Journal of English for Academic Purposes 9 (2010) 116-127

Constructing proximity: relating to readers in popular and professional science

Ken Hyland

Abstract

The view of academic discourse as a rhetorical activity involving interactions between writers and readers is now central to most perspectives on EAP, but these interactions are conducted differently in different disciplinary and generic contexts. In this paper I use the term proximity to refer to a writer's control of those rhetorical features which display both authority as an expert and a personal position towards issues in an unfolding text. Examining a corpus of texts in two very different genres, research papers and popular science articles, I attempt to highlight some of the ways writers manage their display of expertise and interactions with readers through rhetorical choices which textually construct both the writer and the reader as people with similar understandings and goals.

Interpersonality and proximity

The view that academic writing is interpersonal is no longer news. Over the last twenty years analyses of academic texts have shown us that while they may be more lexically dense, cautious and nominalised than many other kinds of writing, they aren't as completely 'author evacuated' as we had once supposed (e.g. Swales, 2004; Hyland, 2004). Instead, they are actually comprised of careful evaluations and interactions. Research papers, we have discovered, are sites where academics don't do not just offer a view of the world, but negotiate a credible account of themselves and their work by claiming solidarity with readers, appraising ideas and acknowledging alternative views. Interpersonality, then, concerns the ways that writers use language to negotiate social relationships by telling their readers what they see as important, how they believe they should select and present material for them, and how they feel about what they write about. It concerns the explicit system of meanings which link the participants in a text as *interactants*, adopting an acceptable persona and a tenor consistent with the norms of the community.

The important interactional norms in research writing involve 'establishing a judicious, discipline-defined balance of tentativeness and assertion, and a suitable relationship to one's data, arguments and audience' (Hyland 2005, p.54), but not all academic writing is the same. Any text is part of a register which spans a range of purposes, audiences and contexts from undergraduate essays to Nobel speeches. In other words, the work of the academy is interpreted using language for different audiences: for experts, for students, for industry, and for practitioners, and in each

case, this recontextualization of material offers different ways of understanding academic practices. By extending our interest beyond the mainstream discourses of the academy we access very different scientific discourses and gain insights into how relations between science and society are mediated and the cultural authority of science is promoted. More centrally for this paper, we also learn something of how interpersonality is negotiated with different audiences. We discover the ways writers display who they are and construct a convincing argument drawing on different discoursal conventions to establish proximity with readers.

I use the term *proximity* here to refer to a writer's control of rhetorical features which display both authority as an expert and a personal position towards issues in an unfolding text. It involves responding to the context of the text, particularly the readers who form part of that context, textually constructing both the writer and the reader as people with similar understandings and goals. While it embraces the notion of interpersonality, proximity is a slightly wider idea as it not only includes how writers manage themselves and their interactions with others, but also the ways ideational material, what the text is 'about', is presented for a particular audience. It is concerned with how writers represent not only themselves and their readers, but also their material, in ways which are most likely to meet their readers' expectations.

So proximity captures 2 key aspects of acting interpersonally. The first refers to what might be called the *proximity of membership*. How academic writers demonstrate their authority to *colleagues* through use of disciplinary conventions. What does the writer do to position him or herself as a disciplinary expert and competent colleague? The second concerns the *proximity of commitment,* or how the writer takes a personal position towards *issues* in an unfolding text. That is, what does the writer do to locate him or herself in relation to the material presented? One points to how we position ourselves in relation to our communities, and the other to how we position ourselves in relation to our text. These are, of course, difficult to separate in practice as we can't cannot express a stance towards the things we talk about without using the language of our social groups. But the concept does allow us to say something about how writers take their readers' likely objections, background knowledge, rhetorical expectations and reading purposes into account.

Proximity emphasizes a reader-oriented view of writing and is closely related to Sacks *et al*'s (1974: 272) notion of "recipient design", or how text and talk are shaped to make sense to the current recipient. In writing, as in conversation, we display an orientation and sensitivity to the particular others who are our co-participants through lexical choice, topic selection, conventions of argument, and so on. In academic writing this means that the process of writing involves creating a text that we assume the reader will recognise and expect and the process of reading

involves drawing on assumptions about what the writer is trying to do. Hoey (2001) likens this to dancers following each other's steps, each building sense from a text by anticipating what the other is likely to do. Skilled writers are therefore able to create a mutual frame of reference and anticipate when their purposes will be retrieved by their audiences.

