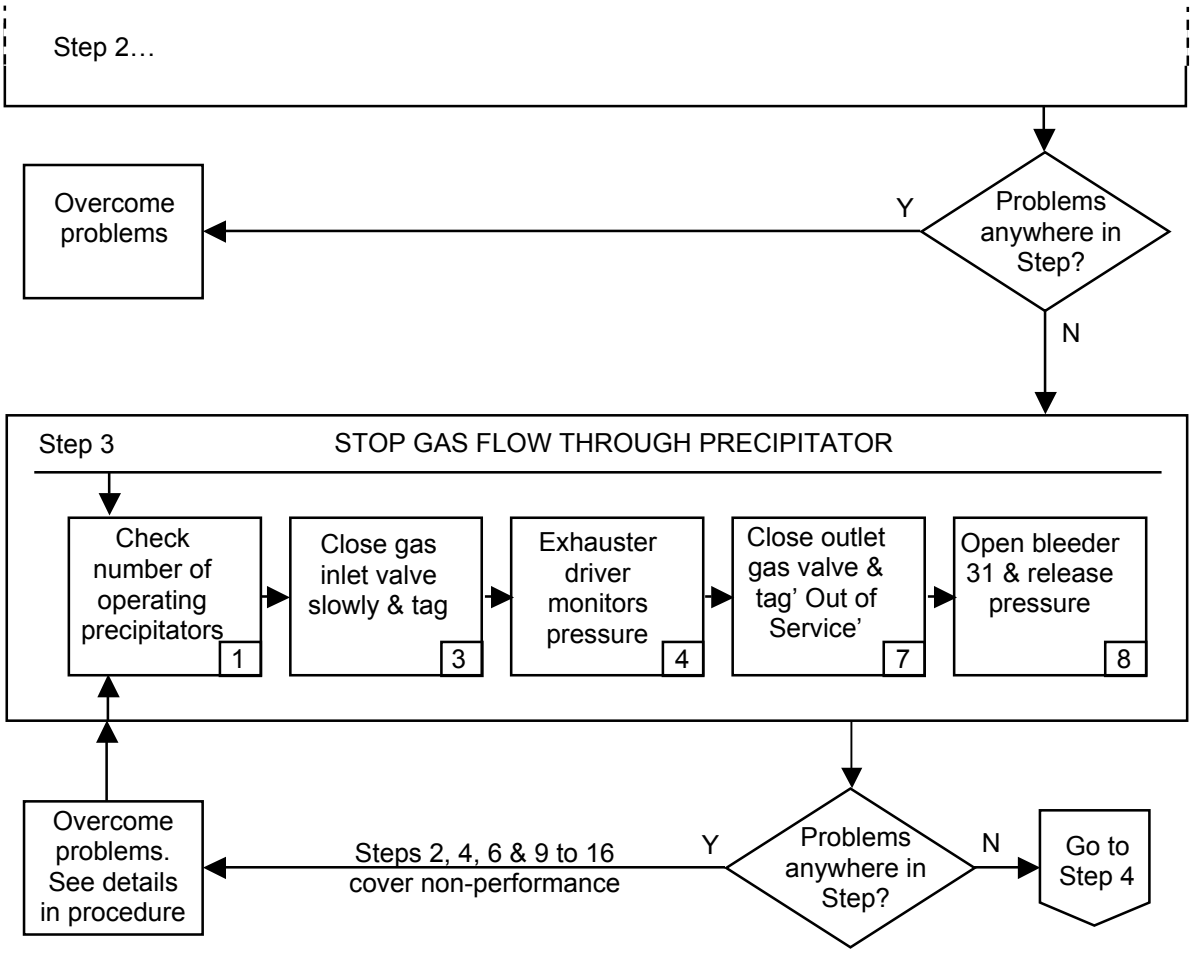
Restating a procedure with a flowchart

The problem of complex procedures is addressed in many enterprises by the use of flowcharts. Flowchart diagrams translate the complex logical relations in a procedure into a conventional set of visual symbols. In the terms developed in section 4.4, they are explicit symbolic complex activity images. The visual symbols do not operate by themselves however - they link units of written text together, and ultimately any flowchart is dependent on an accompanying verbal text, as we saw for multimodal texts in science textbooks in Chapter 4.

The following flowchart Figure 5.7 restates the conditional procedure [5:9] to assist the learner. It translates the conditional and temporal conjunctions into labelled vectors. The key to reading the flowchart is as follows:

- each step in the procedure is enclosed in a box, with the title of the stage written on top,
- within each step, sub-steps are written and enclosed in smaller boxes,
- temporal succession between each step and sub-step is expressed as lines with arrows,
- decision points are written as questions, enclosed in diamonds with choices expressed as yes (Y) or no (N).

Figure 5.7: Tar Precipitator flowchart (from Abeysingha 1991)



The flowchart 5.7 is a combination of verbal and visual expressions of meaning. But the visual expression is ultimately dependent on the verbal text. The complexity of choices in the conditional procedure cannot be adequately handled in the visual text. So after the decision point *Problems anywhere in step?,* the reader is directed to the verbal procedure:

Steps 2, 5, 6 and 9 to 16 cover non-performance->Overcome problems see details in procedure

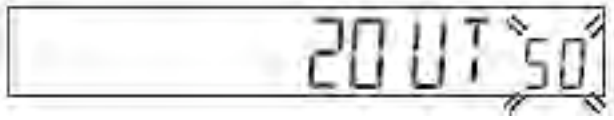
Conditional procedures are also common within instruction manuals for domestic technology, as in [5:10].

[5:10] **SET VIDEO CHANNEL**

Set your TV to UHF channel 40.

- If the two vertical white bars appear clearly on the screen as shown in the illustration (Z "TEST SIGNAL" on page 4), press **OK** and then go to step **4**.
- If the two vertical white bars do not appear clearly, press **OK** and then **PR +** or **–** to set the video recorder to a vacant channel between 28 and 60 which is not occupied by any local station in your area.

(Ex.) If channel 50 is available in your area



Then set your TV to UHF channel 50 and check if the two vertical white bars appear clearly on the screen;

- If so, go to step **4**.
- If not, re-set the video recorder to another vacant channel and try again.

NOTES

- If you set the video recorder to a channel which is occupied by a local station or has neighbouring channels that are occupied by local stations, the picture reception quality will be affected and some interference noise will appear on the TV screen. Be sure to select a vacant channel which has no broadcast on neighbouring channels.
- If you cannot obtain the two vertical white bars clearly with any channel between 28 and 60, consult your JVC dealer.

JVC 2000

The patterns of conditions, dependent actions and numbering are uncannily similar between industrial and domestic operating procedures. The complex logical patterns of conditional procedures are also closely related to the conditional explanations we saw in Chapter 4. In both cases the reader is asked to imagine alternative possible eventualities. In the science explanations, these imagined events are intended to lead to students' understanding of abstract physical relationships. The way this understanding is achieved is through conditional relations between events. In the conditional procedure, the imagined events are possible outcomes of actions the operator might take, and the same strategy is used. Again this illustrates a strong functional relationship between literacy learning in middle secondary science, and the literacy demands of technical operations in manufacturing industry.

5.1.5 Technical procedures - applying technicality to technology

Technical procedures are typically used in scientific testing laboratories within manufacturing enterprises. Their function is to enable a technically trained worker to perform a testing procedure on manufacturing materials, using laboratory technology. Reading and acting on these procedures depends on an extensive apprenticeship into the language and field of science involved. The results of the testing are typically recorded by the technical assistant as figures on a pro-forma. These figures will be interpreted by a supervising technician who may write the results up as a technical note (described in the next section). The goal of a technical procedure is to obtain these figures. To do this the technical assistant must 1) prepare a material sample in the manner required by the testing technology, 2) operate the testing technology and record the numerical results, 3) follow a mathematical procedure to convert these numbers to useful figures. There are therefore three typical phases to the Method stage of a technical procedure:

- Sample preparation
- Testing procedure
- Calculation of results

These are illustrated as follows in the technical procedure [5:11].

[5:11] **Crack examination**
Objective
The objective of the test is to determine the extent of HAZ cracking.

Sample preparation
The test section shall be sectioned transverse to the weld joint, ground to a 1200 grit and etched with 2% nital. To assist metallographic examination, the test piece should be cut down to the approximate dimension shown in Fig. 2.

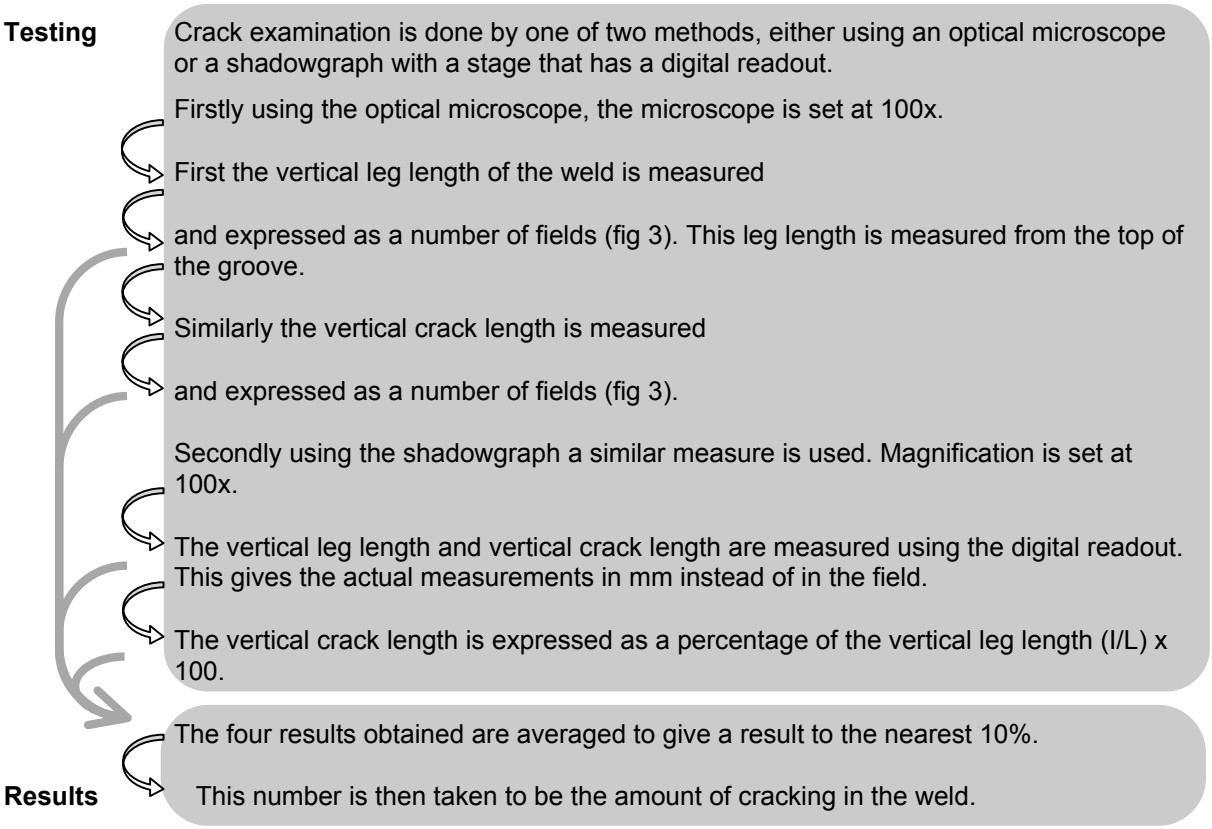
Testing
Crack examination is done by one of two methods, either using an optical microscope or a shadowgraph with a stage that has a digital readout. Firstly using the optical microscope, the microscope is set at 100x. First the vertical leg length of the weld is measured and expressed as a number of fields (fig 3). This leg length is measured from the top of the groove. Similarly the vertical crack length is measured and expressed as a number of fields (fig 3). Secondly using the shadowgraph a similar measure is used. Magnification is set at 100x. The vertical leg length and vertical crack length are measured using the digital readout. This gives the actual measurements in mm instead of in the field.

Results
The vertical crack length is expressed as a percentage of the vertical leg length (I/L) x 100. The four results obtained are averaged to give a result to the nearest 10%. This number is then taken to be the amount of cracking in the weld.

Metallurgical Technology 1991

The ***Sample preparation*** phase consists of four steps - *sectioned, ground, etched* and *cut down*. The ***Testing*** phase then consists of three subphases, first giving two options, and then the steps for each option in turn. The sequence of steps in this and the ***Results*** phase are shown in Figure 5.8 below.

Figure 5.8: Steps in a technical procedure [5:11]



The technical procedure thus has some commonalities with conditional procedures in that multiple options are possible. But it differs from the specialised procedures because the measurements taken are part of a technical field involving mathematics.

Specialised and technical fields

The technical procedure realises the interaction of a two specialised fields - 1) steel fabrication and 2) testing technology, with a technical field - scientific measurement. Extensive knowledge of these fields is assumed on the part of the reader, and additional information is provided to enable the task to be carried out. Terms and clauses that are part of each of these fields are listed in Table 5.1.

Table 5.1: Specialised and technical fields in [5:11]

Specialised field 1: metal fabrication	**specialised field 2: testing technology**	**technical field: scientific measurement**
• HAZ cracking • test section • sectioned • weld joint	• crack examination • sample preparation • transverse • 1200 grit • 2% nital • metallographic examination • optical microscope • shadowgraph • vertical leg length • top of the groove • vertical crack length • magnification set at 100x	• expressed as a number of fields • measurements in mm instead of in the field • vertical crack length is expressed as a percentage of the vertical leg length (l/L) x100. • four results obtained are averaged • to give a result to the nearest 10%. • number is then taken to be the amount of cracking in the weld.

These three fields exemplify a progression from the most accessible (i.e., closer to commonsense) to the most technical (i.e., uncommonsense). Each field involves ideational metaphor, but the variety of ideational metaphors in the specialised fields is closer to those used in everyday speech, such as the common items *length, examination, preparation, magnification*. On the other hand the variety of ideational metaphors in the technical field is becoming very dense, such as the complex sequence *vertical crack length is expressed as a percentage of the vertical leg length*, which is moving towards scientific English (Halliday & Martin 1993).

5.2 Procedural recounts

Above the level of laboratory technicians, step-by-step procedures are relatively uncommon. These are the levels of 'professional' training, qualifications are diplomas to degrees, and workers no longer require detailed procedures to do their jobs. Instead they investigate technical problems, using their knowledge of the technical field and appropriate activities, and report on their investigations in the form of technical notes and research articles. Since both technical notes and research articles recount an investigative procedure, these are forms of procedural recount - a genre we looked at briefly in Chapter 4, in the context of school science. The relationship between procedure and recount is made explicit in the geography textbook *Australian Journey*: first the procedure [5:12].

[5:12] **Investigating an arid lands mystery**
Geographers are interested in land management issues that affect arid lands… To do this the geographer follows a number of steps:

Step 1 Identify the issue to be studied.
Step 2 Research the background to the issue.
Step 3 Go on the field trip. While on the field trip it is important to:
- observe and
- collect information.

Step 4 Use the observations to identify what is happening.
Step 5 Develop a plan to manage the environment.

This procedure is followed by a recount of field research by biologist Lynn Baker, written in terms accessible and appealing to junior secondary students. This is summarised as [5:13].

[5:13] **The mulgara at Uluru National Park**

Step 1 **Identify the issue to be studied.**

Before leaving on the field trip to Uluru National Park, Lynn identified the issue she wished to study and spent time researching it. 'I want to find out why mulgara appear to be in some areas and not in others. If I find that the mulgara are rare I want to be able to suggest ways to conserve their habitat.'

Step 2 **Research the background to the issue**

Lynn didn't just pack her bags and leave for Uluru. She spent time in the library reading what others have found out about arid zone animals.

…

Step 3 **The field trip**

…

The work involved in step 3 can be divided into two parts:

1 Making observations

2 Collecting and recording information

Observing the mulgara and its environment

During her first field trips to Uluru, Lynn spent time observing mulgara and the environments where it lives.

…

Collecting and recording information

Now Lynn needed to collect information that would help her find out why the mulgara seemed to be found in different habitats during times of high rainfall and during times of drought. Her first task was to collect data that showed where mulgara were living and where they were not living.

…

Using computer mapping to locate relict drainage environments

Earlier you learnt that old river systems can't be seen when walking over the ground. However, photographs taken by satellites, circling thousands of kilometres above the earth, do reveal these old rivers.

…

Step 4 **Use the observations to identify what is happening**

Lynn's next step was to carefully study her observations to see what they told her… She started to develop a theory:

'The theory is that in the relict drainage area the vegetation remains in better condition than in areas outside its influence. This area is better able to support animals during drought. It becomes an important refuge area for animals like the mulgara during times of drought. The mulgara in this area are better able to survive than those living elsewhere. This is because the plants are able to collect the water from the underground drainage system. When it rains the habitat in the rest of the country improves. The mulgara are able to spread out over the country and I will find mulgara living away from this area again.'

…

Step 5 **Develop a plan to manage the environment**

Geographers conduct field work to help them decide on ways to manage the environment. When Lynn Baker's work is complete she wants to be able to suggest things that can be done to protect and save the mulgara. This means protecting the environments where it lives.

At this stage Lynn believes the refuge areas that are found in our arid lands must be protected, as the research so far suggests that small animals like the mulgara do rely on them in droughts. …

Scott & Robinson 1993:54-58

These stages of the procedural recount follow the staging of the principal genres written by technical officers and research scientists – technical notes and research articles respectively. The stages of these genres are correlated with the steps of text [5:13] in Table 5.2. In addition the staging of **experiment reports** written by school science students is included. This type mirrors the experiment procedure patterns, but with a Results stage, as in the research article, sometimes followed by a Conclusion.

Table 5.2: Staging of procedural recounts

Technical Note	Introduction	(Method)	Investigation	Conclusion & Recommendation
Research Article	Introduction	Method	Results	Discussion
Experiment report	Purpose, Equipment & materials	Method	Results	(Conclusion)
Text [5:13]	1 Issue & 2 Background	3 Field trip: observation information	4 Identify what is happening	5 Develop a plan

The common goal of these genres is to improve understanding of a phenomenon and thereby resolve or avert a problem. To achieve this they begin by stating the issue/problem and contextualising this in current knowledge in the **Introduction**. The process of research is then recounted in the **Method** stage, observations are reported as **Results/Investigation** and interpreted in the **Discussion/Conclusion**. In technical notes which directly address application issues, this interpretation is then followed by a **Recommendation**. Clearly text [5:13] recontextualises a research report for secondary students. School science is sometimes criticised for alleged artificiality of experiments and procedural recounts, but the comparison here displays clear consistency between science, science industry and school. This is an important observation, as these fields have co-evolved and are interdependent in material production and production and reproduction of knowledge. In particular, science in school recontextualises not only the scientific fields, but the genres with which they are associated.

In the following three sections we describe these stages for technical notes in the specialised field of welding technology, in the technical field of metallurgy, and for research articles in the scientific field of industrial chemistry. All three are from the same industrial field as our procedures, that of steel manufacturing in Australia.

5.2.1 Specialised technical note - solving problems with technology

In materials and product testing areas of manufacturing enterprises it is necessary to produce written reports on testing to customers. These extended texts are typically known as technical notes. Technical notes are written by technicians and applied scientists, often with data recorded on pro-formas as the Results of technical procedures by technical assistants. The goal of the technical note is produce a set of Recommendations to the client on how to solve a specific production problem, or improve production processes.

Specialised technical notes are concerned with technological problems. Text [5:14] addresses problems with welding certain types of steel, and uses specialised knowledge of welding techniques to solve these problems. The steel mill produces coils of thin steel plate, and the ends of the coils need to be welded together. The particular steel plate produced for the electrical industry has a high content of silicon, and this makes welding very difficult.

