Making sense of an everyday science text: Linguistic, visual and spatial design

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Abstract:

In this article, we take a close look at the literacy demands of one task from the 'Marvellous Micro-organisms Stage 3 Life and Living' Primary Connections unit (Australian Academy of Science, 2005). One lesson from the unit, 'Exploring Bread', (pp 4-8) asks students to 'use bread labels to locate ingredient information and synthesise understanding of bread ingredients'. We draw upon a framework offered by the New London Group (2000), that of linguistic, visual and spatial design, to consider in more detail three bread wrappers and from there the complex literacies that students need to interrelate to undertake the required task. Our findings are that although bread wrappers are an example of an everyday science text, their linguistic, visual and spatial designs and their interrelationship are not trivial. We conclude by reinforcing the need for teachers of science to also consider how the complex design elements of everyday science texts and their interrelated literacies are made visible through instructional practice.

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Senses of Scientific Literacy: Fundamental and Derived

In their seminal article about the senses of scientific literacies, Norris and Phillips (2003) delineate two categories in which students must demonstrate proficiency: a fundamental and a derived sense of scientific literacies. The **derived sense** refers to being knowledgeable, learned and educated about science concepts. The **fundamental sense** broadly refers to the act of 'reading and writing' scientific content. Much of the research into school science, as represented in high esteem science education journals such as *Research in Science Education* and *Science Education,* focuses on the derived sense, often ignoring its interrelatedness to the fundamental sense. In this article, we want to cast a clearer lens on the fundamental sense of scientific literacies and its interrelatedness to the derived sense for one science task from the Australian Academy of Science (2005) *Primary Connections Marvellous Micro-organisms Stage 3 Life and Living.* In one part of one lesson entitled *Exploring Bread,* students are required to 'use bread labels to locate ingredient information and synthesise understanding of bread ingredients'. We are not drawing on classroom data from an empirical project; rather we are theorising the design and literacy demands of the task for the purpose of demonstrating both their complexities and interrelatedness to add to our underlying argument that it is assumptive to not scaffold the fundamental sense of scientific literacies within pedagogic instruction focused on the derived sense of scientific literacies.

Their justification is that '[r]eading and writing are inextricably linked to the very nature and fabric of science, and by extension, to learning science. Take them away and there goes science and proper science learning also….' (p. 226). Importantly, their notion of reading and writing is not limited to the cognitive/psychological views of reading and writing as situated in the individual person. Reading is viewed as encompassing 'comprehension, interpreting, analysing and critiquing texts' (p. 229). Through application to practice, they show that science 'does not wear its meaning on the surface. Like any other type of text, it must be interpreted by the reader through an active, critical engagement' (p. 235). Texts must be read to also determine:

> *such meanings as degrees of certainty being expressed, the scientific status of statements, and the roles of statements in reasoning that ties together the elements of substantive content…to examine not only the sources of knowledge, its limits, and its certainty, but also to interpret texts in various ways, to adjudicate those ways in light of available evidence, and to adopt a stance towards the texts that is neither deferential nor dismissive but properly critical (p. 235).*

The impetus our examination herein is the evidence from a range of major international research projects that point to a continued decline in interest among adolescent students in science (e.g. Reiss, 2007; Relevance of Science Education, 2008). In addition, the most recent Organization for Economic Co-operation and Development (OECD, 2006) data from the Programme for International Student Assessment (PISA) details a downward shift in student motivation and involvement in school sciences for a significant number of 15 year olds in the 58 participant countries. The PISA study also reports that, on average, 5.2% of participating students were unable to complete Level 1 tasks, tasks of the lowest level. In addition, just under 20% of students, on average, were not proficient at Level 2 tasks. The prediction is that approximately 25% of secondary school students would be unable to 'participate effectively and productively in life situations related to science' (OECD).

Alongside this international reportage, the Australian media has given much press to the (supposed) lack of achievement in education in Australian schools in general and in terms of science and literacy in particular. These discussions cite the OECD PISA (2006) data, often noting that Australia scored 'well down' on the science scale, below Finland, New Zealand, Canada, China and Estonia and on a par with the Netherlands, Korea and Ireland. Talk-back radio contributes to the discussion, if not the facts, that parents are supposedly better educated than their children. *The Australian* (Half of us lack skills , 2008) reports on an Australian Bureau of Statistics literacy study claiming that 46 % of the population would struggle to understand the meaning of documentation evident in maps, a form of text often used in life situations of science.