[5:14] **GTA Welds on hi-silicon coil plates without filler rod addition**

Introduction
S&CP roll high silicon steel for applications in the electrical industry.
It is desirable to join coils for processing purposes, but the normal joining processes used by S&CP of flash butt welding has not proved capable of welding these high Si steels. The Welding Development Section of BHP SPPD was asked to evaluate alternative means of joining these coils. This report details results found during gas tungsten arc autogenous welding on four different grades of hi-silicon steel. The steels tested were LS07 (0.7%Si), LS13 (1.3%Si), LS22 (2.2%Si) and LS27 (2.7%Si).

Welder settings
The standard parameters used for the tests are tabulated below:

Gas type	Argon
Flow rate	30cu.ft/hr
Voltage	23-24v
Tungsten tip size	3.2mm ground to a 55^0 point
Nozzle size	ø 15mm gas cupped
Stand off	2.5mm

Investigation
Problems were encountered during this welding process with weld discontinuities occurring in most of the test pieces. Consistency of weld shape and form was difficult to achieve with burn through occurring both in welds showing good penetration as well as welds made at lower current levels which showed lack of penetration. We found that only a slight increase in amperage of say 5 amps, after a previous weld giving a good clean weld without full fusion, would cause the next weld to burn through with good weld penetration observed on intermittent sections. Tables 1 and 2 show results of weld trials while Rockwell B results are shown in Table 3.

Table 2 - GTA weld results

Grade	Thickness (mm)	Amperage	Travel speed (mm/m)	Voltage	Comments
LS27	2.1	270	800	23	PBT & cracks
	2.1	280	800	23	PBT & cracks
	2.1	280	700	23	PBT
LS22	2.3	280	700	24	Slight root concavity
LS13	2.3	300-280	700	24	PBT @ 300A & slight BT @ 280. Cracks present.
LS07	2.3	280-260	700	23	PBT @ 280A & Cracking.

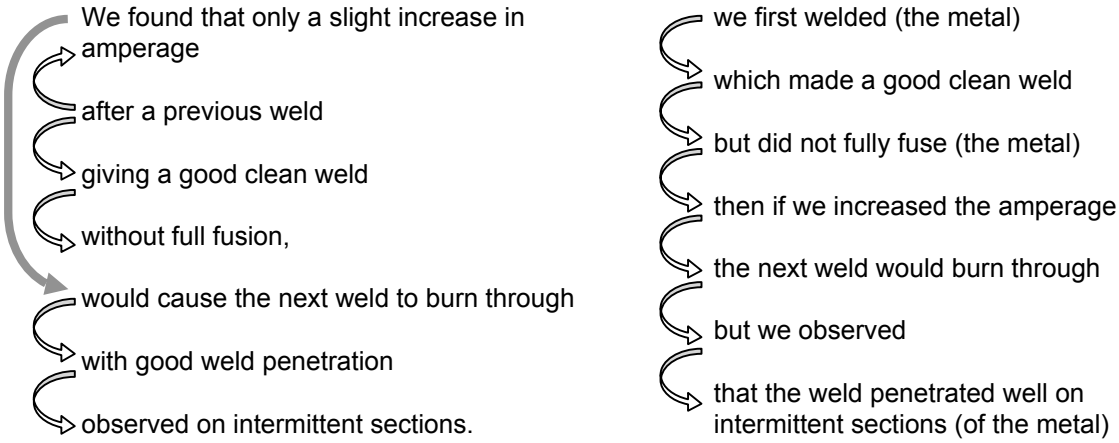
Conclusion & recommendation
From our weld trials we have proven that these steel grades are capable of being welded by the GTA process. However all process variables have to be 'spot on' to achieve consistent full penetration. We suggest further trial welding using an automatic filler wire feeder to produce more consistent welds. Unfortunately we do not have this equipment at present.

Drmota & Draper 1991

The Investigation stage recounts the procedure that was followed, but unlike the school text [5:13] or the recounts we looked at in Chapters 2 and 3, it does not consist of a series of clauses that follow each other in succession. Instead activity

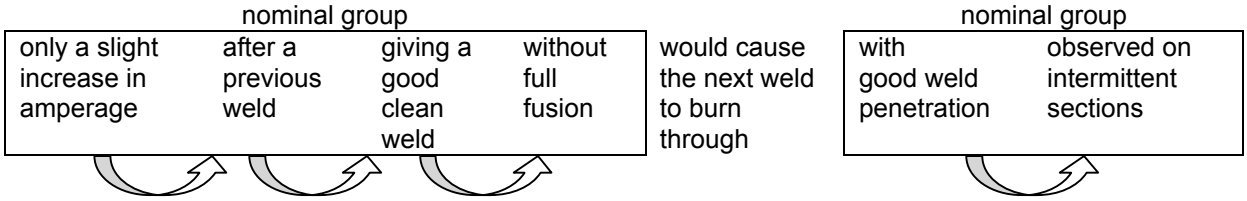
sequences are compressed into single sentences, as we saw for the cooperative procedure [5:8]. These can be unpacked as shown in Figure 5.9.

Figure 5.9: Activity sequence compressed in a sentence



This activity sequence is packed into a single sentence by reconstruing processes as nouns (*a slight increase, a previous weld, full fusion, weld penetration*) and logical relations between processes as verbs (*giving, would cause*) or prepositions (*after, without, with*). These ideational metaphors allow a series of activities to be packed into nominal groups by means of post-modifying, shown as arrows in Figure 5.10.

Figure 5.10: Post-modifying in nominal groups

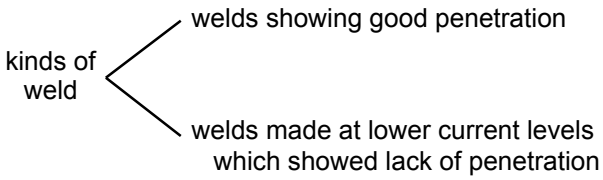


In scientific writing strings of post-modifiers can get very dense, and we find the beginning of this density in the technical note [5:14], such as the following:

welds showing good penetration **as well as** welds made at lower current levels which showed lack of penetration.

Here two nominal groups are linked by *as well as* to form a complex that classifies two types of welds. These two classes of weld are expressed as a taxonomic diagram in Figure 5.11.

Figure 5.11: Classifying in nominal groups



In both nominal groups the characteristics of the weld are the criteria for their classification and these criteria post-modify ‘welds’. At this level of the industrial hierarchy we find a mixture of congruent and metaphorical resources used to represent the unfolding of time, and classification of entities. These two semantic domains are starting to coalesce into the same grammatical pattern of nominalisation and post-modification.

Following the recount of the Investigation, results are presented in a table, with numerical values for variations in welding, and verbal comments on the results. In the Conclusion stage, the writers take subjective responsibility for their investigation *We found*, *From our weld trials we have proven, We suggest further*. They also express feelings *difficult to achieve, a good clean weld, Unfortunately we do not have*. Above this level of industry such explicit personal intrusions become rare.

5.2.2 Scientific technical note - solving technical problems

Scientific technical notes are concerned with technical problems, and are written by applied scientists. Text [5:15] reports the results of chemical testing of a maintenance problem. Metal particles had been found in the oil of gearboxes that drive massive cranes in the steel mill, so the oil was not lubricating the gears properly. The job was find out what was wrong with the oil. It was found that the oil was contaminated with a cleaning compound that thinned it out, reducing its viscosity,and so its effectiveness as a lubricant.

The chemical testing itself would have been done by technical assistants or technicians who may record their results as figures in printed pro-formas, following technical procedures such as [5:8] above. The tertiary trained scientist then interprets these in a technical note with a Discussion and Recommendations for the client.

[5:15] **SUBJECT: OPTIMUL BM460 OIL EX BOS No 1 CHARGER CRANE MAIN HOIST WORM DRIVE GEARBOXES**

Samples of Optimul BM460 oil from the main hoist east and west worm drive gearboxes, sampled 15/1/91, were received at the Coke Ovens Laboratory for analysis 18/1/91...

The analyses of the two samples, together with that for new oil, were available 23/1/91 as follows:

		EAST GEARBOX	WEST GEARBOX	NEW OIL
VISCOSITY @40^{0}C	cSt	383.30	143.90	460.1
ACIDITY	mgKOH/g	4.45	4.09	
MOISTURE	ppm	2167.00	2300.00	
SOLIDS +1.2um	%w/w	0.03	0.02	

Visual examination of the solids indicated the presence of 'bronze' particles 10-20um in both samples plus particles up to 200um in the solids from the west gearbox. The viscosity of the oil in the gearbox after flushing and changing was extremely low, 44.0 cSt @40^{0}C.

Infrared examination of the oil suggested contamination with perchloroethylene (tetrachloroethylene). Confirmation of this finding was the fact that the gearbox had been flushed out with perchloroethylene. Using the viscosity data it was estimated that the low viscosity gearbox oil contained approximately 21% perchloroethylene.

After the oil was changed again a viscosity determination was carried out. The viscosity of the oil (380 cST @ 400) indicated 1% perchloroethylene or 6% of the 44.0 cST had been left in the gearbox after the last oil change.

With the fact that the viscosity of the later samples had been reduced by perchloroethylene contamination the original samples were checked for perchloroethylene contamination. Based upon the infrared spectrum and the viscosity it is estimated that the west worm gear drive contained approximately 9% perchloroethylene and the east gearbox 1%.

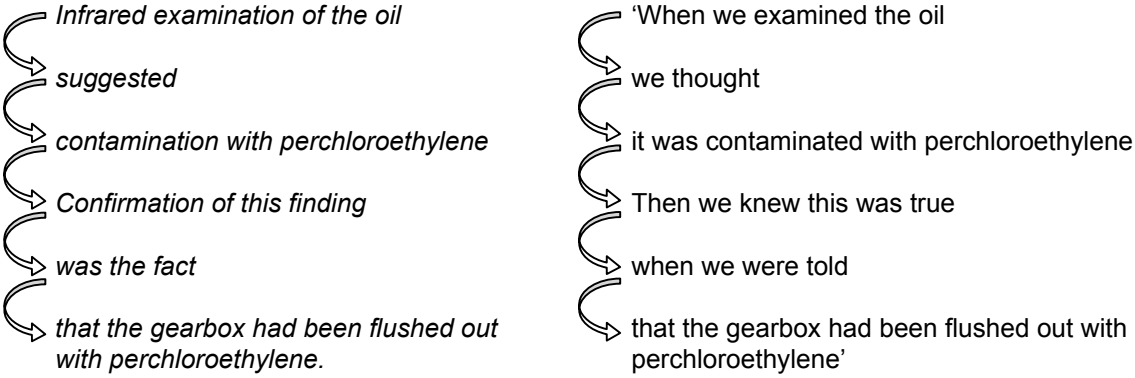
Recommendations
Due to the critical nature of these gearboxes it is recommended that:
(1) A regular checking programme be instituted to monitor the oil quality for physical properties and wear metals.
(2) Whenever flushing and oil changes are carried out viscosity checks should be carried out to determine the possible presence of residual flushing fluid.
The same recommendation should be applied to other similar critical units.

Coke Ovens Laboratory 1991

Like the specialised technical note, the goal of [5:15] is to solve an industrial production problem, and make recommendations for changes in manufacturing or maintenance processes. But a major difference between this and the specialised technical note is that it draws on a scientific field, industrial chemistry. The testing involves the use of technology for measuring 'viscosity' and 'chemical composition' (i.e. phenomena of the scientific field) , and the results of these measurements are reasoned about scientifically to arrive at a conclusion and recommendations.

Again activity sequences tend to be compressed into single sentences, such as the implication sequence of observation and reasoning unpacked in Figure 5.12:

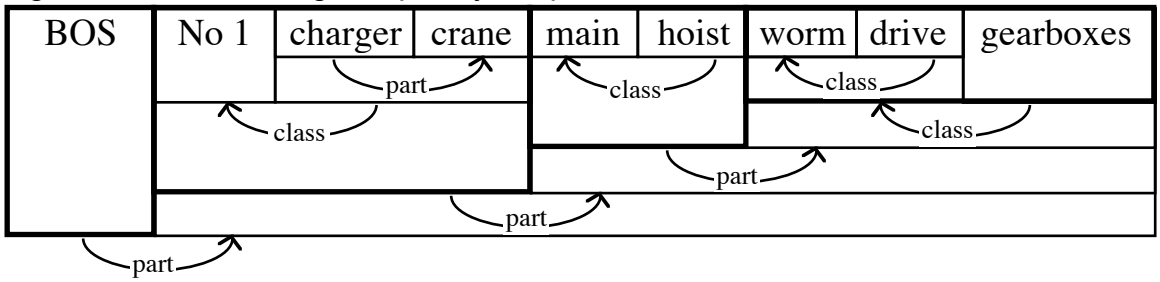
Figure 5.12: Implication sequence of observation and reasoning



However the implication sequence in [5:15] is more implicit than in the specialised technical note, in which temporal sequence is explicitly signalled by *after, previous*, *next*, and the verbs *caused to* and *observed* explicitly express causeand observation. Interpersonally, text [5:15] also effaces the people doing the investigation, shifting responsibility for judgements of cause and proof, from people *We observed* to the observation technique *Infrared examination of the oil suggested*. At this level interpersonal judgements become part of an edifice of abstract entities, grading relations between them as more or less necessary and evident. The world of people and power has been reconstrued as a structure of things and truths. These truths are accumulated as evidence supporting the final Recommendations stage.

Secondly we can note the increasing complexity of specialised terms, such as the title, in Figure 5.13. As we found in the simpler specialised terms, while pre-modifiers classify, specifying members of classes, post-modifiers de-compose, specifying smaller parts of wholes. Although such specialised terms can be very complex, they are made up of components of technology. They differ from scientific technical terms that are defined in scientific texts, and denote abstract taxonomies or explanation sequences (see White 1998 for a fuller discussion of this distinction).

Figure 5.13: Increasing complexity of specialised terms



Although scientific technical note [5:15] does not have headings to signal the stages, it follows the same staging as the specialised technical note [5:14]. The Introduction and Investigation stages are collapsed into the opening paragraph. There is no need to describe the testing procedure in detail, since the reader presumably either knows, or does not need to know, what the tests involve. Instead they are merely named *the normal tests*, *wear metal analysis*. The Results are expressed as tabulated figures (these are the figures supplied by the technical assistants), and these tables are followed by the Discussion stage - the figures form the topic of the discussion. Only the Recommendations stage has a heading. Here the writers' demands become depersonalised *it is recommended that, programme be instituted, checks should be carried out, same recommendation should be applied.*

5.2.3 Research articles - producing science

Research articles have been a special focus of genre research in the ESP tradition referenced above in Chapter 1 (section 1.3.4). Swales 1990 and 2004 and Paltridge 1997 are key resources; and there has been considerable work on specific stages - introductions (Swales 1990, Hood 2004), abstracts (Salager-Meyer 1990, Hyland 2000), literature reviews (Swales and Lindemann 2002) results sections (Hopkins and Dudley-Evans 1988), discussion section (Dudley-Evans 1994) and the transition from results to conclusions in research articles (Yang and Allison 2003). We won't explore this rich tradition of analysis in detail here since our focus is on genre relations across workplace and educational sectors. Instead we'll pursue the pattern of increasing technicality, vis a vis the other procedural genres, through each stage of the genre.

Whereas technical notes are concerned with issues related to specific contexts - workplaces, plants or enterprises, research articles are concerned with more generally applicable scientific knowledge - adding to and modifying the knowledge base of the scientific field. Stages of a research article are as follows:

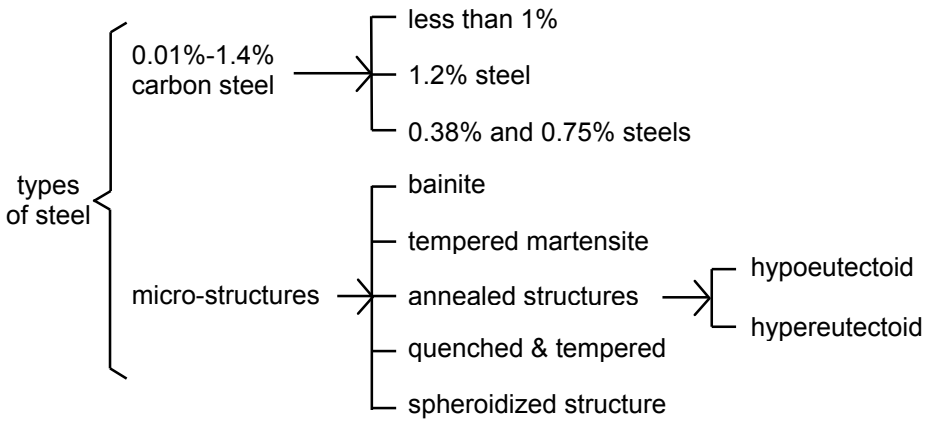
Abstract	A brief summary of the experimental method and the results and discussion.
Introduction	Locates the text in the development of the field by reference to previous research. Establishes a problem that previous research has not dealt with. States intention of current research.
Experimental Details (i.e. Method)	Lists experimental methods used, including equipment and procedures.
Results and Discussion	Presents experiment results in graphic and mathematical form. Interprets these results verbally. Reasons about the probable cause of the problem.
Conclusions	Summary of reasoning
References	Previous research

Research articles also typically include acknowledgements, as well as numerical tables, graphs and other graphic illustrations of data.

The following research article [5:16] is in a similar field to that of the technical notes we have seen - steel manufacturing. The theoretical base of this applied field of science is in industrial chemistry. The overall goal of this research article is to find out how different kinds of steel resist wearing. Different kinds of steel are produced by different manufacturing methods, and have different 'micro-structures' that are visible to the scientist through high tech microscopes. The writer therefore needs to draw complex interlocking causal relations between manufacturing methods, structure and wear. Like most problems in the physical sciences, mathematics is used to describe these complex relationships.

At 10 content words per clause, the Abstract of the research article [5:16] has 4 times the lexical density of everyday spoken discourse. Moreover most of these content words are technical terms in the scientific field of metallurgy, making it very difficult to read for outsiders. A synopsis here will help to make it more accessible. It discusses types of steel, which vary in both their carbon content and their micro-structures, set out in Figure 5.13. Steels are made with various carbon contents. Their micro-structure and hardness can be varied by different kinds of heat treatment.

Figure 5.14: Types of steel in text [5:13]



The Abstract summarises relationships between the hardness of these steels, and their resistance to abrasive wear. A direct linear relationship between hardness and wear resistance was found for some steels, but for not for others. The study showed that resistance to wear varied with both carbon content and micro-structure. And the type of wear also varied with both carbon content and micro-structure.

[5:16] **A study of the abrasive wear of carbon steels**

Abstract
The abrasive wear behaviour of 0.01%-1.4% carbon steels heat treated to various micro-structures and hardnesses was studied using a pin-on-drum machine. For constant hardness and carbon content less than 1.0%, the results show that bainite had the hardest wear resistance, followed by tempered martensite and annealed structures. For 1.2% steel, the annealed structure had wear resistance superior to the quenched and tempered structure and spheroidized structure. Additionally the relationship between relative wear resistance and hardness was linear for annealed steels, but the slope for hypoeutectoid steels was lower than for hypereutectoid steels. A non-linear relationship between wear resistance and hardness of tempered martensite was confirmed for both 0.38% and 0.75% steels. This behaviour indicates that abrasive wear resistance is not simply related to the hardness of materials, but is determined also by the microstructure and fracture properties. Microscopical studies showed the dominant wear mechanism to be microcutting with significant microploughing for very low carbon hypoeutectoid steel, and substantial cracking and spalling in higher carbon steels and in quenched and low temperature tempered medium carbon steels.