Disputing or buying into arguments of a crisis of relevance for school science, or a literacy crisis, is not the focus of our paper. Rather our intent is to contribute to the professional conversation about school science and its relationship with literacy. If, as the article in *The Australian* suggests, significant proportions of the population would struggle to understand an everyday science text, then it is our contention that to solely focus on the derived sense of scientific literacies means that the complex fundamental sense of scientific literacies is not made visible to the population.

We want to extend these understandings of the fundamental sense of scientific literacies to one lesson from the *Primary Connections 'Marvellous Micro-organisms Stage 3 Life and Living'* unit (Australian Academy of Science, 2005). We focus on a task within the *'Exploring Bread'* lesson (pp 4-8). In the next section we review the principled foundations of the Australian Academy of Science's *Primary Connections* project for the purpose of contextualising our research. We then draw on a framework offered by the New London Group (2000) to show the multiple modes of design in the science text under investigation, bread wrappers. In doing so, we (i) make visible the complexity of these everyday science texts and (ii) show the utility of such a framework for framing teachers' thinking about the often invisible literacy demands of science tasks.

Primary Connections: Linking Science with Literacy

The Australian Academy of Science *Primary Connections* project was developed out of recommendations by the Commonwealth's *Discipline Review of Teacher Education in Mathematics and Science.* The project provided (i) a professional development program for science teachers in selected schools, and (ii) the production of instructional handbooks made available to all teachers nationally for a nominal fee. The mission was to prepare students for the future needs of the 'smart economy' and to address the perceived disconnection between science and literacy. An additional aim was to extend teachers' knowledge of science and science teaching. The explicit goal was to demonstrate improvement in teachers' confidence as well as competence for science teaching, particularly as it related to literacies of science.

Primary Connections promotes a hands-on activity-based approach that provides a unique interpretation of Bybee's (1997) five phases of enquiry model. The five phases of enquiry, also known as the 5Es model, encompass five non-hierarchical non-linear phases: engagement, exploration, explanation, elaboration and evaluation. The 5Es are neither tangible, fixed, nor something that can be listed. Rather than listing the content of each, Bybee (1997) draws on theorisations of connecting to prior knowledge, unbalancing the cognitive equilibrium and

engaging in reflective thinking. The explication of the underpinning model of enquiry is important for it offers a lens into what is constructed as desired behaviours for students of primary science, as well as challenging teachers to adopt pedagogies that promote engagement, exploration, explanation, elaboration and evaluation. We propose that the content under instruction needs to consider the interrelated derived and fundamental senses of scientific literacies.

The task under examination in this research paper is from one lesson entitled '*Exploring Bread*' (Australian Academy of Science, 2005, pp 4-8) and situated within the Engage phase. Bybee (1997) posits the core premise of the engagement phase is to connect future and past activities and cites student puzzlement and motivation to continue as markers of successful engagement. Quoting Swanage and Lane (1999), Boddy et al. (2003) state the purpose of the engagement phase is 'to capture children's imagination'. The Australian Academy of Science (2005, p. vii) extend understandings, describing this phase as the time to 'engage students' interest, stimulate curiosity, raise questions for inquiry, and elicit [students'] existing beliefs about the topic'. It will be recalled that the focus task is for students to *'use bread labels to locate ingredient information and synthesise understanding of bread ingredients'*. But are bread wrappers scientific text? They most certainly are; they are the representation of complex scientific fact for everyday audiences. For example, bread wrappers summarise and present complex scientific concepts and the findings of its research under headings such as:

- nutrition information - energy, protein, fat (total and saturated), carbohydrates (total and sugars), dietary fibre and sodium
- ingredients list - which include wheat flour, water, yeast, salt, vinegar, canola oil, soy flour, emulsifiers (471, 481 (both vegetable derived)), preservatives (282), vitamin (thiamine)
- storage information, and
- a consumption warning, presented under the heading of 'attention'.

Additional scientific concepts and information for consumers are located within other written and visual text on the bread wrapper. Three bread wrappers available in Australia are provided below, in Figures One, Two and Three.

nutrition information

Servings per package: 11.5 (21 slices and 2 crusts)
Serving size: 56g

	Avg. Quantity Per Serving 56g	Avg. Quantity Per 100g
Energy	560kJ (134Cal)	1000kJ (239Cal)
Protein	4.6g	8.3g
Fat, total	1.1g	1.9g
- saturated	LESS THAN1g	LESS THAN1g
Carbohydrate	25.2g	45.1g
- sugars	1.2g	2.1g
Dietary Fibre, total	1.6mg	2.8g
Sodium	293mg	523mg

ingredients

Wheat Flour, Water, Yeast, Salt, Vinegar, Canola Oil, Soy Flour, Emulsifiers (471, 481 (Both Vegetable Derived)), Preservative (282), Vitamin (Thiamin).

storage

Store bread at room temperature (20°c) out of direct sunlight.

To freeze bread, overwrap the package with a freezer bag, eliminate air in the bag and seal. Bread will keep in freezer for 4 months.

On thawing, consume within 3 days.

attention

MAY CONTAIN TRACES OF SESAME SEEDS DUE TO THE MANUFACTURING ENVIRONMENT.

coles
$mart buy™
why pay more for everyday basics?

white bread

AUSTRALIAN MADE

650g NET

DA1105 651940

9 300601 274444

Product of Australia
Coles Supermarkets Australia Pty Ltd.
800 Toorak Road, Tooronga, Vic 3146.
Free call 1800 061 562.
www.coles.com.au

FOR EXTENDED LIFE, FREEZE ON DAY OF PURCHASE.
GOLDEN HEARTH BAKERY, 16 PRODUCTION AVE., MOLENDINAR,
GOLD COAST, 4214, QUEENSLAND.PHONE: (07) 5594 9966 PRODUCT OF AUSTRALIA

Golden Hearth

Golden Hearth Organic Bread is a healthy and nutritious alternative for those of us concerned with our environment and the use of chemicals in the foods we eat. This bread is Certified Organic by the Australian Certified Organics (ACO) and conforms fully with the Australian Standard for Organic and Bio-Dynamic Produce. You can be assured that it is free of any Genetically Modified Ingredients. Enjoy the wholesome and nutritional goodness of bread the way nature intended.

NUTRITIONAL INFORMATION

Slices per package: 16 slices and 2 crusts. Serving Size: Av. 100g (2 Slices)

	Average Quantity per Serving	Average Quantity per 100g
Energy	970kJ 232Cal	970kJ 232Cal
Protein	8.8g	8.8g
Fat - total - saturated	1.7g 0.3g	1.7g 0.3g
Carbohydrate - total - sugars	41.4g 3.3g	41.4g 3.3g
Total Dietary Fibre	6.6g	6.6g
Sodium	340mg	340mg

INGREDIENTS

Organic 100% Stoneground Wheat Flour (contains Gluten), Water, Organic Kibbled Wheat (13%), Organic Kibbled Rye (7%), Organic 100% Rye Flour (contains Gluten), Yeast, Organic Sunflower Oil, Salt, Vinegar, Organic Soy Flour, Vitamin (Thiamin).