Introduction
Numerous empirical observations between abrasive wear of carbon steels and both hardness and carbon content have been established [1-5]. Kruschov and Babichev [1-3] proposed a linear relationship between wear resistance and hardness, and also an additive rule of wear resistance for structurally inhomogeneous materials. For tempered structures, Larsen-Badse and Mathew [5] and Larsen-Badse [6] suggested that wear resistance should be a linear function of the logarithm of the absolute tempering temperature above 2500C and the square root of distance between the dispersed carbides. The volume fraction of pearlite is evidently important in controlling the wear of annealed carbon steels, and it has been agreed [7, 8] that wear resistance is, in fact, proportional to this volume fraction in hypoeutectoid steels.
...
Experimental details
...
The microstructures of the specimen materials were examined using optical microscopy. Wear mechanisms were elucidated by scanning electron microscopy of the wear debris, wear surface topography and subsurface. The subsurface was exposed by partially removing and polishing the slightly curved surface formed by the geometry of the drum. Precipitated carbides were studied using transmission electron microscopy, and retained austenite was measured using computer aided image analysis and by linear intercept analysis.

Results and Discussion

...

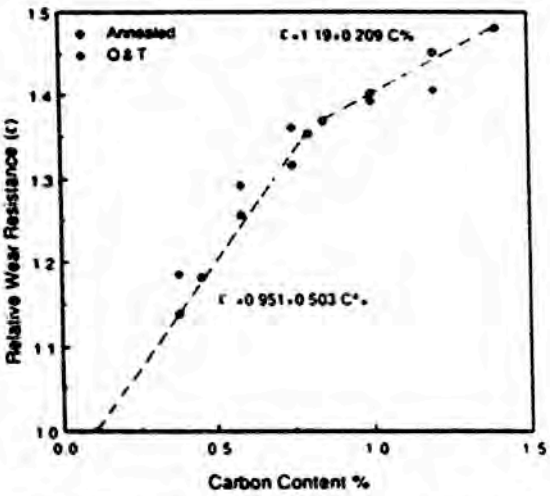


Fig. 2. Diagram showing relative wear resistance as a function of carbon content of annealed steels and quenched and tempered steels.

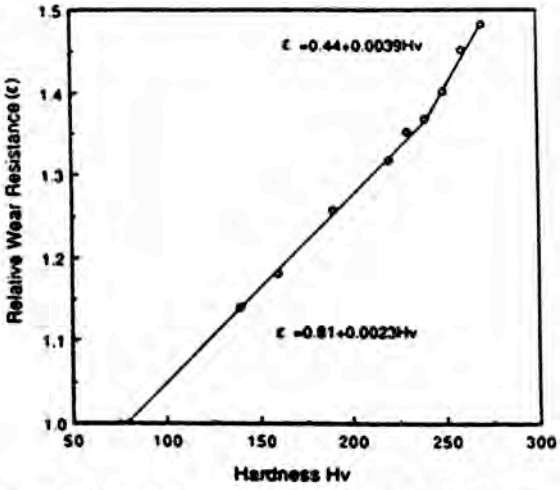


Fig. 3. Diagram showing relative wear resistance as a function of hardness of annealed steels.

The results presented in Figs 1-3 indicate that the grain boundary allotriomorphs of cementite and the cementite in pearlite have different effects with increasing hardness and wear resistance. Also it is clear that a linear relationship between wear resistance and hardness can exist only for steels having similar microstructural characteristics and, for this condition, hardness can be used as a predictor of wear resistance.

Therefore, for the steels with the same type of annealed structures, the linear relationship between relative wear resistance, e, and hardness, HV, can be expressed as

$$e = a + b\,HV$$

where *a* and *b* are constants. This relationship is a modified form of the equation

$$e = b\,HV$$

proposed by Kruschov and Babichev,

...

Conclusions

(1) For annealed steels, both the wear resistance and hardness were linearly related to carbon content with different slopes for hypoeutectoid and hypereutectoid steels. Similarly the the slope of the linear relationships between relative wear resistance and hardness was different for hypoeutectoid and hypereutectoid steels. Thus hardness can be used as a predictor of wear resistance only for annealed steels with the same type of microstructure.

...

Xu and Kennon 1991

First we'll look at the Introduction. In the Abstract of [5:16], the relationships between wearing and different kinds of steel were summarised. In the Introduction the nature of these relationships is expanded. Introductions to research articles typically have three functions:

- to locate the text in the development of the field, by reference to previous research
- to identify a problem that previous research has not successfully dealt with
- to outline the goals of the current research.

Establishing a position within the discourse of the field is part of the interpersonal dimension of the research article. The writers need to identify their own observations and interpretations in relation to other workers in the field, which include their own readers. Simultaneously they need to identify themselves with accepted ideas, and to

question some of these ideas in order to create a position for their own research. References to other research are highlighted as follows (footnote numbers refer to References).

Numerous empirical observations between abrasive wear of carbon steels and both hardness and carbon content **have been established [1-5].**
Kruschov and Babichev [1-3] proposed a linear relationship between wear resistance and hardness, and also an additive rule of wear resistance for structurally inhomogeneous materials.
For tempered structures, **Larsen-Badse and Mathew [5] and Larsen-Badse [6] suggested** that wear resistance should be a linear function of the logarithm of the absolute tempering temperature above 2500C and the square root of distance between the dispersed carbides.
The volume fraction of pearlite **is evidently important** in controlling the wear of annealed carbon steels, and **it has been agreed [7, 8]** that wear resistance is, in fact, proportional to this volume fraction in hypoeutectoid steels.

It is worth noting that, while individual authors *propose* and *suggest* certain relationships, others have been *established* and *agreed* by members of the metallurgy field. The findings of these previous researchers consist of varying relationships between wearing and characteristics of different kinds of steel, which are packaged into long nominal groups. These relationships are first drawn in terms of location, ***between*** *x* ***and*** *y*:

empirical observations **between** abrasive wear of carbon steels **and both** hardness **and** carbon content
a linear relationship **between** wear resistance **and** hardness

But then these relationships 'between' are reconstrued as mathematical functions and proportions:

a linear **function** of the logarithm of the absolute tempering temperature above 2500C **and** the square root of distance between the dispersed carbides
wear resistance is, in fact, **proportional** to this volume fraction in hypoeutectoid steels

Or in other words, relationships 'between' *the logarithm… **and** the square root…*, and 'between' *wear resistance **[and]** this volume fraction*.

Next the Experimental Details (i.e. Method) stage. As in technical notes, the experimental methods are not spelt out step-by-step, but are simply named. Most of the methods are given in the Experimental Details stage, in which each sentence begins with the object studied, and ends with the technology used to study it, as follows:

The microstructures of the specimen materials were examined using **optical microscopy**.
Wear mechanisms were elucidated by **scanning electron microscopy** …
The subsurface was exposed by **partially removing and polishing** …
Precipitated carbides were studied using **transmission electron microscopy**,
and retained austenite was measured using **computer aided image analysis** and by **linear intercept analysis**.

This pattern was actually established in the first sentence of the Abstract, which begins with the research problem, followed by characteristics of the material studied:

The abrasive wear behaviour	*of 0.01%-1.4% carbon steels*	*heat-treated to*	*various micro-structures*	*and hardnesses*	*was studied*	*using a pin-on-drum machine.*
Research problem	Steel: composition	temper	structure	hardness		Research technology

It is by these various means that the extreme lexical density of the research article is organised in patterns that are recognisable and readable to the authors' peers in the scientific field.

Next Results and Discussion. Whereas the Investigation stage of the technical notes consisted of sequential explanations, compressed into a few sentences, the corresponding Results stage of the research article is more closely related to conditional explanations. That is, the characteristics of different steels constitute variable conditions with varying wear effects. However there are not just a few conditions, such as we saw in conditional explanations in Chapter 4, or in the conditional procedure [5:9] above. The research reported in this article has found numerous variations in both conditions and outcomes, so these are modelled mathematically and presented as graphs, in *Figs 1-3* (see above).

These mathematical results are then generalised verbally, as two kinds on conditional relations:

The results presented in Figs 1-3 indicate that the grain boundary allotriomorphs of cementite and the cementite in pearlite have different effects with increasing hardness and wear resistance. Also it is clear that a linear relationship between wear resistance and hardness can exist only for steels having similar microstructural characteristics and, for this condition, hardness can be used as a predictor of wear resistance.

These two generalisations construe conditions and effects as follows:

Condition	**Effect**
with increasing hardness and wear resistance	grain boundary allotriomorphs of cementite and the cementite in pearlite have different effects
only for steels having similar microstructural characteristics	hardness can be used as a predictor of wear resistance

This last verbal generalisation is then expressed more exactly as a mathematical equation, that builds on previous research:

Therefore, for the steels with the same type of annealed structures, the linear relationship between relative wear resistance, e, and hardness, HV, can be expressed as

$$e = a + b\,HV$$

where *a* and *b* are constants. This relationship is a modified form of the equation

$$e = b\,HV$$

proposed by Kruschov and Babichev.

Finally the Conclusion stage summarises the conditional relations between wear resistance, hardness, carbon content and different steel types, and the significance of this result for steel manufacturing is restated:

Thus hardness can be used as a predictor of wear resistance only for annealed steels with the same type of microstructure.

5.3 Protocol

As we noted in Chapter 1 with reference to Conal's bus rules [1.8], procedures are complemented by a genre called protocol, which restricts rather than enables behaviour. Restrictions on behaviour are occasionally incorporated into procedural genres, at the point where they are relevant. Text [5.17] from the BHP steel mill, includes warnings at the beginning of the procedure (*no smoking...)* and between steps D and E of phase 2 (*do not proceed if…).*

[5.17] **SAFETY**

WARNING: NO SMOKING whilst working on preheater.

1 Isolate Tundish Car Long Travel Drives

Isolate and tag Tundish car long travel drives 1 & 2 at local centres in No. 2 switchroom.

2 Isolate Gas Systems

A) Light pilot flame by depressing "Preheat Pilot On" push button at Tundish Preheat Control Station.
B) Observe pilot flame in end of burner. Small flame approx. 20mm in diameter and mostly blue in color.
C) Isolate and tag Main Gas Shut-off Valve.
D) Observe burners for presence of any additional flame other than Pilot flame.

WARNING: DO DOT PROCEED if additional flame present after 5 minutes.
Contact Process Engineers to carry out further isolation.

E) Depress "Preheat Pilot Off" push button to extinguish pilot flame.
F) Isolate and tag Pilot Natural Gas Shut-off valve.

3 Isolate 110 Volts Ignition Transformer Supply

Remove fuse from Burner Management Panel. Terminal Strip X1, Terminal No. 1.

Turning to domestic appliances, Jim's new kettle foregrounds warnings of this kind after what is labelled step 3 in its operation procedure - using special formatting to highlight the warnings (boxed text, in blue font).

[5.18] **Operation of your kettle**

1. To fill the kettle, remove it from the power base and open the lid by pressing the lid release button. Fill with the desired amount of water. Always fill the kettle between the minimum and maximum marks on the water window. Too little water will result in the kettle switching off before the water has boiled.

2. Ensure that the lid is locked firmly into place. Place the kettle firmly onto the power base. Plug the power cord into 230/240 power point and switch 'On'.

3. Press the On/Off switch to the 'On' position. The power 'On' light and water guage will illuminate.

Always fill the kettle between the minimum (Min) and maximum (Max) marks on the exterior of the kettle. Too little water will result in the kettle switching "Off" before the water has boiled. Filling above the maximum mark on the exterior of the kettle may result in boiling water splashing from the kettle. Note

The kettle must only be used with the power base supplied. Use caution when pouring water from your kettle, as boiling water will scald. Do not pour the water too quickly. Note

The kettle will automatically switch 'Off' once the water has boiled. Lift the kettle from the power base and pour the water. Take care to hold the kettle level, especially when filled to the maximum level. To re-boil it may be necessary to wait for a few seconds to allow the control to reset.

The kettle may be stored on its power base when not in use. The power point should be switched off and the appliance plug unplugged from the power base when not in use.

Texts like [5.17] and [5.18] are best interpreted as procedures, with a prosody of prohibition emerging now and again where required.

In other contexts, where understandings about how to undertake an activity sequence can be taken for granted or are spelled out elsewhere, the protocol genre itself may emerge as a list of restrictions. Alongside the kettle operating procedure in [5.18] Jim's instructions for use include a page of protocol genre including no less than 16 warnings - drawing on a range of congruent and grammatically metaphorical commands to do so (Martin 1991).

[5.19]
This appliance has been designed specifically for the purpose of boiling drinking quality water only. Under no circumstances should this product be used to boil any other liquids or foodstuffs.

- Always use the appliance on a dry, level surface.
- Do not touch hot surfaces. Use handle for lifting and carrying the appliance.
- Never immerse the kettle base, switch area, power base or cord in water, or allow moisture to come in contact with these parts.
- Keep clear of walls, curtains and other heat or steam sensitive materials. Minimum 200mm distance.
- The appliance is not intended for use by young children or infirm persons without supervision.
- Young children should be supervised to ensure that they do not play with the appliance.
- Do not let the cord hang over the edge of a table or counter, touch hot surfaces or become knotted.
- Do not place on or near a hot gas burner, electric element, or in a heated oven.
- This appliance is intended for household use only. Do not use this appliance for other than its intended use.
- Do not use outdoors.
- Do not operate the kettle on an inclined surface.
- Do not move while the kettle is switched on.
- Always turn the power off at the power outlet and then remove the plug fro the power outlet before attempting to move the appliance, when the appliance is not in use and before cleaning or storing.
- The installation of a residual current device (safety switch) is recommended to provide additional safety protection when using electrical appliances. It is advisable that a safety switch with a rated residual operating current not exceeding 20mA be installed in the electrical circuit supplying the appliance. See your electrician for professional advice.
- Regularly inspect the power supply cord, plug and actual appliance for any damage. If found damaged in any way, immediately cease use of the appliance and return unit to the nearest authorised Breville centre for examination, replacement or repair.

An appliance of this kind is arguably too dangerous to use, but at least Jim has been warned!

Protocol is a very important feature of bureaucratic discourse, deployed for rules, regulations, laws and legislation (see Martin & Rose 2003 for discussion). Conal's

bus rules were a proto-administrative discourse of this kind. In these contexts it functions alongside procedures to manage populations, and may incorporate features of legal discourse where these are required.

From a client perspective protocol can also be deployed as tips for running the gauntlet of unfamiliar activity sequences and regulations. Here are a few words of advice from the Sydney Morning Herald's 2005 *Student Survival Guide* for incoming University students - their *Golden Rules* for studying.

[5:20] **Golden Rules**
Put assignment/exam dates - and *start* dates - in your diary/wall planner
Ensure study time is proportionate to the value of assignments/exams
Study hard early on to develop good habits
Do the *essential* reading before *additional* texts
Don't read course material cover to cover - ask how
Re-read and summarise lecture notes
Talk to fellow students and tutors about the subject
If struggling, ask - before assignments are due
Keep up a social life [*SMH* 1/2/3005: 18]

In Jim's experience Canadians are the world's experts in the protocol genre, something flowing on he expects from the deep grammar of prophylaxis which lies at the heart of their culture. During recent trips to Canada he has encountered lists of more than 30 rules[45] governing behaviour at public swimming pools (prompting his Australian partner to suggest that it is impossible to go swimming in Canada without breaking at least 5 rules). On his last trip he noted that even the small signs designating lap lanes as slow, medium and fast included a list of rules for using lap lanes on the back facing swimmers in the pool. Just in case readers think we're being too irreverent here (the deep grammar of Australia is surely responsible), we'll leave you with our favorite piece of anal retentive protocol - from a towel dispenser in the male toilet in a small diner north of Vancouver.

[5.21]
The Passive Restraint Guide is designed to prevent intentional abuse by children.
Excessive towel loop length could make intentional abuse more likely. Failure to follow loading instructions could result in serious injury or death.

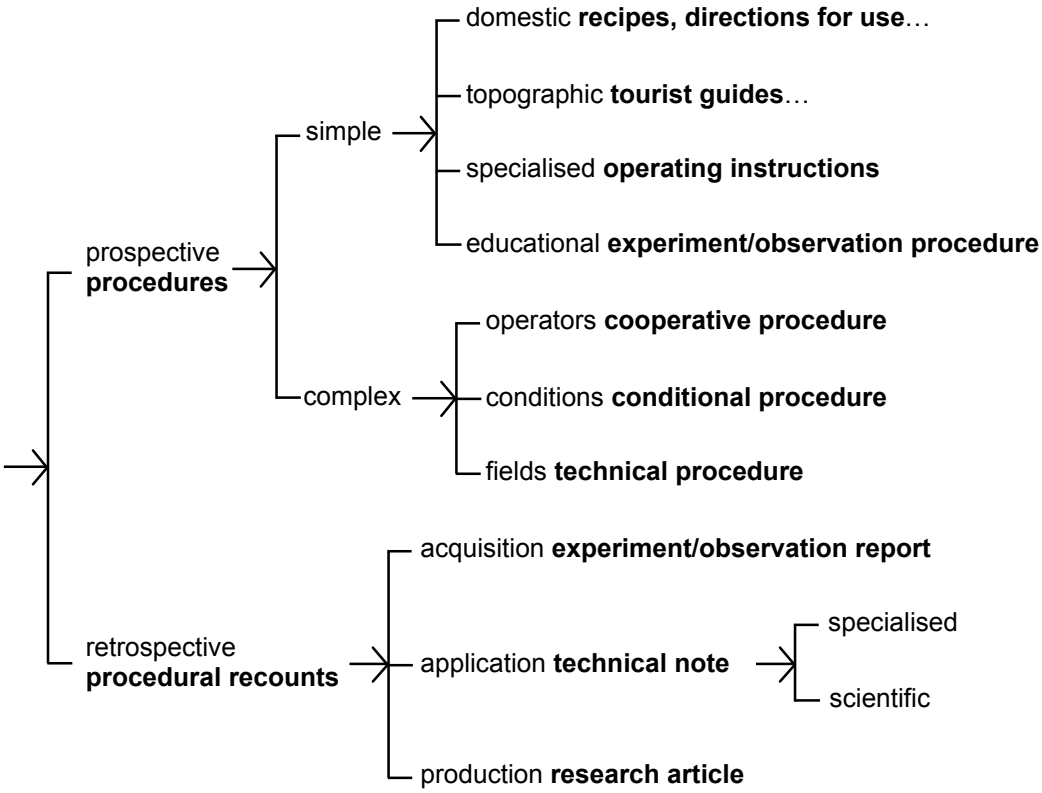
This was for the maintenance operator, but dared we dry our hands?

In administrative discourse, changes to procedure and protocol are managed through a genre of text referred to as directive. Directives specify the change required with a Command nucleus, and in addition may motivate and enable this proposal in various ways. Directives are explored in Iedema et al. 1995, Iedema 1997. Procedures and protocol are also related to Jorden's policy genre, introduced in 6.2.1 below.

5.4 Procedural systems

In the diverse realm of ‘doing’ science, procedures and procedural recounts give complementary perspectives on activities, one prospective and the other retrospective - one directing what to do and the other telling what happened. For these reasons we will model them here in single system network, in Figure 5.15.

Figure 5.15: Procedural genres



We have included in domestic procedures all those texts associated with household activities such as recipes, directions for use on foods, medicines, cleaning products, and simple instructions for games. Topographic procedures include tourist guides but may also include certain games, particularly computer games, as well as directions for finding locations (both oral and written). Specialised simple procedures include operating instructions for industrial and domestic technologies (although operating manuals can also include complex procedures). And procedures for experiments or observations in school science have their own unique structure. The structures of complex procedures vary with multiple operators (cooperative procedures), multiple conditions (conditional procedures) and multiple fields, as the complexity of technical procedures involves both specialised and technical fields. With respect to procedural recounts, research articles recount the production of science, technical notes recount its application in industry, and reports of school science experiments and observations recount its acquisition in school. Finally all the members of this network contrast with protocols, as time structured vs non-time structured, but for reasons of space we have left this contrast out of the diagram.