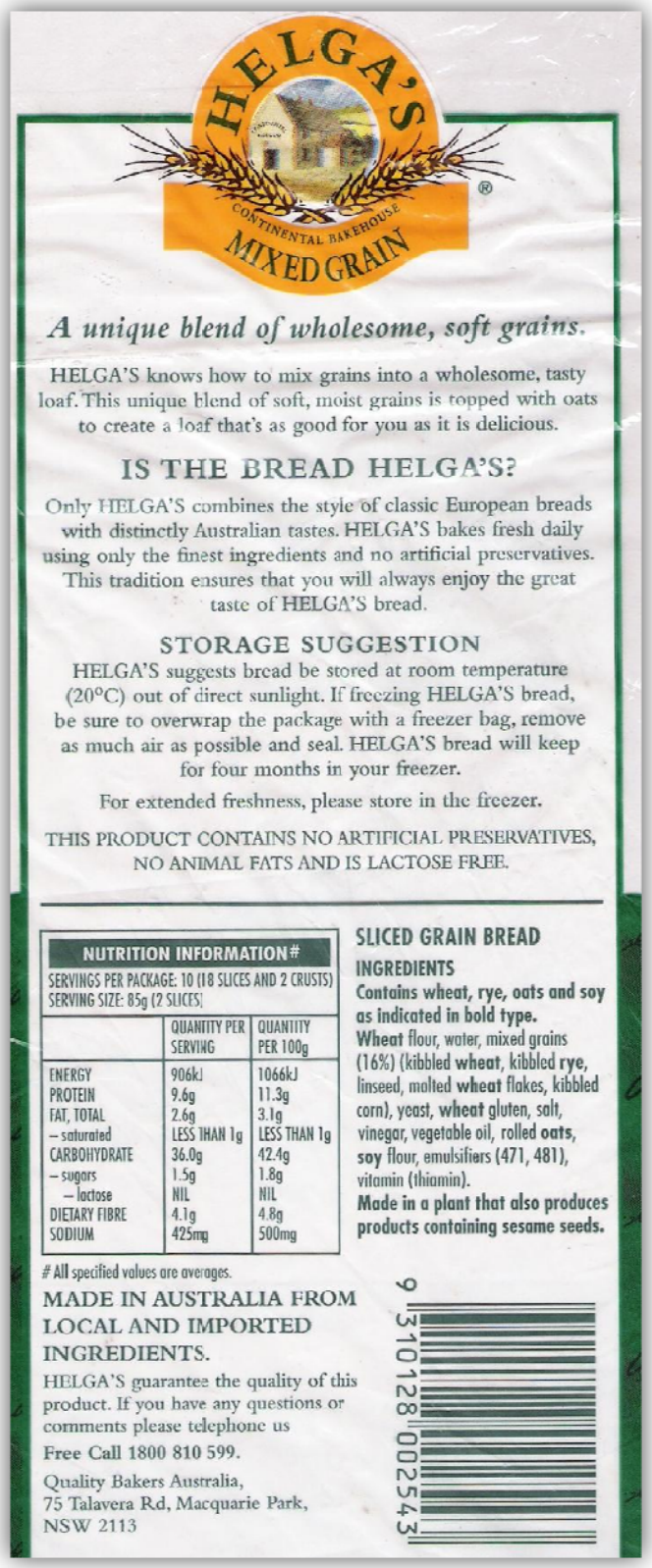
SLICED WHOLEGRAIN BREAD

9 310332 651353

MONEYBACK GUARANTEE

GOLDEN HEARTH ORGANIC BREAD CARRIES A MONEYBACK GUARANTEE. IF YOU ARE NOT COMPLETELY SATISFIED, PLEASE PHONE: (07) 5594 9966

FOR EXTENDED LIFE, FREEZE ON DAY OF PURCHASE.
GOLDEN HEARTH BAKERY, 16 PRODUCTION AVE., MOLENDINAR,
GOLD COAST, 4214, QUEENSLAND.PHONE: (07) 5594 9966 PRODUCT OF AUSTRALIA


HELGA'S
CONTINENTAL BAKEHOUSE
MIXED GRAIN
A unique blend of wholesome, soft grains.
HELGA'S knows how to mix grains into a wholesome, tasty loaf. This unique blend of soft, moist grains is topped with oats to create a loaf that's as good for you as it is delicious.
IS THE BREAD HELGA'S?
Only HELGA'S combines the style of classic European breads with distinctly Australian tastes. HELGA'S bakes fresh daily using only the finest ingredients and no artificial preservatives. This tradition ensures that you will always enjoy the great taste of HELGA'S bread.
STORAGE SUGGESTION
HELGA'S suggests bread be stored at room temperature (20°C) out of direct sunlight. If freezing HELGA'S bread, be sure to overwrap the package with a freezer bag, remove as much air as possible and seal. HELGA'S bread will keep for four months in your freezer.
For extended freshness, please store in the freezer.
THIS PRODUCT CONTAINS NO ARTIFICIAL PRESERVATIVES, NO ANIMAL FATS AND IS LACTOSE FREE.
NUTRITION INFORMATION#
SERVINGS PER PACKAGE: 10 (18 SLICES AND 2 CRUSTS)
SERVING SIZE: 85g (2 SLICES)
QUANTITY PER SERVING
QUANTITY PER 100g
ENERGY 906kJ 1066kJ
PROTEIN 9.6g 11.3g
FAT, TOTAL 2.6g 3.1g
– saturated LESS THAN 1g LESS THAN 1g
CARBOHYDRATE 36.0g 42.4g
– sugars 1.5g 1.8g
– lactose NIL NIL
DIETARY FIBRE 4.1g 4.8g
SODIUM 425mg 500mg
All specified values are averages.
MADE IN AUSTRALIA FROM LOCAL AND IMPORTED INGREDIENTS.
HELGA'S guarantee the quality of this product. If you have any questions or comments please telephone us
Free Call 1800 810 599.
Quality Bakers Australia,
75 Talavera Rd, Macquarie Park,
NSW 2113
SLICED GRAIN BREAD
INGREDIENTS
Contains wheat, rye, oats and soy as indicated in bold type.
Wheat flour, water, mixed grains (16%) (kibbled wheat, kibbled rye, linseed, malted wheat flakes, kibbled corn), yeast, wheat gluten, salt, vinegar, vegetable oil, rolled oats, soy flour, emulsifiers (471, 481), vitamin (thiamin).
Made in a plant that also produces products containing sesame seeds.
9 310128 002543

per.