5.5 Macrogenres

Most of the texts we have used to exemplify genres in the preceding chapters have been short; in larger font most would occupy half a page to a page. This was not merely for convenience of analysis - we haven't gone trawling through piles of texts selecting only those around this size. Rather it seems to have something to do with a text as a unit of discourse; genres tend to come in around these sizes (with plenty of room for variation up and down). This applies as much to technical written texts such as the reports, explanations and procedures we examined in Chapters 4 and 5

(although technical notes and research articles tend to be a bit longer), as it does to the historical explanations and arguments in Chapter 3, and the stories in Chapter 2. Intriguingly many of these were spoken stories, including traditional stories from cultures as diverse as Indigenous Australia, ancient Europe and southern India.

On the other hand, many of these short genres were extracts from longer texts. This was illustrated for spoken stories with Evie's observation and exemplum [2:7], both part of a much longer recounting of her experiences as a stolen child. For written stories we took extracts from novels such as *Follow the Rabbit-Proof Fence*, which we described as a series of smaller stories, following the girls' journey from their home to Moore River Native Settlement and back again; and from short stories such as Jennings' *Good Tip for Ghosts*, which we described as a serial narrative (following Rothery 1994), with five Complications, each with their own Orientation, Evaluation and (temporary) Resolution. In Chapter 3 we extracted genres from several books on Australian history and contemporary politics, and exemplified how short texts may be nested within larger ones, in Frank Brennan's recount of events surrounding the abuse of child refugee [3:15]. In Chapters 4 and 5 many of the texts we used were from science textbooks or technical manuals.

In this section we will explore relations between short genres that go to make up larger texts, which we will refer to as **macrogenres**. Work on macrogenres includes Martin 1994, 2001a on science and geography textbooks as macrogenres. Christie 2002 deals insightfully with these issues in the context of classroom discourse as she develops her work on curriculum genres. Muntigl 2004 involves an intensive study of therapeutic discourse as it unfolds over several counselling sessions for couples. Jordens 2002 looks at story, policy and arguing genres as they unfold in his interviews with cancer patients, their family, and the health professionals involved in their treatment. And Iedema (2003a, b) follows a series of meetings culminating in the building of a new hospital wing, a process reconstituting language as material reality which he refers to as resemiotization. For excellent work on the role of images in macro-generic texts, see O'Halloran 2004, especially the article by Guo Libo on biology textbooks. To explore macrogenres here, we will again use Halliday's logicosemantic relations, to model macrogenres as serial structures, as we did for relations between story phases in Chapter 2, and for multimodal texts in Chapter 4.

The notion of genre complexes has already been introduced in Chapter 4 in the context of the multimodal text in Figure 4.26. This double page spread described and explained the *Mulga plains* of Australia's arid lands with three verbal texts and three visual texts. The verbal texts include a descriptive report about *Mulga plains*, a factorial explanation *The mulga tree* (analysed as text [4:10]), and a conditional explanation *Flowering and setting seed*. These three texts are related by enhancement and extension, as follows.

[5:22] **Mulga plains**

The biggest shock for many arid land travellers is the dense scrub that covers much of the arid plains. This scrub can be so dense that it is difficult to walk through. Travellers begin to wonder if they really are in arid country.

It is the mulga tree that grows so densely across the desert plains. It is so well adapted to the arid climate that it covers one third of our arid desert ranges and rocky outcrops are surrounded by gently sloping hills and plains. This is red earth country and is the country of the mulga tree.

x (explaining adaptation)

The mulga tree

How can plant life grow so well in such dry, hot and infertile places?
Surviving the long drought

The mulga likes long droughts - if it is too wet mulga trees will not grow.

The shape of the mulga tree is a key to it surviving dry times. The branches of the mulga fan out from the bottom-like a huge half moon. The branching leaves and stems catch the rain and it trickles down to the soil. This traps more rainfall than if the tree grew straight up. The mulga catches more water than a gum tree. This water is stored in the soil to be used by the tree during

Even the leaves help it survive the drought. They are a silvery grey colour. The sun's rays bounce off the leaves helping the plant to stay cool. Also the mulga tree makes its own food by dropping thousands of leaves.

+ (adding further factor)

Flowering and setting seed

For many years geographers thought that our arid land shrubs and trees only flowered after rain. We now know this is not true. The long living plants flower each year. Even in a dry time mulga will flower in spring and summer. The tree simply makes less flowers. If it rains in spring the tree makes more flowers.

Even if a tree flowers it may not set seed. Setting a lot of energy, energy that may be needed to find water during a drought. If it has rained the tree does not have to use as much energy to find water. For the mulga to set seeds there must be rain in late summer and again in winter. When the seeds drop to the ground, rain is then needed if the seeds are to start growing.

These three texts, with their visual accompaniments, consitute one section in a chapter of a secondary school geography textbook *Australian Journey: environments and communities* (Scott & Robinson 1993). The organisation of this excellent textbook construes the field of geography in Australia in two parts, *Australian environments*, including four types of environment (arid lands, wetlands, woodlands, forests), and *Australian communities*, with three kinds of communities (urban, rural, remote). Each chapter includes reports and explanations that describe and explain these social and natural phenomena, but the book is also concerned to construe geography as a scientific activity, conducted by experts in their fields, and these activities are presented as primarily focused on environmental conservation. To this end, each chapter on environments is followed by a chapter on 'managing' this environment (cf Martin 2001a and Veel 1998 on the 'greening' of school geography). The key genres in these chapters on geography as an activity are procedures and procedural recounts. Hence apprencticeship into the field of geography is construed as learning both a hierchically organised body of knowledge, realised in reports and explanations, and a set of technical practices, realised in procedures and procedural recounts. We will examine how the activity of geography is construed by relations among these procedural texts, but first let's look at how the field as a whole is organised in the book.

The organisation of the field is given by the headings throughout the book. This is analysed as a hierarchy of periodicity below [5:x], and logical relations between each section and chapter are indicated by symbols for elaboration, extension and enhancement. The particular sections we analyse here are highlighted in bold.

[5:23] **Australian Journey: environments and communities**

Part one Australian Environments
- 1 Introduction
  - = What is Australia?
  - = Australia today
  - …
- = 2 Exploring arid lands
  - = What are the features of Australia's arid lands?
  - x A useful tool to help geographers observe
  - + The steps to being a good observer
  - = Types of arid lands
    - = Desert ranges and rocky outcrops
    - **+ Mulga plains**
    - + Spinifex plains
    - + Saltbush and bluebush plains
    - + Desert rivers and salt lakes
  - = Exploring Uluru National Park
- x 3 Managing arid lands
  - x The issues involved in managing the arid lands
  - **x Investigating an arid lands mystery**
  - + The world's arid lands
- + 4 Exploring wetlands
  - …
- x 5 Managing wetlands
  - …
- + 6 Exploring woodlands
  - …
- x 7 Managing woodlands
  - …
- + 8 Exploring forests
  - …
- x 9 Managing forests
  - …

+ Part two Australian Communities
- 10 Introduction
  - x Where are Australian communities found?
  - x Why are Australian communities where they are?
  - x How are Australian communities changing?
- = 11 Living in urban communities
  - …
- + 12 Living in rural communities
  - …
- + 13 Living in remote communities
  - …

The Introduction to *Part one* first elaborates the heading by describing Australia in relation to the world, and other lands. It then elaborates this description by classifying environmental regions in *Australia today* (northern, southern, coastal, arid). Chapter 2 *Exploring arid lands* exemplifies this classification with a specific environment type. The criteria for classifying environments as arid lands are then given in a report describing five of their *features* (soils, plants, animals, rainfall, temperature). The next section *A useful tool to help geographers observe,* enhances the whole text, describing how geography is done with specialised types of observation, which is then added to by a procedure for doing geographic observations *The steps to being a good observer*. This procedure is required for students to do the exercises

associated with many sections of the textbook. It is immediately followed, for example, with exercise [5:4].

[5:24] Exercise
Being a good observer
Look carefully at Figs 2.1 to 2.5 and reread the information on pages 14-15.
[the section *What are the features of Australia's arid lands?* and photographs associated with each feature]

Figure 2.1 [an aerial photograph of a sand plain with sparse trees]
List the key features that you can observe. You must list the features of:
- vegetation
- landforms

Figures 2.3 and 2.4 [birds in a tree, and a wallaby among rocks]
- List the key features that you can observe.
- What animal can you observe or would you expect to see?

Figures 2.2 and 2.5 [people measuring rainfall, and in jumpers around a fire at night]
- List the key features that you can observe.
- What comments can you make about the:
  rainfall
  temperature
  evaporation

Such procedures function to engage the student in the field, mimicking the geographic activities of observation, literature research and recording (cf procedure [5:5] above). Rather than being logically related to preceding texts, we can interpret them in terms of NEGOTIATION as moves in an exchange, where the writer first gives information, then demands a service from the readers (cf Chapter 1, section 1.5.6). This service requires them to reread the information given, and give it back in written form. The multimodal activities of observing, reading and writing are demanded here as both commands and questions.

Following this detour into geography as activity, the next section *Types of arid lands* then returns to geography as classification, and these types are detailed with a series of subsections, added one after another, that describe each type, and explain its features. The section analysed above as [5:22] *Mulga plains* is typical of these subsections, describing the environment type in general and then explaining features such as strategies for surviving drought. The last section in this chapter then exemplifies these landscape types in a specific area of arid lands around Uluru (Ayers Rock).

Chapter 2 provides the factual basis on which chapter 3 argues that arid lands must be conserved through scientific management, and recounts how to do so. In these respects chapter 3 enhances chapter 2 with consequence and manner. This argument is developed, first with some explanations of former poor management *The issues involved in managing the arid lands*, then enhanced with a procedure and procedural recount of how to manage scientifically, *Investigating an arid lands mystery*. The last section *The world's arid lands* adds further arguments for management with respect to global environmental issues.

These patterns are repeated for the following chapters in Part one. There is thus an overall taxonomic movement in Part one, from Australia in comparison to other lands,

to general kinds of Australian environments, to four types of environments recognised by geographers, to specific subtypes within each of these. The physical geography of Australia is construed in a classifying taxonomy, as a system of environmental types and subtypes. Along the way, doing geography in Australia is construed as activities involving specialised observation of the environment, and these activities are motivated by concerns for environmental conservation.

Likewise, Part two classifies Australian communities on the criteria of their location, explains why they are so located, and accounts for how they are changing over time. Each chapter then describes and exemplifies these community types, explains how they are changing, and argues for scientifically informed planning on this basis. While the terms change from 'management' to 'planning' as we move from natural to social environments, the message continues that geographical observation must inform environmental policy. Martin 2001a and Veel 1998 describe how this complex construal of geography as scientific activity and environmental conservation is woven into school curriculum texts, and must be reproduced by school students in their writing tasks.

In keeping with the focus of this chapter of *Genre Relations*, we will conclude with the procedure and procedural recount in chapter 3 *Managing arid lands*, introduced as texts [5:12] and [5:13] above, and their logical relations to its other sections. The chapter begins with an exposition arguing for scientifically informed management. This is enhanced by a factorial explanation of former poor management, each factor of which is added as a consequential explanation of changes since white settlement, with its own heading. This rationale is then enhanced by a generalised recount of geographers' role in management through case studies (for generalised recounts see Chapter 6 below, 6.2.1), and this is enhanced by a procedure for such case studies, which is in turn exemplified by the procedural recount of a case study at Uluru. Each step in this long procedural recount is a genre in itself, and within *Step 3 The field trip*, there are three subsections of varying genres. Only brief extracts of each section are presented here, and headings in the textbook are shown here in bold.

[5:25] **3 Managing arid lands**

Exposition (rationale for geography informing management)

Imagine spending months at a time in Uluru National Park trying to find out about Australia's arid land animals. This is what Lynn Baker does. She spends long days in search of a small marsupial called the mulgara.

…

Much of Australia's unique desert fauna is vanishing before our eyes and most Australians have not heard of, let alone seen these animals.

…

The second reason that all Australians should be concerned is that arid lands are a major grazing are for sheep and cattle.

…

If landowners can make sure that desert habitats are better managed, two things will happen:

- the desert will be able to continue to support grazing activity, and,
- Australia's unique flora and fauna will survive.

x **The issues involved in managing the arid lands**

Factorial explanation (former poor management)

For thousands of years people have used the arid lands. With the arrival of European settlers the arid lands began to be used to graze cattle and sheep. The way the land was used or managed has changed.

…

= Consequential explanations x 4
Issue number 1 Changes to burning
…

\+ **Issue number 2 Changing land ownership and responsibilities**
…

\+ **Issue number 3 Disappearing vegetation and soil**
…

\+ **Issue number 4 Changing animal life**
…

x **Investigating an arid lands mystery**
Generalised recount (geographer's field trips)

Geographers are interested in the management issues that affect arid lands. To investigate these issues, it is important to go to the area to be studied. Geographers call these trips field trips.
The aim of field trips is to:
- observe what is happening
- collect and record information

When a field trip is finished the geographers study the information collected. They then:
- decide what is happening in the case study area
- develop ideas on how to improve or change what is happening

…

x Procedure

It is important that a geographer makes the best use of the time while on a field trip. To do this the geographer follows a number of steps:
Step 1 Identify the issue to be studied.
Step 2 Research the background to the issue.
Step 3 Go on the field trip. While on the field trip it is important to:
- observe and
- collect information.

Step 4 Use the observations to identify what is happening.
Step 5 Develop a plan to manage an environment.

= **The mulgara at Uluru National Park**
Procedural recount

Before leaving on the field trip to Uluru National Park, Lynn identified the issue she wished to study and spent time researching it.

= **Step 1 Identify the issue to be studied** (policy)
'I want to find out why mulgara appear to be in some areas and not in others. If I find that the mulgara are rare I want to be able to suggest ways to conserve their habitat.'

x **Step 2 Research background to the issue** (recount)
Lynn didn't just pack her bags and leave for Uluru. She spent time in the library reading what others have found out about arid zone animals.
…

x **Step 3 The field trip** (recount)
…
The work involved in step 3 can be divided into two parts:
1 Making observations
2 Collecting and recording information

= **Observing the mulgara and its environment** (recount)
During her first field trips to Uluru, Lynn spent time observing mulgara and the environments where it lives.
…

x **Collecting and recording information** (recount)
Now Lynn needed to collect information that would help her find out why the mulgara seemed to be found in different habitats during times of high rainfall and during times of drought. Her first task was to collect data that showed where mulgara were living and where they were not living.
…

\+ **Using computer mapping to locate relict drainage environments** (generalised recount)
Earlier you learnt that old river systems can't be seen when walking over the ground. However, photographs taken by satellites, circling thousands of kilometres above the earth, do reveal these old rivers.
…

x **Step 4 Use the observations to identify what is happening** (sequential explanation)
Lynn's next step was to carefully study her observations to see what they told her… She started to develop a theory:
'The theory is that in the relict drainage area the vegetation remains in better condition than in areas outside its influence. This area is better able to support animals during drought. It becomes an important refuge area for animals like the mulgara during times of drought. The mulgara in this area are better able to survive than those living elsewhere. This is because the plants are able to collect the water from the underground drainage system. When it rains the habitat in the rest of the country improves. The mulgara are able to spread out over the country and I will find mulgara living away from this area again.'
…

x **Step 5 Developing plan to manage the environment** (exposition)
Geographers conduct field work to help them decide on ways to manage the environment. When Lynn Baker's work is complete she wants to be able to suggest things that can be done to protect and save the mulgara. This means protecting the environments where it lives.
At this stage Lynn believes the refuge areas that are found in our arid lands must be protected, as the research so far suggests that small animals like the mulgara do rely on them in droughts.
…

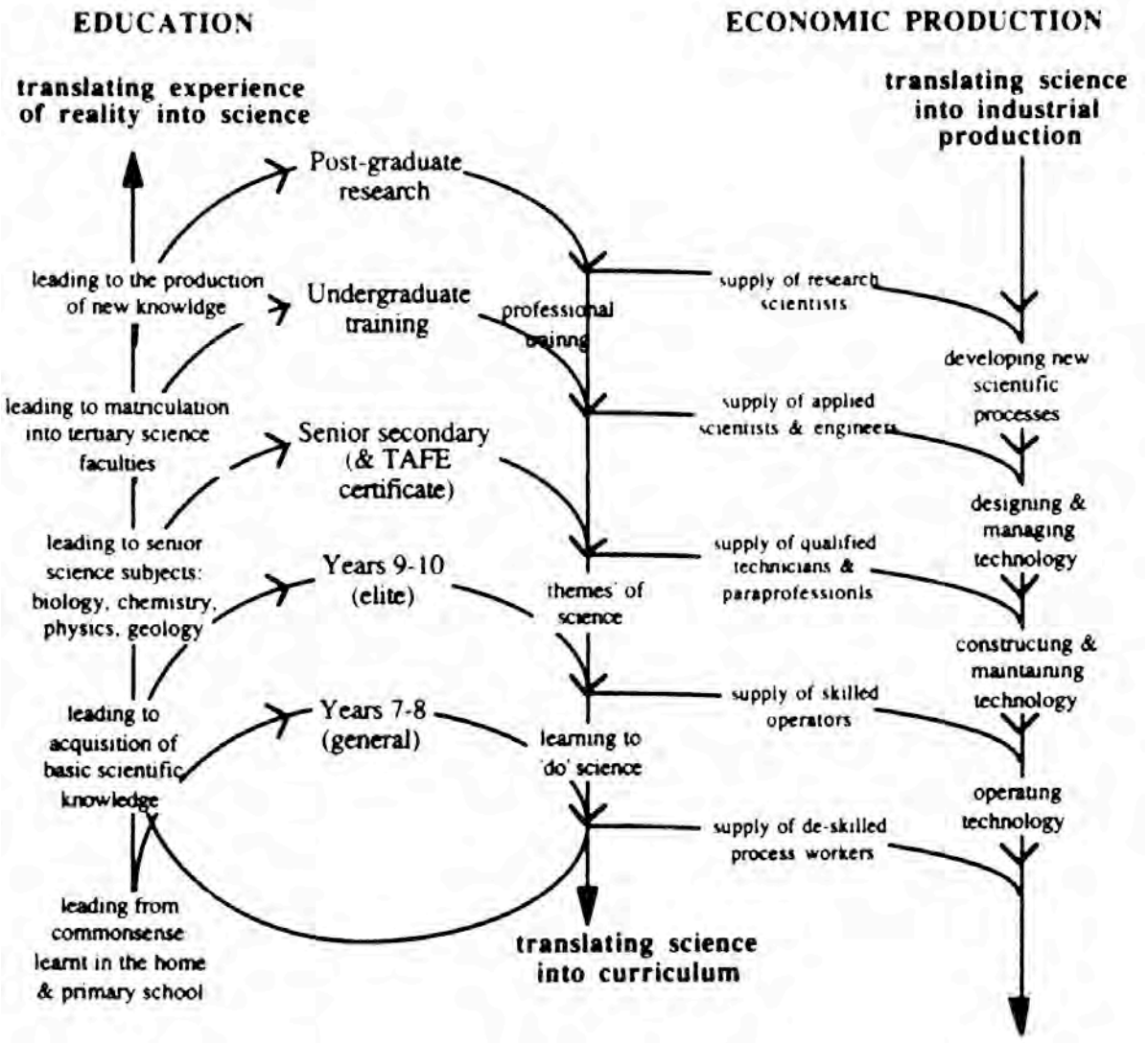
In summary, the rhetorical structure of the chapter is expository: it begins with why geographers are needed, then what it is they do, followed by an example of what they do; in genre terms, thesis, evidence and example. In terms of apprenticing potential geographers, the activity of geography is thus contextualised and made appealing from two perspectives. First it is logically related to the need for environmental conservation. The previous chapter motivates this need by describing the complexity and beauty of Australia's arid lands, so that the explanations of environmental degradation here are counterexpectant problems, and geographic study is construed as (part of) a solution. Secondly it is logically related to the activities of a specific geographer, with whom the readers are invited to personally identify. An appraisal analysis would provide more insights into the interpersonal relations enacted here between the reader, the land, geography and the geographer, but unfortunately we have run out of space.