The remainder of this paper asks ‘With which text design elements do students have to engage to use a bread wrapper to *locate ingredient information and synthesise understanding of bread ingredients*?’ Our findings highlight the complex designs of an everyday scientific text. In doing so, we contend that the complexities of the fundamental sense of scientific literacies must not be treated as trivial; rather they need to be acknowledged and scaffolded through overt instruction in the science classroom.

Bread Wrappers: A Multimodal Text Analysis

Gee (2008, p. 40), in talking about schooling in general, emphasises what ‘appears to be crucial for success now are abilities to deal with multimodal text (texts which mix words and images), nonverbal symbols, and with technical systems within specific, and now usually highly collaborative and institutional practices’. Linking such ideas to science education, Wellington and Osborne (2001) purport that the greatest barrier to learning school science lies with learning how to engage with and produce its complex representations. Likewise, Lemke (2000) insists that learning in the subject of science includes learning to use and express its specialised language in meaningful and multi-modal ways. Hand and Prain (2006) cut to the chase, explaining that without these multiple modes there can be no science; science cannot be separated from its integrated modes of representation.

These theorizations emphasise the integrated meaning making systems of multimodal text, which, according to the New London Group (2000), can be considered as five interrelated designs modes: linguistic, visual, spatial, gestural and audio design. Central to the task of *‘us[ing] bread labels to local ingredients information and synthesise understanding of bread ingredients’* are the first three of these design elements: linguistic, visual and spatial design. Tables One, Two and Three, below, provide an analysis of each of the three bread wrappers in terms of the three design elements.

Table One: Linguistic Design (includes structure, vocabulary, cohesion and modality)

Bread Wrapper 1 **Coles White Bread**	**Bread Wrapper 2** **Golden Hearth Organic**	**Bread Wrapper 3** **Helga's Mixed Grain**
Vocabulary is scientific (eg. *nutrition information* categories) and everyday (eg. *slice* and *crust*). Suggestions for storage of bread are structured as procedural text, mostly thematised by commands (*store, eliminate, seal*). Cohesion is achieved through temporal sequencing of procedures. This section represents scientific findings on the 'life' of bread and the conditions under which it can be kept for longer. In comparison, wrapper 3 uses statements rather than commands. 'Attention' section uses relatively high modality (eg. *may*). It offers a 'warning' about potential ingredients NOT listed in the ingredients list. To understand why requires understanding of the scientific concept of allergic reactions combined with legal concepts of duty of disclosure. Information about quantity of ingredients can be determined by accessing the *nutrition information* (e.g., quantity of *sugars* and *sodium* are listed). Understandings of chemical composition of table salt (*sodium chloride*) and chemical process of metabolism of *sugars* needed.	Contains more written text than wrapper 1. Written text is made up of compound sentences, characterised by long nominal groups (eg. *the wholesome and nutritional goodness of bread*). Nominal groups also used in ingredients list (eg. *Organic 100% Stoneground Wheat Flour*) to include information about quality of ingredients, not just the everyday 'factual' term. How does this representation function in relation to that presented in wrapper 1? The section of writing has style of information report, stating what the product is. This brings an authority of fact to this everyday science text. Includes command: '*Enjoy the wholesome and nutritional goodness….*'. More information about the ingredients NOT listed in the ingredients list includes the statement that [The ingredients] *conforms fully with the Australian Standard for Organic and Bio-Dynamic Produce.* The written paragraph states this bread is for those *concerned with the use of chemicals in the food we eat.* To determine what chemicals might be ingredients in bread, students need to compare the ingredients list of wrapper 2 with wrapper 1. 'MONEYBACK GUARANTEE' states that the bread '*carries*' something, but it's not a concrete ingredient. Saturated fats -wrappers 1 and 3 list 'LESS	Contains more written text than wrappers 1 and 2. Written text uses some compound and one complex sentence, but main grammatical device is long nominal groups (eg. *A unique blend of soft, moist grains).*. Reading from top to bottom, immediately after the emblem, is an everyday summary of (some) ingredients, presented in italics and slightly larger than main written text (*A unique blend of wholesome, soft grains).* In the next paragraph down, the quality of ingredients that set this loaf apart are evaluated as *Only Helga's, only the finest ingredients*. Emphatic use of words; list of 'NO' ingredients. The possible inclusion of sesame seeds as an ingredient differs from wrapper 1. In wrapper 1, included in 'attention' and emphasises the process of 'containing'. Wrapper 3 makes its disclosure under the ingredients list but not listed as an ingredient per se: '*Made in a plant that also produces products containing sesame seeds'*. It foregrounds the location of production (*in a plant*) and uses a word with multiple meanings (*plant*). Range of modality (e.g. *you will always enjoy* vis-à-vis *Helga's suggests…).* Information on the quantity of lactose per slice (NIL) and per 100g (NIL). The inclusion of

	THAN 1g' (NB. capital letters), whereas wrapper 2 lists the amount as 0.3g. This is less than 1g, but a different interpretation is effected. The 'LESS THAN 1g' notation renders the amount of saturated fat in breads 1 and 3 as inconsequential or insignificant.	lactose as a category makes for interesting discussion. Gives perception that lactose is bad. Use of by-line before listing ingredients. By Australian law, ingredients have to be listed in order of volume/amount, commencing with the most used ingredient. Students should discuss the function of this by-line.

Table Two: Visual Design (includes colour, perspective, visual relationship to other visuals and verbal text, size relationships)

Bread Wrapper 1 Coles White Bread	Bread Wrapper 2 Golden Hearth Organic	Bread Wrapper 3 Helga's Mixed Grain
Uses strongly contrasting plain colours of black, red and yellow in white background. Size of red tick, most dominant, more dominant than scientific information (*nutrition, ingredients, storage and 'attention'*). Product type (*white bread*) of secondary important, followed by brand name (*Coles $mart Buy*) and weight (*650g NET*). Science (*nutritional*) information and 'o*ur promise'* downplayed in rank by virtue of size. Red tick similar to Heart Safe Tick endorsed by Australian Heart Foundation. The Heart Safe Tick represents the product has been scientifically certified as such. It is supposed to shortcut the critical analysis consumers who are concerned about their eating/health might undertake as they select food products. Other recognisable symbols include *Australian made* logo (which implies national pride) and $ (symbol to suggest value). These discourses of national pride and value sit alongside the science discourse of healthy/heart safe food item.	Uses earthy tones, in keeping with wholesome, down-to-earth message. Visuals of an old fashioned kitchen (suggests timelessness), dominant by its concentration of black colour. Shows some of the utensils/equipment used in the (science of) bread making. Visual of wheat husks (signify wholesomeness), dominant by its size and colour. This identifies the core ingredient. Headings of 'Nutritional information' and 'Ingredients' brought into relationship by use of strong colour (mid yellow). Importance of 'Nutritional Information' explanation and list of ingredients brought into dominance by use of softer) yellow. 'MONEYBACK GUARANTEE' written in uppercase letters and coloured yellow to highlight significance. This provides a discourse of 'satisfaction guaranteed', that is, that the science process is can be guaranteed.	Uses muted green and gold colours to suggest national (Australian) pride, even with an atypical Australian name of "Helga's". Graphic of country bakehouse to reinforce traditional values, framed by  crest of wheat husks and gold to emphasise naturalness and wholesomeness (wheat husk) and status (emblem shape). Picture of bakehouse has blue skies and buildings of earthy tones (accentuate nature and bread making is a 'natural' science). Rhetorical question (*Is the bread Helga's?)* has relationship with spoken text on TV and radio advertising. Also in larger font, thereby denoting significance. Ingredients list has some items bolded. Students should discuss the function of this visual design.