What is usefully displayed here is the way that this pedagogic text frames relations between technical activities, social issues and personal actions. This is achieved by linking reports, explanations, procedures, procedural recounts and expositions in an intricate logical series. This series of genres apprentices students into a hierarchy of knowledge and specialised activities that could eventually give them the power to participate in controlling the natural and social worlds.

5.6 Conclusion

In this chapter we have sketched parallel semiotic developments in the industrial hierarchy and in science education. Relationships between levels of education and economic production are schematised in Figure 5.16. The education field in this model is presented as a spiralling curriculum, in which learners acquire the discourse of science in steps, from junior secondary to post-graduate research. Correlating with each of these curriculum steps is a jumping off point into the field of economic production. At the first level, if you have not learnt to read the genres of junior secondary science (and can demonstrate that you have in written assessments), you may be destined to supply industry with the de-skilled manual labour required by process line production. Those learners who do learn to read the reports and explanations described in Chapter 4, will also be able to read the operating procedures described above, to become skilled operators of industrial technology. Those who can successfully demonstrate their acquisition of junior secondary science are permitted to get further education at diploma level, to become technicians capable of carrying out technical procedures, such as text [5:11]. Those few who acquire the abstract technical discourse of senior secondary science are permitted to enter undergraduate programs that train professional applied scientists and engineers. And finally the handful who can demonstrate a special aptitude for reading and writing science may be permitted to go on to post-graduate study, and so contribute to the production of scientific knowledge.

Figure 5.16: Stages in science education and levels in industry



The numbers of learners jumping off at each level of the education curriculum are far from equal, as shown in Figure 5:17. In Australia almost twice as many never enter further education (~55%) as those who acquire vocational qualifications at technical college (~30%), which are twice as many again as those who receive professional degrees at university (~15%), and these proportions have changed only slightly over the past twenty years at least (ABS 1994, 2004, Rose in press). In terms of occupations, the large lower group includes manual labour and skilled operators (and the unemployed), the middle group tradespeople and technicians, and the small upper group scientists, engineers, educators and managers at various levels. Unequal acquisition of the science genres described here thus has extensive consequences for both socioeconomic structure and occupational options. The lower group have relatively few of these options, have little autonomy in the workplace, and earn the least, the middle group may have more options for autonomy and earning, but it is the upper group who primarily participate in the control of the natural and social world that these genres afford.

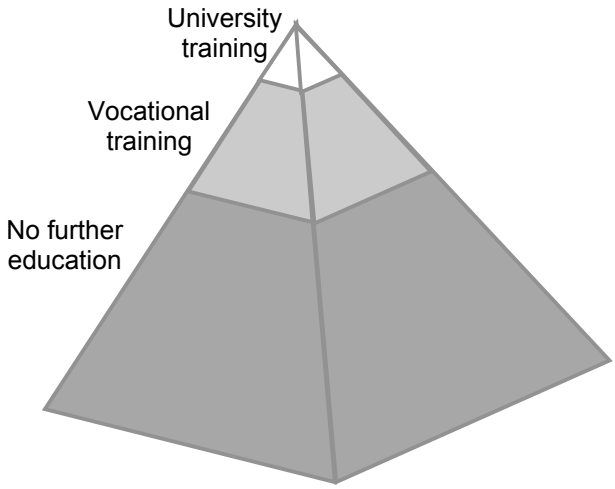


Figure 5:17: Proportions of educational qualifications

One of the reasons so few learners acquire the privileged genres of science is that written discourses become more remote from the construal of experience in everyday spoken discourse, as we move up the industrial ladder and the education sequence. Activities involving things and people in commonsense parlance are reconstrued in technical fields, as abstract things that act on other abstract entities, and these relations of 'acting upon' then become abstract things themselves, a semiotic process Halliday refers to as grammatical metaphor (Halliday 1998, Halliday & Martin 1993, Martin 1989, 1993, Rose 1993, 1997, 1998, 2004a, 2005d, to appear a). Eventually sequences of unfolding activities come to be re-expressed as parts of composition taxonomies, as criteria for classifying the abstract entities they modify, as we described above. Instead of a sensually experienced world of happenings involving actual people, things, places and qualities, reality comes to be experienced virtually as a generalised structure of abstractions. Instead of a subjectively negotiated social order, enacted in personal exchanges, interpersonal meanings are subsumed in the causal relations between abstract things, graded as more or less necessary or evident.

Of course the scientists, engineers, educators and managers that live this abstract reality in their working roles, also know the older spoken construal. They (we) learn it first as children and continue to deploy it in personal relationships. This is one dimension of what Bernstein (1971-96) has called elaborated coding orientations, that provide access to more than one set of options for making meaning. The scientific construal however is dominant in modern industrial society, and is integral to the maintenance and expansion of its stratified social structure; the theories of natural reality it realises have evolved in tandem with the relations of production in industrial capitalism. The scientific construal is currently the exclusive property of those socioeconomic classes which benefit most from this system, and its version of reality reflects the structures of institutional roles which members of these classes occupy in the course of making their living and negotiating power.

Today access to technical discourses is required not only by professionally and vocationally trained workers, but increasingly for employment at all levels of industry.

As we stated at the beginning of this chapter, many of the texts in this chapter are from manuals produced as part of the national and global industry restructuring movement which increasingly requires that all workers are trained and accredited. Without control of written technical discourses, this training is not possible, and employment opportunities are restricted to a shrinking market for unskilled low-paid manual labour. As globalised capital is able to rapidly move manufacturing from regions of higher education and wages to regions of lower education and wages, it is only possible for workers in developing nations to achieve wage parity through control of literate technical discourses.

There is a view however, popularised by the 'new literacies' group among others, that teaching technical literacy "is simply imposing western conceptions of literacy onto other cultures" (Street 1996:2). The ideological goal of literacy research in this view is to privilege literacy practices documented amongst disempowered peoples, over teaching literacy practices regarded as cultural imperialism. To this end, policies focused on vocational literacy training may be specifically rejected; Prinsloo & Breier (1996:15) for example, dismiss such literacy policies in post-apartheid South African as "a quick fix by way of fast delivery by large-scale programmes". Street (1996:1-2) characterises these literacy programs as 'the autonomous model of literacy', i.e. disconnected from the cultural contexts of learners, and suggests that developing nations naively and mistakenly assume that literacy training will bring social benefits such as "'modernisation', 'progress' and economic rationality, to name a few". In the South African context, he associates literacy "attached to formal education" with "vested interests which depend upon the old views for their legitimacy", clearly implying a connection between advocates of state literacy programs and the racist ideology of apartheid. As research in this paradigm is concerned not with what workers need to know, but what they already do know, its results cannot be used to inform the literacy programs it opposes. Rather proposals emerging from such research focus on altering the attitudes of educators, administrators and workplace managers, rather than educating workers. For example, following their study of literacy practices in a Cape Town factory, Breier & Salt's (1996:83) recommendation is that management "stop insisting that communication take place on its terms alone, with the onus on workers to acquire the necessary skills to participate".

It is claimed that this new literacies position "offers a more culturally sensitive view of literacy practices" (Street ibid), and there is no doubt that the documenting of diverse language practices serves valuable functions. It is of course a key goal of *Genre Relations*, in which we set out to explore the cultural contexts of language use. Unfortunately however, the associated disparaging of technical/vocational literacy teaching has the potential to undermine such programs where they are most needed, such as post-apartheid South Africa, where the gulf between rich and poor is reportedly second only to Brazil (cf Muller 2000 on this debate), or in Indigenous Australia which has among the worst education, employment, income and health statistics in the world (Rose 1999, 2004a, Rose et al 2004). In our opinion this ethnographic valorising of others' cultural practices over their educational needs is an example of what Bernstein 1990 considers the boundary maintaining function of agencies of symbolic control. At the socio-economic level, such apparently liberal views function to protect the economic interests of the new middle class, ensuring that the world's have-nots continue to be denied access to its semiotic resources. As an alternative we would like to suggest that access to the discursive resources of

power is the democratic right of all citizens, and that as linguists and language educators it is our responsibility to make these resources available to all.

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[44] Due to its religious importance, the correct procedure for cooking a kangaroo was one of the first skills taught to David when he first lived with the Pitjantjatjara communities. First a small incision is made in the kangaroo's belly, the intestines are removed for separate cooking, and the incision sewn up with a stick. A long pit is then dug and a large fire of sticks is prepared, onto which the carcase is thrown and turned until all the fur is burnt. The feet are removed by twisting, to extract sinews for binding spearheads and other wooden tools, and the tail is cut off. When the fire has burnt down, the coals are scraped out of the pit, the carcase and tail are laid in it, and coals scraped back over them. When cooked, the carcase is removed and butchered in a precisely prescribed sequence. The legs are first cut away, then the pelvis and lower back are disjointed at a particular vertebra, the upper torso is split in two and the head removed. The various parts are shared out according to work done – hunting and cooking – and obligations to and needs of various kin.

[45] This contrasts with the typical three rules in Australian pools: No running. No spitting. No bombing.

Chapter 6 Keeping going with genre

Our main aim in writing this book has been to extend an invitation to readers to consider genres as configurations of meaning and to think paradigmatically about relations among genres – focussing our attention on stories, histories, reports, explanations and procedures. In this final chapter we want to explore a little further various issues arising from a project of this kind, which as we noted earlier tries to map culture as systems of genres. We begin with an obvious query – Is genre everything? And we then turn to the question of genre relations – one genre to another in the culture, and one genre to another as a text unfolds.

6.1 Is genre everything?

Is there life beyond communication? Is there meaning beyond genre? Just how much work can we make genre theory do?

6.1.1 Genre in a functional model of language and social context

The first thing we need to do in response to a query about the limits of genre is to place our work on genre within the functional model of language and social context in which it evolved. As we noted in Chapter 1, in this model (see Fig. 1.9) genre is positioned as an abstract level of analysis co-ordinating field, mode and tenor (known collectively as register), and register is realised in turn through language (discourse semantics, lexicogrammar and phonology/graphology). This picture means that of course there is more to genre than the descriptions in Chapter 2-6 entailed. Our treatment of linguistic realisations there was necessarily sketchy and exemplary; and as we apologised in Chapter 1, serious consideration of field, mode and tenor was beyond the scope of this volume.

In a model of this kind then, genre may have less work to do than in other frameworks (e.g. Berkenkotter & Huckin 1995, Bhatia 1993, Biber 1995, Miller 1984, Swales 1990), because the descriptive workload is distributed across strata and metafunctions (ideational, interpersonal and textual meaning). For example, the kind of 'knowledge' involved in genre is a matter for **field**, where professional, disciplinary, recreational and domestic activity would be described. Similarly, the effects of speaking and writing, and of mono-modal and multi-modal discourse is a matter for **mode**, where the amount of work language is doing has to be explored. Likewise for the negotiation of social relations, which is the concern of **tenor** and its implications for interpersonal meaning. When comparing our model of genre with that of others, it may be useful to treat analyses of field, mode and tenor as more delicate extensions of the genre descriptions offered in Chapters 2-5. It is often the case that genre plus aspects of field, mode or tenor in our model does the work of genre alone in alternative frameworks[46]. As noted in Chapter 1, we don't actually model register and genre in these terms because to do so would mean restating comparable field, mode and tenor descriptions from one genre to another and we in fact see field, mode and tenor as tools for generalising knowledge, multi/modality and social relations across genres.

Another important respect in which there is more to genre than canvassed here has to do with what Matthiessen 2003 has called 'individuation'. In Bernstein's terms, this

has to do with the relationship between the reservoir of meanings in a culture and the repertoire a given individual can mobilise. For Bernstein this is a matter of coding orientation, which has been fruitfully explored in SFL by Hasan and her colleagues (see especially Cloran 1989, 1999, Hasan 1990, 1991, 1992, 1996, Hasan & Cloran 1990, Williams 1999, 2001). Access to genres is an important part of this picture, and a major political motivation behind literacy interventions based on our work. Studies of the factors influencing the relations of reservoir to repertoire in a given culture can be usefully related to work on ideology and subjectivity in other frameworks (for discussion of the relation of CDA to SFL see Chouliaraki & Fairclough 1999, Martin 2000a, Martin & Wodak 2003).

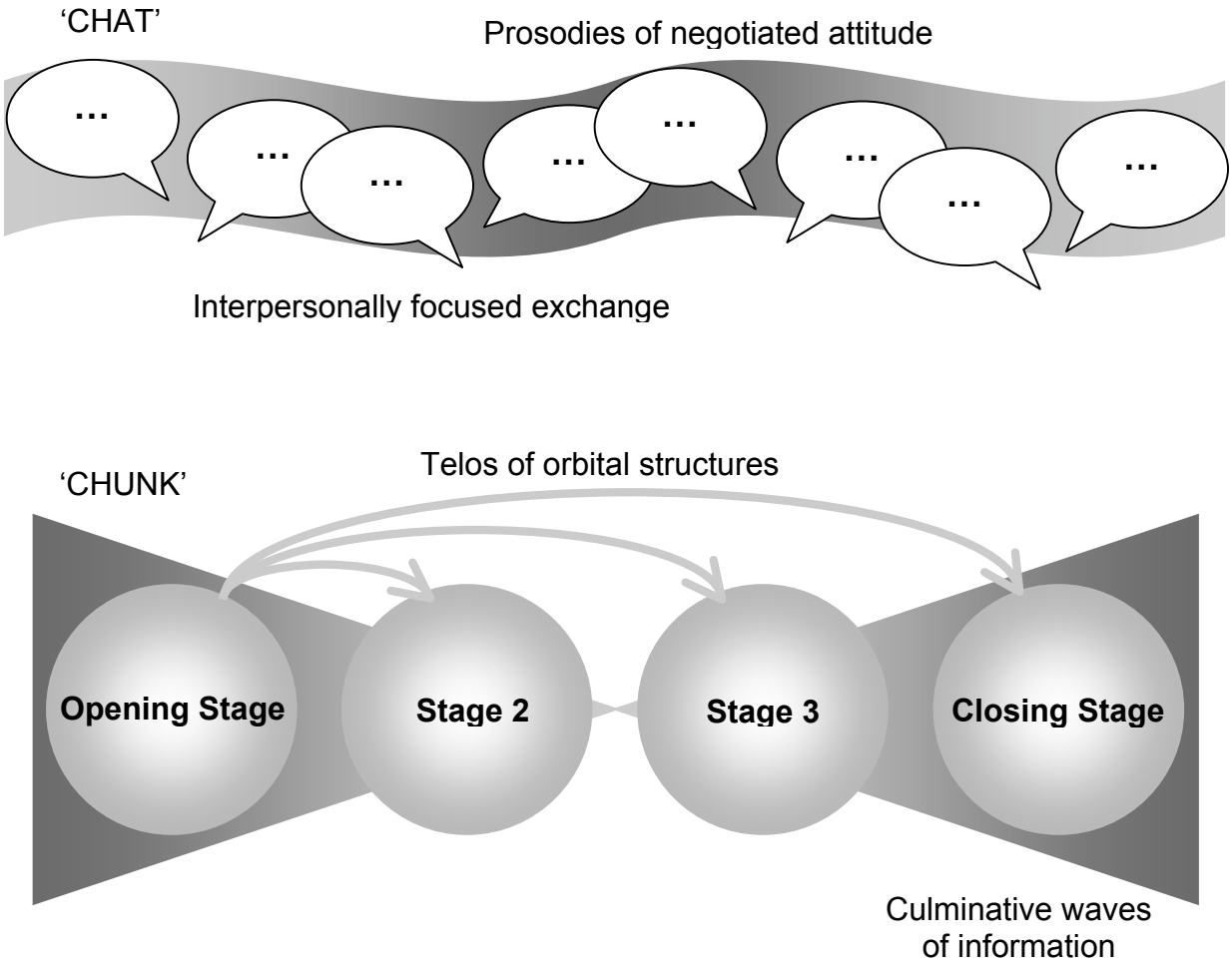
In short then, in a functional model of language and social context, there is more to say about genre as we move across strata and metafunctions. At the same time, the model assumed here does privilege genre as its ultimate level of abstraction, thereby giving genre responsibility for coordinating the recurrent configurations of meaning in a culture. In such terms, genre mediates the limits of our world - at the same time as offering systemic linguists a wholistic perspective on their metafunctionally and stratally diversified analyses.

6.1.2 Genre and chat

The idea that social life is delimited by genre is a controversial one in another respect, since it so readily conflicts with various modernist ideals (or one might say modernist conceits) – for example personal choice, individualism, spontaneity, creativity, freedom and liberation. Even those prepared to grant the recurrent closure of institutional genres, such as science reports or historical explanations, are less prepared to acknowledge the delimitation of informal spheres of social activity, in particular casual conversation. Eggins & Slade 1997 in fact demonstrate the utility of genre description in workplace conversation, recognising what they call ‘chunk and chat’ – recognisable generic chunks (eg. gossip and various story genres), with less clearly defined chatty transitions in between.

More problematic perhaps is Eggins & Slade’s dinner table conversation data for which the major social imperative is ‘keep talking’, and where there is perhaps more chatty banter to be found than clearly bounded chunks of gossip or narration. One way to think about ‘chat vs chunk’ is to return to the notion of types of structure introduced in Chapter 1. In such terms the basic ideational organization of chat is serial rather than orbital; chat involves an open-ended series of dialogic moves designed to keep the conversation going, and thus contrasts with orbital genres in which stages enable a nuclear move that consumates the telos of the genre. (cf. the narrative [2:10] or factorial explanation [4:10]). Compared with chat, the chunky genres also map culminative waves of information onto the orbital structure, further strengthening our sense of a beginning, middle and end. Chat on the other hand coasts along through a kind of prosodic extension of the attitudes under negotiation, weakening our sense of bounded wholes (Martin 2000). These contrasting modes of unfolding are illustrated in Figure 6.1.

Figure 6.1: Contrasting modes of unfolding in chunk and chat genres



In a sense then, chat does give us the illusion of being 'outside of genre'. But this is because its more fluid structuring principles resonate with the modernist conceits noted above. We feel free, even though we're not. As Eggins & Slade show, chat does involve recurrent configurations of meaning that are the basis for the recognition of any spoken genre, whether informal (as in their data) or institutional (as in for example the work of Christie 2002 on classroom discourse or Ventola 1987 on service encounters) – including some very conservative ideological motifs, at times disguised and thus enabled by humour.

6.1.3 Genre and non-verbal communication

How else to get away from genre? Another popular refuge is extra-linguistic reality, including other forms of communication and physical and biological materiality. This may be accompanied by accusations of logocentricity as far as genre theory is concerned. By defining genres as configurations of meaning, we have tried to open the door to multimodal realisations of genres, including various modalities of communication (e.g. image, music and spatial design as introduced in Chapter 1). Work on multimodal genres is an important focus of innovative discourse analysis for the noughts, and presents a number of challenges for the register variable mode which have yet to be resolved (Baldry 1999, Kress & van Leeuwen 2001). The challenge posed by this research for genre lies in the development of models which

not only co-ordinate discourse across metafunctions (i.e. across field, mode and tenor variables) but across modalities as well. For promising work on intermodality see O'Halloran 2004 and Royce in press.