Table Three: Spatial Design (includes visual relationships of text components, use of charts)

Bread Wrapper 1 **Coles White Bread**	**Bread Wrapper 2** **Golden Hearth Organic**	**Bread Wrapper 3** **Helga's Mixed Grain**
Connects text through colour and size, eg. large red tick  (has resonance with symbol used to represent scientific testing/approval) connects with large red for *$mart buy*. Separates text by blocking text (eg *nutrition information, ingredients, storage, attention, our promise*). Uses chart for nutrition information, a summary of scientific concepts made available for an everyday audience. The spatial design used is columns, separated by white space rather than lines. The column title are written in code: 'Avg. Quantity Per Serving 56gr' and 'Avg. Quantity Per 100gr'. Indentation is used to show scientific forms of fat (*total and saturated*) and sub-category of carbohydrate (*sugar*).	Visual border (jagged) serves to contain important text, with peripheral information located outside of border. This wrapper suggests storage information is peripheral. And the storage information is different from that of wrapper 1. Wrapper one suggests thawed bread needs to be consumed within 3 days, but wrappers 2 & 3 only mention time for freezing. Students should consider how ingredients list affects storage suggestions. Double lines around 'MONEYBACK GUARANTEE' separates this block of information. The central message, a form of spatial dominance, is on nutrition. This nutrition panel is also twice as large as the panels in wrappers 1 & 3. Hearth visual, Nutritional Information, Ingredients list, wheat husks visual are all centred (creates balance). Uses chart for nutrition information and takes more room than wrapper 1 or 3. Columns and rows have same headings but you need to read the slices per package information to work out that the Golden Hearth Bread is a heavier/larger serving, therefore when comparing measures across the 3 products, the *Average Quantity per 100g* should be used rather than the *Average Quantity per serving*.	Written text and visuals in the top half are centrally laid out with sub-titles & white space providing horizontal division. This serves to create balance I the half that provides sentences about ingredients, the baking process, storage suggestions and the NO ingredients list. Nutritional information significantly smaller than in wrapper 2 and about equal to wrapper 1. Layout identified by marked columns.

Conclusion

This paper began by discussing the relationship between science and literacy. It drew on Norris and Phillips' (2003) notion of two senses of scientific literacy, derived and fundamental senses, and used a framework offered by the work of the New London Group (2000) to analyse the linguistic, visual and spatial designs of an everyday science text, bread wrappers. This analysis showed the complexity of everyday science texts. It thus offered teachers of an important reason, as well as a useful framework for, identifying the structural and design features of everyday science texts. The challenge that remains is how such complexities are articulated in and through pedagogic practice and their possibilities for assisting in redressing the continued decline in interest among adolescent students in science (OECD, 2006; Reiss, 2007; Relevance of Science Education, 2008) and the prediction that approximately 25% of secondary school students would be unable to 'participate effectively and productively in life situations related to science' (OECD, 2006).

References

Australian Academy of Science. (2005). *Marvellous micro-organisms Stage 3 Life and living.* Canberra: Australian Academy of Science.

Boddy, N., Watson, K., & Aubusson, P. (2003). A trial of the Five Es: a referent model for constructivist teaching and learning. *Research in Science Education*, 33, 27-42.

Bybee, R. W. (1997). *Achieving scientific literacy: from purposes to practices.* Portsmouth: Heinemann.

Gee, J. P. (2008). *Social linguistics and literacies: Ideology in discourses (3rd Edition)*. London: Routledge.

Hand, B. & Prain, V. (2006). Moving from border crossing to convergence of perspectives in language and science literacy research and practice. *International Journal of Science Education, 28*(2-3), 101-107.

Half of us lack skills to cope with modern world. (2008, January 10). The Australian.

Lemke, J. (1990). *Talking science: language, learning and values*. Norwood, New Jersey: Ablex Publishing.

New London Group. (2000). A pedagogy of multiliteracies: designing social futures. In B. Cope & M. Kalantzis (Eds.), *Multiliteracies: literacy learning and the design of social futures*. South Yarra: MacMillan Publishers Australia.

Norris, S. & Phillips. L. (2003). How Literacy in its Fundamental Sense is Central to Scientific Literacy. *Science Education*, 87, 224-240.

Organization for Economic Co-operation and Development (2006). *Organization for Economic Co-operation and Development Global Science Forum: Evolution of student interest in science and technology studies policy report.* Retrieved January 1, 2008 from http://www.oecd.org/dataoecd/16/30/36645825.pdf

Reiss, M. (2007). Comment: Bottom of the Class. *The New Scientist, 196*(2632), 23.

Relevance of Science Education. (2008). *Relevance of Science Education*. Retrieved 18 October, 2008 from http://www.ils.uio.no/english/rose/

Wellington, J & Osborne, J. (2001). *Language and literacy in science Education*. Philadelphia, PA: Open University Press.