Alongside non-verbal modalities of communication, physical and biological systems are certainly significant dimensions of analysis around genres. But to bring them into the picture we have to analyse talk about them, by laypersons or by physicists, geologists, chemists, biologists and so on – in more and less common sense terms (including mathematical and technical language and various kinds of imaging). This talk is as close as we can get as discourse analysts to the material world outside genre, gazing through the lay or uncommon sense discourses which have evolved to model physical and biological reality (Halliday & Martin 1993, Martin & Veel 1998, O'Halloran 2003). We would like to stress at this point that specialists are gazing at reality through their discourse too; so our meta-discursive perspective is not really different in kind from the necessarily discursive modelling technologies that scientists use. And on the border of communicative and material reality lies human action, which has been the special focus of Martinec's research into movement, gesture and facial expression (1998, 2000 a, b, c, 2001). Since Martinec models this activity in social semiotic terms, it can be brought into the picture as an attendant 'paralinguistic' modality.

So yes, there are non-verbal modalities of communication to worry about. And yes, there is a material world outside, but one which we inevitably semioticise as we explore. We remain satisfied that genre is well positioned in our model as a resource for co-ordinating communication across modalities in multimodal texts as our understandings of inter-modality unfold.[47]

6.2 Relations among genres - paradigmatic relations

How do we tell one genre from another? Are there texts that are more one genre than another, and others in between? Is it possible to have mixed genres, which we treat as realising more than one genre at a time?

6.2.1 Family membership

As a general rule, the better our genre analysis, the easier it will be to recognise genres as we come across them. If we return to story genres, then we can draw on the body of work outlined in Chapter 2, and expect to find recounts, anecdotes, exemplums, narratives and observations. Looking at the stories in Elaine Russell's beautiful children's picture book, *The Shack that Dad Built* (2004), clear examples of these are easy to find. Elaine recounts moving from La Perouse to Murrin Bridge ('From the beach to the bush'):

[6.1]
We used to sit around the campfire at night, and Dad would tell us about how he travelled all over the place before he and Mum started a family. Sometimes he'd tell us scary ghost stories. But one night when I was about ten, he told us that we were going on a long trip. He had got a job as a handyman on a mission called Murrin Bridge, way out in the country. We would live in a house with floorboards and proper windows. Not long after that, we packed up our clothes (there weren't many!) and said goodbye to our friends, and to Violet, who was staying behind. We were all excited, but also sad at the thought of leaving La Perouse and the beach where we loved to swim and fish.

She tells a moving anecdote about a Christmas present she missed out on (‘My saddest Christmas’):

[6.2]
One Christmas eve, my parents took me and my brothers and sisters to nearby Matraville, where a charity was giving away toys to Aboriginal children. It was a very hot day, and the queue was so long. I watched lots of kids going home, happy with their dolls and bikes and scooters and toy cars. My heart was set on a doll that said “Mama, Mama”. When we finally reached the head of the queue, the people told my parents that they’d run out of toys. I cried and cried.

And she offers an equally moving exemplum about friendship and respect among outsiders (‘The Hand of Friendship’):

[6.3]
One day, while we were playing outside our shack, we were surprised to see a family of gypsies coming down the road in a caravan pulled by a horse. They really seemed like strangers in a strange land. But my father extended the hand of friendship. The gypsy family said we were the first people to make them feel welcome. That night we all sat around a big campfire telling our stories to each other.

She includes a narrative about getting over her anxiety on her first day at school (‘My school’):

[6.4]
My sister Violet walked me to school on my first day, saying “Hurry up! We’ll be late!” When we got to the school gate, she just left me there – she went to a different building because she was older. I was scared! I felt a lot better when we lined up to go to our classes. I soon made some new friends and we played games in the schoolyard. The next day I wasn’t scared at all!

And in an observation she shares an insight into her Dad’s character that led to him building a shack for the family at La Perouse:

[6.5]
When I was about five we moved to Sydney because my father, Clem, had found a job. W went to live in La Perouse. Some of Dad’s cousins already lived there, and so did lots of other Aborigines – some in the mission, some in shacks. Dad didn’t want to live in the mission, though. He preferred to be independent.

Like these stories, the biographical recount that introduces Elaine Russell [6.6] is about specific people, but instead of referring to a specific incident it hops through time (in bold).

[6.6]
Elaine Russell was born in Tinghua, northern New South Wales, **in 1941**. She spent her childhood in La Perouse, and **later**, on the Aboriginal mission at Murrin Bridge, where her father was a handyman. **In 1993**, Elaine enrolled in a visual arts course and was finally able to realise her lifelong ambition to become a painter. Her work has been exhibited in museums and galleries around the world. **In the 2001** Children’s Book Council of Australia Awards her first book, *A is for Aunty*, was shortlisted for the Picture Book Award and was an Eve Pownall Information Book Honour Book.

Elaine has six children and ten grandchildren, and lives in Glebe, New South Wales.

And the historical recount that introduces her book [6:7] also hops through time, but here the participants are mostly generalised (in bold).

[6.7]

Aboriginal people have lived on the east coast of Australia for more than 40 000 years, and La Perouse, on the shores of Botany bay, has been used as a camping ground or meeting place for at least 7500 years. **People** followed the seasonal fishing between La Perouse and the south coast of New South Wales.

Records of **permanent Aboriginal habitation** at La Perouse date back to around 1880, when twenty-six Aborigines from the south coast took up permanent settlement. In the mid 1880s, the camp was officially established as an Aboriginal reserve. The camp was first run by **missionaries and a policeman**, and in later years by **resident managers**. Tin houses were built and in 1894, a mission church. But the sand dunes they stood on were too unstable, and the mission buildings were moved to higher ground in 1929-1930.

These were the Depression years, and **hundreds of unemployed people – black and white** – moved into the area around the mission and set up camp, building shacks out of whatever materials they could find. As the Depression ended, **many of the white people** moved on, and by the time Elaine Russell and her family moved to La Perouse, the area was **predominantly Aboriginal** once more.

So far these texts fit the story and history genres we identified in Chapters 2-3. But what about a text like the following [6:8]? This looks like a story, but instead of past tense, activities are modalised for usuality with *usually* and *would* (in bold).

[6.8]
On the weekends, when the tourists came out to La Perouse, they**'d usually make their way down** to the wharf. There they**'d throw** coins into the sea and watch the kids dive for them. I was too small to dive, so I **would sit** on the wharf and hold the coins that my brothers collected. Afterwards we**'d go** and buy the biggest bag of hot chips we could get, then **sit** on the beach and **have** a good feed. Yum! The golf course provided the local kids with another way to make money. Golfers **often lost** their balls in the long grass and bush around the course. Kids **would watch** where the balls went then **come back later** to find them. They**'d take** them home, **give** them a wash, and **sell** them back to the golfers – who **were usually** happy to get their favourite balls back!

This time round, instead of a specific incident and what it meant, Russell generalises across experience, telling us about two ways in which the kids at La Perouse would often make money. And instead of specific participants, we get mainly generic ones (tourists, coins, kids, golfers, balls):

the tourists – they **-** their (way) - they
coins – them – the coins - money
the kids - the local kids – kids - they
Golfers **–** their (balls) – the golfers – their (favourite balls)
(their) balls – the balls – them – them – them – them – (their) favourite balls

The events related are sequenced in time, like stories rather than history or biography. But this time round we are looking at generalised activity sequences, not specific ones. What kind of genre is this?

Conservatively, we might argue that this is simply a generalised recount (or two generalised recounts, one after the other, to be precise – diving for coins, then selling golf balls). But would this be saying enough about the different focus of this genre? Is it too narrative a gaze?

Alternatively we might read Russell as shifting from narrative towards history here. Her generalised recount relies on generic participants engaged in recurrent behaviour. Unlike historical recounts and biographical recounts however, [6.8] does

deal with specific activity sequences; it doesn't hop through time, like [6.6] and [6.7], but records habitual behaviour step by step.

Moreover each sequence in [6:8] culminates with an attitudinal burst, involving affect and appreciation (*Yum!* and *happy to get their favourite balls back!*), something we expect from narrative but not history. On balance then, while the generalised recount shares certain features with history discourse, on balance it seems more narrative than history.

What about the discourse of administration? Jordens (2002), in the course of his study of interviews with cancer patients, family and hospital staff involved in their care proposes a non-narrative genre he calls 'policy'. For Jordens, the policy genre proposes a behavioural routine, implemented in specific circumstances on the basis of a particular rationale. Its general structure is Scenario ^ Policy ^ Rationale, as in [6.9 below]. In the following example, one of his doctors discusses an aspect of his current institutional practice as far as warning patients about their prospects of recovery is concerned.

[6.9]
Scenario
Um in more recent years when I first came back into clinical practice after a time out of practice I again found myself being unduly *over*-supportive and talking about the negatives but emphasising the positives a little bit too much. And I found that in the first couple of years I was back in practice I think I was tending to carry the patients' burdens a little bit. And then when it did go bad then I felt like I'd failed {{CJ: Right}}, or they felt like this was really unexpected.

Policy
And nowadays I'm finding it more important for my own survival in this for the next twenty years of my practicing life *not* to carry their burdens. {{CJ: Right, so that involves being careful about how you talk to them in the beginning about prospects – {{Jon: Exactly}} and the possibilities of cure and –}} That's right. It really – I really find it vital now to make absolutely clear at the start that there's no guarantees that this is going to be fixed. "We'll do our best" and, you know, "We're hopeful" and "There is a good chance. But there is no guarantees". And I wouldn't have said –. I – you know, I would have made sure that they understood that message before. But now, at the end of my standard consultation at the end of treatment, I now deliberately say to people: "Yes it has all gone well. I am quite happy with it. I think you're gonna be okay. But there are no guarantees."

Rationale
And I guess that reflects scars of a few times when it went wrong. And even though they ought to have known, and they would have been told by me that it might go wrong, I still ended up feeling guilty that it did, or they felt that something had gone wrong when it hadn't. {{CJ: Right.}} [Jordens 2002: 163-164]

Unlike historical and biographical recounts, this text does focus on the details of activity – what the doctor now says at the beginning of treatment and at the end:

I really find it vital now to make absolutely clear **at the start** that there's no guarantees that this is going to be fixed. "We'll do our best" and, you know, "We're hopeful" and "There is a good chance. But there is no guarantees"…

But now, **at the end of my standard consultation at the end of treatment**, I now deliberately say to people: "Yes it has all gone well. I am quite happy with it. I think you're gonna be okay. But there are no guarantees."

And like the generalised recount it does construe habitual behaviour. In policies however, the behaviour in question is current practice, not what happened in the past (although the doctor does contrast his current practice with his past):

nowadays I**'m finding** it more important… *not* to carry their burdens
now I really **find** it vital to make …clear that there's no guarantees
now I deliberately **say** to people, "… But there are no guarantees."

before I **would have made** sure that they understood that message

And current practice is explicitly motivated through a rationale stage giving reasons for what is done.

Attitude in this policy focuses on appreciation of the significance of what to say and the quality of service provided:

more important…*not* to carry their burdens.
vital…to make **absolutely clear**…that there's no guarantees…
We'll do our **best**
There is a **good** chance
it has all gone **well**
I am quite **happy** with it.
you're gonna be **okay**.

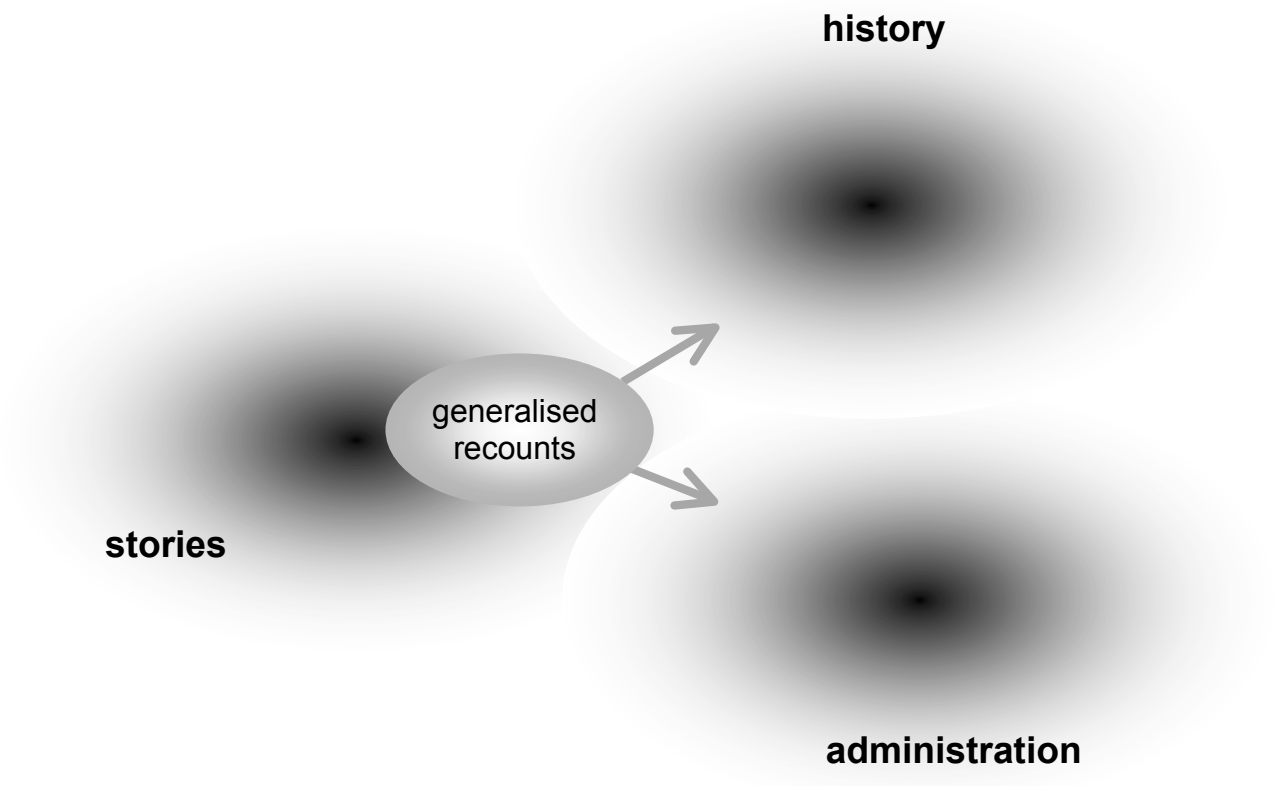
Once again then, though the generalised recount leans towards some relevant administrative discourse, its overall configuration of meanings is closer to those of the narrative genres. Critically, when we look at the phasing of these meanings, the generalised recount unfolds through sequence in time (in the case of [6.8], one activity sequence after another); historical and biographical recounts on the other hand hop from one setting in time to another. The policy's phasing is different from both of these in that it culminates with a rationale, motivating the behaviour specified in its nucleus. These differences show the importance of taking staging into account when considering relations among genres.

Topologically speaking we might place generalised recounts like [6.8] towards the periphery of the narrative family, drawn 'outwards' by the semiotic 'gravity' of both historical and administrative genres, illustrated in Figure 6.2, and summarised in more detail in Table 6.1 below. Whatever its position in a universe of meaning as genre analysis unfolds, the critical point is that where it belongs depends on the configurations of meaning it shares and does not share with other genres and how these are phased as the genre unfolds. Since sharing meaning is ultimately a matter of degree, topology provides a better modelling strategy than typology for such 'intermediate' genres.

Table 6.1: Configurations of meaning across generalised recount, historical recount and policy genres

	GENERALISED RECOUNT	HISTORICAL RECOUNT	POLICY
PARTICIPANTS	mainly generic	mainly generic	specific & generic
TENSE/MODALITY	modalised usuality	past	habitual present
ACTIVITY SEQUENCE	step by step	setting to setting	specific steps
ATTITUDE	affect, appreciation	some judgement	appreciation
CAUSE	implicit motivation	implicit motivation	explicit motivation
PHASING	activity sequencing	resetting in time	routine ^ rationale

Figure 6.2: Generalised recounts drawn 'outwards'



6.2.2 Shifting gears

Not all individual texts of course fit neatly into one genre or another. Some texts shift gears, from one configuration of meaning to another. Elaine Russell's text 'Our New Home' begins with a paragraph of description and moves on to a paragraph of generalised recount. Whereas night-time behaviour is managed as a single event in

the first paragraph (*us kids would all sleep…*), day-time behaviour is unpacked as an activity sequence in paragraph two.

[6.10]
We only had one big room in our shack. The walls were lined with newspaper to help keep out the cold and heat. At night, us kids would all sleep on a big mattress on the floor, the girls up one end and the boys down the other.

During the day we would put the mattress away, and Violet and I would sweep the floor. I sprinkled water on the first so it didn't fly everywhere. Then Mum would put down an old piece of lino. I thought it looked lovely!

We might be tempted to treat paragraph one as the Orientation stage of a generalised recount; but this would gloss over the contrast Russell makes between night and day routines.

Another shift in gears is found in [6.11] which starts out as a report in paragraph one and moves to hortatory exposition in paragraph two: the text begins by generalising about threats to animals, and continues by arguing why they need to be conserved (Martin 2001a).

[6.11]
At one time overhunting was the greatest threat to animals. Since 1600 78 mammals and 94 birds have become extinct. At least one third were wiped out by hunting. Although overhunting is still a serious threat, the destruction of the habitat has become more important. Extinct animals can never be brought back to life. For every species of animal which has been wiped out by man, there are many more which are endangered.

Animals need to be conserved not just because they are beautiful or unusual. The survival of all species, including people, depends upon the maintenance of a wide range of native species in their natural habitat. Survival of species is not a competition between people and animals - it is a matter of living together, with people conserving and managing natural environments to ensure that native species continue to play their roles in the world we all share. These following animals are but a mere few of the species currently battling extinction.

Texts like [6.10] and [6.11] are often referred to as examples of 'mixed genres', by way of capturing the transitions from one genre determined configuration of meaning to another. Strictly speaking of course we should refer to examples such as these as mixed **texts**, which happen to instantiate more than one genre. The concept of a 'mixed genre' is in itself contradictory, since recognising such phenomena entails acknowledging the typologically distinct systemic categories we find in our mix. For example, calling something a mixture of report and exposition means that we already know what reports and expositions are, and regularly recognise them as discrete relatively bounded categories. It's not the genres that are mixed, but the individual texts that instantiate them.

6.2.3 Genesis

At this point we need to bring time into the picture, since 'mixed texts' are one obvious source of new genres. If the mix gets instantiated often enough, because the social purpose of such texts recurs often enough, then we soon stop seeing it as a mix of genres and accept it as a new genre in which the shift in gears is treated as a

predictable move from one stage to the next – each partaking in the accomplishment of the telos of the new genre.

In our work on secondary school geography for example we began to wonder if we were witnessing the emergence of a new green genre, such was the impact of ecology and environmentalism on the Australian curriculum (Martin 2001a, Veel 1998). In [6.12-14] below for example (taken from a Year 10 Geography assignment), we begin with traditional reports on three rainforest animals, of the kind we'd find in modernist geography textbooks and encyclopaedias. In each case this is followed by discussion of status of the animal in question as a threatened species (highlighted in ***Sand*** font).

[6.12] **THE JAGUAR**

In South America, the jaguar is the greatest of the hunters and its vantage point is a tree, the jaguar leaps onto its unsuspecting prey. Ranging to eight feet in length and 125 to 120 pounds in weight, the jaguar is the largest of all the cats. It is stocky, muscled body, short legs and massive chest make the jaguar a powerful and efficient hunter. Although the jungles of Brazil form the centre of the jaguar's homeland they have been spotted as far away as Mexico.

Through its range, the jaguar adapts to many habitats from the swampy marshes to the stifling rainforests. The jaguar is also a good climber but does most of its hunting on the ground. Deer, tapir, peccary and toucans are frequent victims but the big cat is also fond of fish.

Jaguars have always been prized for their beautiful spotted coats. For many years the jaguar skins were exported annually to the fur markets of the world. In recent years some 23,000 were exported. Many South American countries now protect the jaguar, but unfortunately the big cat can still be legally hunted even where they have already become endangered. In the Amazon Basin, its last stronghold, it is threatened today not only by hunting, but by the loss of suitable habitat as the rainforest is being opened up to timbering, farming, livestock raising and other human activities.

[6.13] **Gorilla**

The gorilla is commonly known as the gentle giant of the rainforest. The biggest of the apes, sometimes reaching a weight of 300 kilograms and a height of 1.75 metres. The gorilla is quite a friendly creature unless threatened or provoked.

The rainforests which these gorillas inhabit supply all the fruits and plants they need, ***but the troubling thing is that these forests are shrinking because the land is continually being cleared for farming. Many of these are sold to zoos or hunted for their fur and paws. As a result, their numbers have dropped alarmingly.***

Today the gorillas number only a few thousand, while there are fewer than 400 mountain gorillas.

In zoos and wildlife parks it has taken more than a hundred years for the first of these animals in captivity and with the raising of animals being so difficult it will not be easy to try and restock the wild.

[6.14] **ORANGUTAN**

Orangutan means man of the woods. They are called this because like other great apes, gorillas and chimpanzees they are like humans in many ways.

At 80 kilograms the male orangutan is by far the largest truly tree-dwelling. Treetop life for such a heavy animal would be impossible if it did not possess remarkable hooked hands, hand-like feet, long arms and tremendous strength. These adaptions allow the orangutan to hang tirelessly, for hours at a stretch, suspended by only three limbs while picking fruit with the spare hand. It can only hang upside down, clinging with only one foot.

Orangutans once lived in all of the forests in South East Asia but today they are only found on the islands of Sumatra and Borneo. They now number fewer

than 5000. There are many reasons, for the declining populations during the last 200 years: - their rainforests are being cleared, they are shot for sport and some were killed as they were thought of as extremely dangerous. Many were collected for zoos, while a lot of the young ones were taken for pets.

Today about a third of those in zoos were bred in captivity, and many pet animals are being taken back to their natural habitats. All of the governments concerned give them full protection. Forest reserves have been set aside to save the orangutan. Since most of the world's tropical forests are being cut for timber, these parks are vital.

In the 'extensions' our student writer's attitude to their plight is made explicit (*unfortunately, troubling, alarmingly*) and concessive adjuncts are deployed to engage a sense of urgency in the reader (*still, even, already, not only... but, only, only*). There are no explicit exhortations, but the play of inscribed and evoked attitude paints a dire picture of what is going wrong and the challenging nature of protection measures (zoos, wildlife parks and forest reserves). This evaluation clearly functions as an implicit call for action, and in this respect we can interpret the green reports as subsuming an expository stance. So where report and arguments once stood as complementary geography genres, as we showed for the textbook *Australian Journey: environments and communities* in section 5.5 above, these genres are now fusing to occupy a niche of environmental sensitivity in Australian secondary school curricula and practice.

One relatively well documented example of the emergence of a new genre is provided by Iedema 1997b and White 1997 who describe the development of the 20th century news story our of 19th century recounts, focussing on the disruption of the time line as newspapers foreground highly charged evaluative meaning by way of attracting a more diversified readership. So instead of personal recounts beginning with initial events and culminating with final ones we have news stories beginning with a Headline/Lead and unfolding through a series of dependent satellites each elaborating that Headline/Lead nucleus and not the satellite before. The changing social conditions behind this, according to Iedema and White, have to do with the centralisation of print media ownership, and the need to appeal to a much wider range of readers than newspapers were concerned with in the 19th century.

News stories were considered in Chapter 2 above and so will not be exemplified again here. Note however that the change in organization canvassed here pushes news stories to the periphery of the family of narrative genres, since they are no longer chronologically structured and unfolding through time is such a central dimension of the meaning of narrative genres. The only thing holding news stories in the family perhaps is the fact that we can still usually reconstruct the sequence of events from what is reported even though sequential conjunctive links are not deployed. If this residue of chronology were to be lost, as a result perhaps of 20th century marketing pressures or web based transmission, then news stories would certainly have to be reconsidered as card carrying members of the narrative family of genres (and perhaps change their name from news stories to news reports in the process).

We'll finish this section with one more example of generic change, this time considered from the perspective of inter-cultural communication. In Chapter 2 we noted the infantilising of Australian Indigenous culture through the just-so story

genre, a genre fostered in Australian primary schools as we illustrated in Chapter 1 with text [1.10]. This raises important questions about how we read a text arising in one culture and recontextualised into another. One Australian publisher, Ashton Scholastic, has published a series of 'Aboriginal Stories' which attempt to speak across the cultural divide. One of these, The Echnida and the Shade Tree (Green 1984), is reproduced as [6.15] below (for representations of echidna see Figure 6.3); the publisher presents the story as "Told by Mona Green (Compiled by Pamela Lofts)". Inside the front cover it describes the book as "based on a story told by Mona Green, of the Djaru Tribe, to Aboriginal children living in Halls Creek, Western Australia. The illustrations are adapted from their paintings of the story." [For this monomodal presentation, '/' separates text on facing pages of a two page spread, and '//' separates one two page spread from the next.]

Figure 6.3: Echidna in the flesh and as ancient Aboriginal rock art

[6.15] **The Echidna and the Shade Tree**
Away out in the middle of the desert, there once grew a huge tree. //

It was so big, that it shaded the whole land from the scorching sun. //

All the animals lived in the shade of the this tree. Each day, they would hunt for food, while old Echidna stayed behind. He looked after the children. //

Each time, when the animals returned with the food, they would give the children the tastiest bits – / but poor old Echidna got only the scraps. //

This made Echidna very angry! He grabbed hold of that giant shade tree and shook it. He pulled it. And, with a mighty tug, tore it right out of the ground – roots and all. //

He put the tree on his back and stomped off. / Soon, the animals realised that their shade was moving and that they would die of thirst in the hot sun. //

They chased after Echidna and begged him to stop. They begged him to put the tree back. //

But he just marched on in anger. / The animals threw a boomerang. Surely that would stop him! //

But it didn't. it hit him on the feet and broke his toes – //

But he still shuffled on! / At last, the animals hurled their spears. //

Echidna howled in pain. Soon, he was completely covered with spears. //

The giant tree crashed to the ground. It rolled over and over across the plain – / and it's huge branches broke off and stuck into the ground. //

Poor Echidna lay dying. Soon the animals began to feel sorry for him. / Cockatoo flew up and asked, 'Where would you like to be buried? //

In an antbed? / In a clump of spinifex grass? In between some rocks?' Echidna chose the rocks. When he died the animals buried him there and covered him up. Only the spears were sticking out. //

To this day echidnas have spears on their backs. They still shuffle about on little bent and broken feet, as they hunt for ants among the rocks. //

The animals, too, still live in the desert. They hunt in the shade of the small trees that grew from the branches of that one giant tree. //

And they will never die of thirst, because water filled up the hole left by the shade tree – and made a huge lake, called Nongra. //

We believe that publishing the story in this way is a genuine attempt to open up an Indigenous perspective for non-indigenous children. But how will they read this genre? The last three paragraphs invite a reading of the story as an explanation of natural phenomena – why the echidnas have spines, how they walk, what they hunt, and how Nongra Lake was formed. And this invites a reading of the story through a just-so story template – rendering it a fanciful childish native tale about how the world was formed. On the book's back cover, Mona Green comments that "when my husband was a stockman, we used to go out to Nongra Lake to see if the cattle had enough water. I had heard the story about this giant lake and I think that, from the air, it would look a tree with roots stretching out."

This comment seems to reinforce the creation reading of the story foregrounded in the 'just-so' genre, but to the Djaru elders who told the story to Mona Green, it may have several quite different interpretations. For example, at the level of social obligation, echidna clearly represents the aged grandparents who often stayed in camp to care for young children while their parents foraged, so that his anger at being given only scraps is morally justified. As the senior members of the society are custodians of its sacred cultural capital, the shade tree that echidna uprooted and carried off probably stands for an aspect of this. Indeed, in the context of sacred ceremonies in Australia's Western Desert, society is divided into a 'shade' moiety and a 'sun' moiety, that play complementary ceremonial roles. So at the level of religious theory, the hijacking of the shade tree may represent a threatened withdrawal of half the society's sacred repertoire, which it could not survive, any more than the people could survive burning by the sun. The slaying of echidna would then represent the rescue of this repertoire through the ritual transformation of the offender from echidna the man to echidna the animal. This interpretation is reinforced by his burial in the rocks, leaving only his quills/spears sticking out. This is clearly a reference to the species of cane bush that grows in the rocky hillsides of arid

Australia, from which are obtained the shafts for making spears; as men obtain their primary economic tools from the buried corpse of echidna, so too they obtain their most valued semiotic resources from the cultural heritage of their ancestors. If this interpretation is correct, then the key activities in the story would undoubtedly be reenacted in ceremonial performances, accompanied by a series of songs. Such sacred songs and rituals, like the echidna myth, are immeasurably old. They are not invented by any individuals past or present, but come down to us mysteriously through deep time, along with the rest of the social and natural worlds we are heir to (cf Rose 2001a, 2005b, in press b).

Djaru children would be apprenticed into this system of of esoteric knowledge and practices in stages. They would hear this story repeatedly from an early age. At some stage they would recognise the analogy between the spearing of echidna and the quills on the animal they know, and they would recognise the offended behaviour of the old man in that of their own grandparents, and its ethical implications. They would learn to respond to the narrative pattern of expectancy and counterexpectancy that makes repeated retelling always pleasurable, and to identify themselves with the protagonists' victory and the wonder of Nongra Lake's everlasting waters that resulted. But at some time as they become adults, the esoteric layers of meaning encoded in the story would be revealed to them. At that moment the familiar childish entertainment the story gave them would be transformed in a flash of adult insight into the deep principles and origins of their society. This is the experience of initiation, the pleasure of discovery that we experience as a metamorphosis from ignorance to wisdom. The knowledge is derived from the elders who reveal it to us, but the experience of discovery is ours. This experience is a powerful force for socialisation, as much in contemporary urban societies as in the hunting-gathering cultures of Australia. Indeed it underlies the whole academic enterprise in which we are engaged, as well as the school education that prepares us for it.

How many steps would it be from say Conal's understanding of this story to that of the Aboriginal children living in Halls Creek today, to that of Mona Green, to that of the elders who told her the story, and back further to the elders who had assumed custody of it over tens of thousands of years in Indigenous languages and cultures? It is doubtful Conal would recognise any of significance of the social relations and obligations described in the story. He wouldn't see that as part of this meaning of this genre, because he can only read in terms of the social purpose of the genres he knows; and he knows just so stories are make-believe – the stuff of legends (a term often used to refer to stories recontextualised from Indigenous traditions along these lines). Non-Indigenous adults reading the story may recognise some of the moral message implied in the story; certainly these messages are often emphasised in retellings of Aboriginal stories for a general audience. But it is highly unlikely that many would recognise the abstract principles of social and natural order that the story encodes, and certainly not its relation to the religious practices that reenact and so reproduce this social and natural order. Rather for the average reader these stories remain firmly in the just-so genre, entertaining tales that give child-like explanations of natural phenomena and social behaviours.

As a genre is recontextualised from one culture to another it cannot help but become something else, a new genre (a transformative process that Bernstein described for texts that are recontextualised from production to education). When this occurs for

significant texts of Indigenous cultures, the Indigenous meaning of these genres is bound to be transformed in this process, especially where colonialist templates such as Kipling's just-so-stories are available for their appropriation. Of course reconciliation necessarily involves communication across incommensurable cultures. But semiotically speaking, handler beware!

6.2.4 Contextual metaphor

We'll conclude this discussion of relations among genres with reference to what Martin (e.g. 1997) calls contextual metaphor, defined as the process whereby one genre is deployed to stand for another. One well-known example of this is Eric Carle's (1970) children's story *The Very Hungry Caterpillar* in which a caterpillar eats and eats, builds himself a cocoon and turns into a beautiful butterfly – a recount genre standing for a scientific explanation of metamorphosis. Genre symbolism of this kind was popularised in Australian schools in the late 1980s as progressive literacy pedagogy spread across the curriculum, promoting narrative as a primary act of mind (sic) and encouraging story writing to promote real learning (sic) in science and other content areas (Martin 1990). This gave rise to recounts with titles such as 'Emma's egg' (about conception) or 'Journey to the Brain' (about sound waves in the ear). Of course recounts and scientific explanations are every bit as incommensurable as Indigenous narratives and just so stories, and the project degenerated into farce – although at times we couldn't help applauding the play of humour that contextual metaphor affords. One of our favourite examples, from a different context, is the following land rights recipe from *Pulp* (the student magazine of Southern Cross University [1998]), a procedure standing for a hortatory exposition.

[6.16] **Terra Nullius Pie**
INGREDIENTS...
1 * "Empty" continent (a wide brown one will do nicely)
10 * Point Plan, OR
100 Litres "Sorry Tears"
Some live Cultures
Plenty of re-written history to garnish

METHOD
Take the land and thoroughly clean of any people. Remove as much of the forest and minerals as you can. Next liberally pour wastes into waterways until nicely blue-green. At this point you'll be tempted to carve the pie up into 10 big slices, but this may cause heartburn or even armed insurrection later! ALTERNATIVELY, sprinkle well with sorry tears and leave to reconcile for a while. When cool, share it out - if no one is too greedy there'll be plenty to go round...

Contextual metaphors, like grammatical metaphors, operate by offering readers a literal 'surface' reading implicating one genre, but providing in addition 'other genre' indicators signalling the presence of a 'deeper' genre lurking behind. There may in fact be more than one layer to this. Text [1.17] for example is literally a personal recount, about a trip to the library.

[1.17]
Yesterday I went to the library and found a book about dolphins. I had seen dolphins on TV and I was interested in them. I wanted to find the answer to the question, why are dolphins so interesting to humans?

The book said that dolphins were sea mammals. I bet you didn't know that dolphins have to breathe air! If they don't breathe air, they will die.

I have often wondered what dolphins like to eat, so I looked in the book for information about this. Do they eat other fish, I wondered? I found out that they do.

I suppose you know what dolphins look like, of course. I found out some interesting things, such as what that dorsal fin is for and how they keep warm.

Why do we humans like dolphins so much, I often wonder. I searched in the book for the answer to this question, but could not get down to the real reason. The book talked about their tricks and stunts and their general friendliness. As I thought about it, I came to the conclusion that it had something to do with the fact that they, like us, are mammals.

But it uses projection to mount a second field, which is concerned with dolphins:

The book said	that dolphins were sea mammals.
I bet you didn't know	that dolphins have to breathe air!
I have often wondered	what dolphins like to eat,
I wondered	do they eat other fish
I often wonder	why do we humans like dolphins so much
I came to the conclusion	that it had something to do with the fact that they, like us, are mammals.

In this sense the text is a recount (about a trip to the library) standing for a report (about dolphins). Beyond this however, the text unfolds dialogically though a question and answer format:

I wanted to find the answer to the question, why ...?
- The book said that ...

I have often wondered what...
- so I looked in the book for information about this.

Do they...I wondered?
- I found out that ...

I suppose you know what...of course.
- I found out some interesting things, such as what ...and how...

Why do we ...so much, I often wonder.
- I searched in the book for the answer to this question, but could not get down to the real reason. The book talked about ... As I thought about it, I came to the conclusion that ....

As we can see, this mock Socratic dialogue culminates with a conclusion about why we like dolphins, and so might be additionally construed as an argumentative genre focussing on why this is indeed the case… so that we end up with a recount standing for a report standing for an argument perhaps, if we try and tie up all the loose ends and push our contextual metaphor reading to its limits. Confirming this reading is the title given to the text by its author: “Is this a report or a recount or a discussion?”. The title reflects the fact that the text was contrived by a secondary school English consultant as a challenge to genre theory, mounting the argument (discredited above) that mixed genres show that there aren’t genres and so genre-based literacy programs should be expunged as a base line for designing pedagogy and organising curriculum. Our response of course was that anyone writing contextual metaphors of this order had already learned what recounts, reports and arguments were like, and had the literacy facility to compose a text in which one symbolised another. The

working class, migrant and Indigenous kids we were working with were operating far from middle class currency of this order.

In short then, our genre theory, like any other, has to take responsibility for mixed texts which instantiate more than one genre. The challenge lies in understanding the ways in which they do this. And this involves mapping out the system of genres a culture deploys, and carefully considering the ways in a text might draw on one or more of them and thus 'mix genres' (sic) or not. In this section we've looked at various issues as far as recognising genres is concerned, including texts that change gears from one genre to another, genre evolution, cross-cultural appropriation, and contextual metaphor. Below we shift from a paradigmatic to a syntagmatic perspective and ask how genres can be extended or combined to form much longer texts than those we've been considering in this chapter thus far.

6.3 Relations between genres - syntagmatic relations

How do we tell where a genre begins and ends? Are there always sharp boundaries? How do genres combine and grow to form long texts?

6.3.1 Combining genres – expansion

In section 5.5 we introduced the notion of macrogenres, drawing on Halliday's 2004 model of logicosemantic relations. We return to this conception here, beginning this time round with story genres, and focussing on story genres, and their recontextualisation as steps in longer texts. We begin with expansion, and its subtypes – elaboration, extension and enhancement, followed by projection.

First, expansion by elaboration. Once upon a time…

[6.17]
A small child asked her father, 'Why aren't you with us?' And her father said: 'There are other children like you, a great many of them…' and then his voice trailed off.

…which we might read as a bare anecdote. Add some appreciation…

[6.17']
A small child asked her father, 'Why can you not be with us?' And her father had to utter some **terrible** words: 'There are other children like you, a great many of them…' and then his voice trailed off.

… and the family's pain of separation is directly inscribed. Add some more appreciation…

[6.17"]
It was **as simple and yet as incomprehensible as** the moment a small child asks her father, 'Why can you not be with us?' And the father must utter the terrible words: 'There are other children like you, a great many of them…' and then his voice trails off.

.. and the pain is further inscribed as bewildering. Generalise the deixis, and we know it is the author talking about his own family, not someone else's…

[6.17'"]

It was as simple and yet as incomprehensible as the moment a small child asks her father, ‘Why can you not be with us?’ And the father must utter the terrible words: ‘There are other children like you, a great many of them…’ and then **one**’s voice trails off.

…the agony is a personal one. Reframe the story as an example of the price paid by the family of a political leader…

[6.17""]
In that way, my commitment to my people, to the millions of South Africans I would never know or meet, was at the expense of the people I knew best and loved most. = It was as simple and yet as incomprehensible as the moment a small child asks her father, ‘Why can you not be with us?’ And the father must utter the terrible words: ‘There are other children like you, a great many of them…’ and then one’s voice trails off.

…and we re-read the text as an exemplum – an instance of the effect of a moral dilemma. Contextualise the dilemma, as part of the politics of apartheid South Africa…

[6.18]
In life, every man has twin obligations – obligations to his family, to his parents, to his wife and children; and he has an obligation to his people, his community, his country. In a civil and humane society, each man is able to fulfil those obligations according to his own inclinations and abilities. But in a country like South Africa, it was almost impossible for a man of my birth and colour to fulfil both of those obligations. In South Africa, a man of colour who attempted to live as a human being was punished and isolated. In South Africa, a man who tried to fulfil his duty to his people was inevitably ripped from his family and his home and was forced to live a life apart, a twilight existence of secrecy and rebellion. I did not in the beginning choose to place my people above my family, but in attempting to serve my people, I found that I was prevented from fulfilling my obligations as a son, a brother, a father and a husband.
=
In that way, my commitment to my people, to the millions of South Africans I would never know or meet, was at the expense of the people I knew best and loved most. = It was as simple and yet as incomprehensible as the moment a small child asks her father, ‘Why can you not be with us?’ And the father must utter the terrible words: ‘There are other children like you, a great many of them…’ and then one’s voice trails off. [Mandela 1995: 746-750]

…and we move into a discussion by Mandela of the personal cost of his decision to serve his people (Mandela’s text is further discussed in Martin & Rose 2003, Chapter 7). The text now illustrates one way in which discourse expands through elaboration, with a story serving as an illustration in expository discourse. It also illustrates the way in which our reading of a story will be shaped by its co-textualisation. What started off in [6.17] looking like a moving anecdote, inviting us to empathise with a family’s pain, ends up in [6.18] as an exemplum provoking judgment about the cruel consequences for his family of a rebel’s courage. The critical point here is that expansion of one genre by another always involves some degree of recontextualisation. We cannot help but read text in terms of what has gone before, and to some extent reinterpret what has gone before with respect to what in fact follows. Since reading is a process, genre analysis has to be a matter of contingent interpretation – attuned to unfolding discourse, not just chunks of de-co-textualised discourse taken out of time.

Expansion through extension can be illustrated through texts [6.12-14] above, which reported on three rainforest animals. In the secondary school geography report from which these text were taken these combined with a forth report on butterflies (parts of which were impossible to decipher) to form four step additive chain (Martin 2001a):

THE JAGUAR
…
\+ **GORILLA**
…
\+ **ORANGUTAN**
…
\+ [6.19] **BUTTERFLY**
Tropical forests are the home of many beautiful butterflies. The ?xxx Rajah birdwing lives in Borner. Also the giant ?xxx, which has the same wingspan as a bird inhabits the ?xxx rain forest of the Amazon. These two butterflies have become extremely rare. Butterflies are netted and killed, then preserved ?xxx. Sometimes their wings are made into souvenirs. Most ?xxx have become extinct due to the destruction of the forests.

These four reports in fact function as an elaboration of text [6:11] – the report cum exposition interpreted as shifting gears in 6.2.1.2 above. The green culmination of each report supports the urgency of the implicit call for action in [6.11], a co-contextualisation reinforcing the environmentalist orientation of the report as a whole.

VICTIMS UNDER THREAT
… These following animals are but a mere few of the species currently battling extinction.
= **THE JAGUAR**
…
\+ **GORILLA**
…
\+ **ORANGUTAN**
…
\+ **BUTTERFLY**

The following narratives illustrate expansion through enhancement, as they present South East Asian responses to 9/11 (Martin 2004a). The Singapore detention is presented as overlapping in time with the arrests in Macau (*meanwhile*); and the reactions on public transport in Hong Kong, where the texts were written, are compared with these (*similarly*).

[6.20]
The Macau police found themselves in a *Keystone Cops* episode, arresting and detaining seven "suspected Pakistani terrorists." The scare was enough to close the U.S. Consulate in Hong Kong for a day, though the men turned out to be tourists, a word which is spelled somewhat like terrorists, and we suppose to some people, just as frightening. One of the arrested people in fact was a Hindu, a chef from Hong Kong, who had been cleverly tracked down by undercover cops sitting peacefully at the Hotel Lisboa bar.
x
[6.21]
Meanwhile (and we're not making this up), two Indian nationals on a flight from Singapore to Hong Kong were detained at Changi Airport after an American passenger said he heard one of the men calling himself a "Bosnian terrorist." (The man in fact said he was a "bass guitarist."
x
[6.22]
Similarly, there have already been reports of taxis putting up "out of service" signs and people changing seats on buses when confronted by dark-skinned people – as if changing your seat would save you if a bomb went off, anyway. But such is the logic of xenophobia.

Taken one at a time, we would probably read [6.20] as an exemplum (mocking the stupidity of the Macau police), [6.21] as an anecdote (poking fun at the American passenger in Singapore) and [6.22] as an observation (explicitly judging the racist responses in Hong Kong and implicitly appreciating the break-down of social order).

The editorial from which these stories were taken in fact positions them as three examples of what it refers to as *some unfortunate cases locally of backlash*, appreciating the incidents and their like as regrettable, but not judging the perpetrators too harshly, and not really inviting empathy with the victims. And this survey of the local scene contrasts sharply with the preceding discussion of reactions in America, which are strongly criticized using explicit judgment and considerable amplification (Martin 2004a, Martin & White 2005):

> [strong negative judgment of America's response]
>
> \+ On a smaller and closer scale, we have already begun to see some unfortunate cases locally of backlash against members of the Muslim community (or even just people who look like they *might* be Muslim).
>
> = The Macau police
> …
> x Meanwhile… at Changi Airport
> …
> x Similarly.. reports of taxis
> …

As the editorial concludes, *If, as all the pundits are saying, there is no hope of normalcy returning soon, let's at least hope that sanity does*. (*HK Magazine* Friday Sept 21 2001: 5), the breakdown in social order, and by implication its threat to business, is what concerns the editor and his readership in Hong Kong. So ultimately, the point of the stories is to exemplify the need for a speedy return to business as usual; we're not invited to respond by prosecuting perpetrators of racist discrimination or making reparations to their victims.

As we can see, both the geography report and *HK Magazine* editorial make use of different types of expansion as the texts are elaborated, extended and enhanced. At a glance, the report scaffolds this more overtly than the editorial by using headings to punctuate the moves. But a range of discourse semantic devices are also at play managing the transitions, including cataphoric deixis (*these following*), general lexis (*animals, Muslim community*), comparative text reference (*on a smaller and closer scale*), metadiscourse (*cases*), nominalization (*extinction*, *backlash*) and conjunction (*meanwhile, similarly*). As with clause complexing, expansion enables genres to unfold indefinitely, one to another, until the large scale goals of the macro-genre are achieved.

Since we have already drawn on several of the genres from Russell's picture book, it may be useful to outline their relation to one another and the rest of *The Shack that Dad Built* here, as [6:23]. Basically the stories take us through Russell's childhood, from birth to the bush, via temporal succession (enhancement); this progression is extended by two series of extending vignettes, arranged before and after starting school.

[6:23] **The Shack that Dad Built**

When I was little
… (observation)
x Moving to Sydney
…(observation)
x The Shack the Dad Built
… (observation)
+ Our New Home
… (description/generalised recount)
+ The Biggest Backyard on the World
… (observation)
+ Bush Tucker
…(generalised recount)
+ Fish for Supper
…(generalised recount)
x My School
… (narrative)
+ Money for Hot Chips
…(generalised recount
+ My Secret Garden
… (observation)
+ The Hand of Friendship
…(exemplum)
+ My Saddest Christmas
… (anecdote)
x From the Beach to the Bush
…(recount)
x Leaving
… (recount)

Compared with many other picture books, Russell's stories are strongly punctuated with headings that demarcate one story from another. This segmentation reinforces the relative lack of discourse semantic continuity as we hop from one memory to the next and encourages us to hear Russell not just telling stories but looking back at what happened, at a much later stage of life. And this indeed is how the inside front jacket cover constructs the picture book – as a collection of memories:

[6.24]
When Elaine Russell was five, her dad built the family a shack just outside the Aboriginal mission at La Perouse. In The Shack the Dad Built, Elaine's vivid paintings illustrate her happy memories of hide-and-seek in the sand dunes and hunting for bush tucker along with more poignant memories, such as "My Saddest Christmas Ever."

Warm, funny, and sometimes sad, this true story of an indigenous childhood on the sores of Botany Bay is for everyone to share.

6.3.2 Combining genres – projection

One obvious way in which genres combine through projection is for a character in one genre, a story let's say, to project another genre by verbalising it (telling another story for example, or writing a letter). We are all familiar with this strategy from classic macro-genres such as Chaucer's *Canterbury Tales* and *Tales of the Arabian Nights*. Russell's exemplum, 'The Hand of Friendship', which we presented above, recalls sitting round the campfire exchanging stories with the gypsy family; and we can easily imagine this text unfolding through some of the stories told that night. Later on in her recount 'From the Beach to the Bush' she recalls her father telling scary ghost stories, another opportunity for projecting one or more tales. Some of the

stories used as examples in Chapter 3 were projected along these lines in the stolen generations report, *Bringing Them Home* (for discussion of the projection of Indigenous voices in Australia see Martin 2003a, 2004a).

One version of this gambit addressed by Rothery and Stenglin in their work on the development of narrative writing in schools involves 'reality' projecting 'fantasy', by imagining it as it were (Rothery & Stenglin 1997, 2000). In such texts a recount of everyday life is taken as a jumping off point for an excursion into a fantastic world where different rules apply. Conal, writing at age 9 (a year or so after he wrote the texts reviewed in Chapter 1), plays with this motif in his story 'The Golden Rings'. The activity sequence of coming home from school unfolds as usual until he enters the garage a second time. There he discovers a treasure box with jewels, one of which transports him into a whole new world in which he is kidnapped by pirates, who take him to a shop, where he is knocked out, waking up to realise he is dead.

[6.25] **The Golden Rings**
On a sunny and bright day I was walking home. My house is just around the corner. My house is white with a white door. It has a white window and the walls are white.

Everything is white except for the garage. The garage is yellow with a blue door. I got to my house, went inside and put my bag in my bedroom. Then I went out side again and into the garage. The garage has completely changed. On the inside there are splintery old walls, not painted white but just plain. There was a dusty old table with a treasure box on the old dusty table. In that treasure box there were golden rings with diamonds in them. The diamonds were red, orange, yellow, blue, purple and green. I didn't know if it was a mirage. So I picked one up and put it on my finger. It was real. It was the blue one I put on. I looked down at the ring and then looked up again and I was in a whole new world.

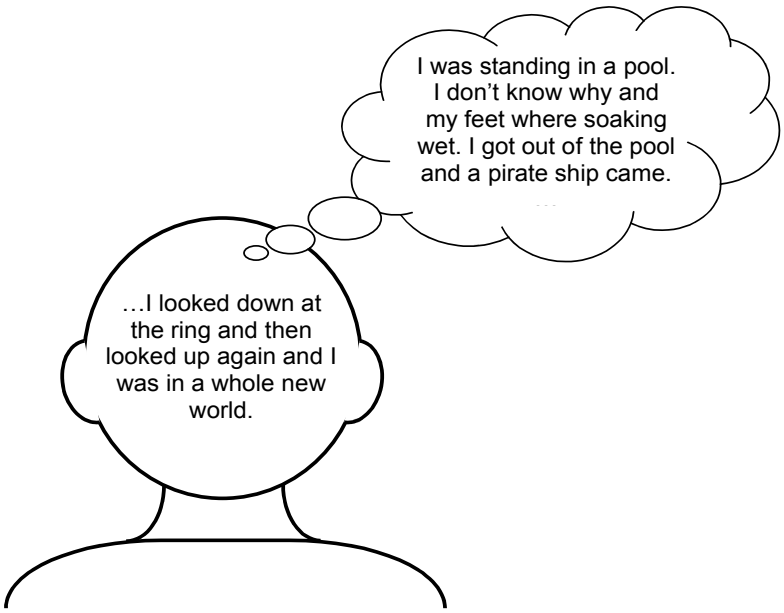
I was standing in a pool. I don't know why and my feet where soaking wet. I got out of the pool and a pirate ship came. A man grabbed me and pulled me onto the pirate ship with two other men. We stopped at a shop. There was a plank that we walked up onto the entrance to the strange shop. The shop had a picture of a crab on the top of the shop. The door opened and I walked in with the two other men.

There was an old man with a knife; he said "Hello. So you have brought him." They put me on a chain. One of the men came up to me with a stick and banged me on the head with it and everything went black. I was in a place and I saw Zeus and Jesus. I realized that I was dead.

Then I saw my body in the garage, dead on the ground.

Rothery and Stenglin see this strategy for developing discourse as an important step towards writing modernist narratives in which the story symbolises an underlying moral message (sometimes called 'theme'; Martin 1996a). Along this path Conal still has to learn to get the projected field to comment more judgmentally on the projecting one, and later on to subsume one field into the other so that 'reality' stands for a deeper transcendent truth. His successes to date are schematised in Figure 6.3.

Figure 6.3: Conal projects ‘fantasy’ from ‘reality’



6.3 Rules and resources

Genres makes some people nervous. They offend modernity, which prefers to hide its genericity beneath its creed of individualism. They upset post-modernity, which is entranced by the surface play of intertextuality in instances of discourse, and is suspicious of systems that might constrain the carnivale. But modernity and post-modernity are fashions of meaning, posing against what went before. If we develop theories that are overly imbued by these cultural dispositions we end up with rules for scholarly etiquette perhaps, but not a theory of discourse – not at least a theory of discourse that seriously interrogates the how and why of texts in social contexts, our mission in *Genre Relations*.

For modernity, the main worry about genre is creativity. Genre is read as rules prescribing what to do, and thus contesting freedom. This is a powerful rhetoric, nowhere more powerful perhaps than in the English classrooms of western secondary education where we have collided with it now and again in our work on literacy in schools. In response we have tried to argue, following Bakhtin, that creativity in fact depends on mastery of the genre (cf. the discussion of contextual metaphors above in text [6.16] and [6.17]). And further to this we have tried to position genre as a resource for generating discourse (rather than a system of rules delimiting what we do). In this we are simply following Halliday’s (e.g. 1978) conception of language as a resource for meaning, and this is why we have placed so much emphasis in this book on relations among genres– the systems of genres on which speakers draw to negotiate life as we know it. Seen as system, genre is not so much about imposing structure as offering choice – a menu with several courses of social purpose to choose.

A further comment we could make in this regard has to do with modular perspective on making meaning which SFL affords, with genre coordinating a complex interplay

of complementary kinds of meaning (ideational, interpersonal and textual) across language strata (register, discourse semantics, lexicogrammar and phonology/graphology) and across modalities of communication (language, image, music, spatial design etc.). There are many ways in which metafunctions, strata and modalities can interact to instantiate a genre. Overwhelmingly, developing a text is not like filling out a form, where almost all the meaning has been frozen for administrative purposes; rather there is normally a tremendous playoff of meanings going on. But without genre we would be puzzled as to what was going on, confounded perhaps. Because we cannot not mean genre.

For post-modernity, the main worry about genre is hegemony. Genre is read as rules inscribing power - effacing the powerless and contesting possible futures. This has been a fashionable rhetoric, voiced on behalf of the 'other' in populist queer, feminist and post-colonial literature. This is an engaging arena of debate, to which we offer three main observations here.

Our first point is that the status of a genre derives from its power, not the other way round. In post-Fordist global capitalist world order, power has to do with controlling the environment (for production, via discourses of science and technology) and managing people (for consumption, via discourses of government and bureaucracy). The more power a genre has in these respects, the higher its status will be, and the more powerful the people deploying the genre will be (and so the higher their status). There is nothing in the genre theory developed here that privileges more powerful genres over less powerful ones, although it is certainly the case in practice that we have concentrated in our literacy initiatives on providing universal access to what we consider to be powerful genres. We concentrate on redistributing access to powerful genres because we think this is a significant step in subverting a social order in which middle aged, middle class, anglo-saxon, able-bodied men preside over the accelerating destruction of our planets' material resources and pitiless exploitation of its disempowered people. As humanists, we put our faith, however naively, in the imaginary futures to which subversion of this kind might lead.

This raises the issue of change, and our second point about genre and power. This is that genres are always changing. They are like all semiotic resources in this respect. As life would have it, texts unfold, individual repertoires develop, and a culture's reservoir expands; and by the same token, as mortality would have it, texts abort, repertoires decline, and cultures disappear. In this flux, the key to understanding genre and change is metastability. As system, genre functions as a kind of inertia; it stabilises social life to the point where we have time to learn how things are done and negotiate our repertoire for a few decades with significant others. As process, genre allows for gradual change, as texts unfold in relation to both recurrent and divergent material and social conditions; as divergence recurs, innovative configurations of meaning stabilise, and new texts become familiar genres (cf. the recount to news story evolution outlined above). The key to modelling change is setting genre up in such a way that it dictates familiarity (so we know where we are coming from) at the same time as enabling innovation (so we can see where we are going). This makes instantiation a major focus of genesis oriented research in SFL (for further discussion see Halliday & Matthiessen 1999).

The third and final observation we would make as far as genre and power is concerned has to do with the discourse of critique itself and who has access to it. We have always found it an instructive exercise to take the language of critical theory and compare it with the language of the disempowered voices it purports to speak for. Our general impression is that the discourse of critique represents the most abstract academic written discourse to have evolved in human history (Martin 2003b) – a discourse which we suspect takes a least an undergraduate education to read and a post-graduate education to write. Who, we wonder, will teach this discourse to the other, if we listen to the critical theorists and stop teaching powerful genres and the language that realises them? Or are we being called upon to imagine a utopian plenum in which abstract discourse is not required and alternative discourses, enjoying equal status one to another, abound?

To our mind, in a world under threat from the rapidly technologising pursuit of profit, that relentlessly seeks out whatever resources it can to exploit, this is a silly fantasy; ecologically, economically, socially, culturally, too much damage has been done, and there is just no time left to waste. We now need our powerful genres and those which will evolve from them more than ever; and for life as we know it to have any chance of survival we have to pass those genres around – and have them reworked by people who will use them a lot more sensibly than the remorseless short-sighted patriarchs who manage them now.

6.4 Dialogue

As we noted at the beginning of this final chapter, we have written this book as an invitation to consider genres as configurations of meaning and, following on from this, an invitation to map cultures as systems of genres. This is an extroverted enterprise as far as linguistics is concerned, since it involves going beyond language in several directions at the same time. For one thing it means treating social context as more abstract levels of meaning, stratified as register and genre. And for another, it means modelling alternative and attendant modalities of communication as linguistically as possible, in order to bring them into the picture for multimodal genres. Beyond this it means finding some way of taking into account the physical and biological materiality from which social semiotic systems have evolved, and in which there are ongoingly embedded; the strategy we proposed for managing this here was to take both lay and professional discourse about these material systems as data, and bring material reality into the picture via this semiotic veil.

In an enterprise of this kind no single discipline can presume to have a monopoly on meaning, let alone insight. We have learned a lot, and have much more to learn, from our affine disciplines in the humanities and social sciences, and from science and mathematics as we bring materiality into the picture. And beyond this there are lay discourses from all walks of life, and from all kinds of subjectivities, each of which is infused with talk about social life, drawing on the everyday terms the very terms they use to talk over what is going on. With respect to all of this complementary insight, our basic strategy is trespass. We try our best to go in and model what is going on as functional linguists, and thus produce a social semiotic account which reads practices as genres. This means treating everything as information, an imperial recontextualisation if ever there was one - privileging linguistics as its informing

discipline, and involving massive reconstitutions of perspective, most radically perhaps in the context of physical and biological materiality.

But we intend our incursion as a friendly one. We visit the territories of others because in our experience productive dialogue across disciplines is only possible when they focus on a comparable object of inquiry, map out overlapping claims, and then begin to talk – a process which is considerably enhanced by shared political commitment. We have to intrude we have found, to listen; trespass to hear. That at least is our experience in language education, where our interest in schooling, together with Bernstein's conception of pedagogic discourse, engendered negotiations that we are proud to look upon as genuine transdisciplinary work (Bernstein 1990, 1996, Christie 1999). Yes we are intruding, but with our ears and eyes open, trying our best to learn.

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[46] Kress 2003 for example employs a 'tenor' flavoured concept of genre, complementary by mode (multimodally oriented) and discourse (ideologised field) in his unstratified model of social context variables.

[47] We have not included a cognition dimension of analysis in this survey because in our model we do not operate with a concept of mind; readers perplexed by this omission may find Halliday & Matthiessen's 1999 invitation to reconsider concepts as meanings an engaging argument. Basically our position is that contemporary models of perception and semiosis make the mind redundant with respect to evolutionary accounts of brain function (Edelman 1992, Edelman & Tononi 2000).

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