The concept of *proximity* therefore helps us to understand how writers typically position themselves and their work in relation to others, so we can see interpersonality as the rhetorical construction of proximity. In this paper I plan to look at how writers in two very different genres, research papers and popular science articles, create a sense of proximity by textually constructing themselves and readers as having shared interests and understandings. Comparing key features from these contexts, I show how different language choices are employed to negotiate academic claims and construct proximity with two very different audiences.

A tale of two genres

Despite competition from electronic publishing alternatives such as e-journals and personal websites, the research article (RA) remains the pre-eminent genre of the academy. The RA is not only the principal site of disciplinary knowledge-making but, as Montgomery (1996) has it, 'the master narrative of our time'. One reason for this pre-eminence is the value attached to the processes of peer review as a control mechanism for transforming beliefs into knowledge. Another is the prestige attached to a genre which restructures the processes of thought and research it describes to establish a discourse for scientific fact-creation. In this context language becomes a form of *technology*, or a resource for controlling an environment, by presenting interpretations and positioning participants in particular ways to establish knowledge.

Several studies have shown the ways that serial drafts and reviewers' comments guide science writers to rhetorically accommodate their laboratory activity to the concerns of the discipline (Berkenkotter & Huckin, 1995;Casanave & Vandrick, 2003). Through reviewers' recommendations to modify the strength of their claims, provide propositional warrants, and establish a context through citation, writers gradually integrate their new claims into the weave of disciplinary relevance and prior work. This process indicates that new facts are not added piecemeal to the heap of existing knowledge, but are the extension of an ongoing conversation among members, conducted in a shared 'theory-laden' language and particular patterns of argumentation. Professional research writing is therefore seen as a tension between originality and deference to the community, and the language authors use to argue their claims constructs this proximity with readers.

This extract from an article in *The Astrophysical Journal Letters*, a highly-regarded molecular science periodical, helps to illustrate this:

(1) We used *Suzaku* observations to measure the spatial variation of the Fe Kα line with radius in the *Tycho* supernova remnant. The Fe line widths show a significant decrease from a FWHM value of 210 eV at the center to 130 eV at the rim. Over the same radial range the line center energy remains nearly constant. These observations are consistent with a scenario in which the shell of Fe-emitting ejecta in *Tycho* is expanding at speeds of 2800-3350 km s^{-1}. The minimum line width we measure is still a factor of two larger than expected from a single component plasma emission model. If thermal Doppler broadening is the dominant additional source of broadening, we infer an ion temperature of (1-3) × 10^{10} K.

(*Astrophysical Journal Letters* 693 L61)

This text is written for a professional audience with a high degree of specialised expertise. Information is presented with considerable exactness, foregrounding procedures and using technical jargon, nominalisations, precise measurements, cautious inferences from data, and acronyms. It is a discourse of exclusivity underpinned by a specialised knowledge of methods and of the meanings which results have for insiders.

'Popular science', in contrast, is produced for audiences without a professional need for information about science but who want to keep abreast of developments. In fact, popular science discourses play an enormous role in shaping most people's views of academic research: informing lay understandings of the interests, methods and knowledge that it produces. Their existence underlines that 'science' is not a monolithic entity always understood in the same way, but a social construct created by different groups with different interests. Popular science itself also addresses a range of different audiences (Hyland, 2009). While many popular science books are written by scientists for an elite educated audience, the public gets most of its information about science from specialised magazines like *New Scientist* and *Scientific American*. Most daily newspapers now have specialized science sections and the number of science articles in the press has been increasing (Pellechia, 1997).

These offer interpretations of academic activity recast with an eye for the interests, beliefs and preoccupations of a new readership. But it would be a great oversimplification to dismiss popular science as merely infotainment. This is a discourse related to the academy, its work, and its forms of communication but stripped of its more forbidding rhetorical

features. While attempting to wield the authority of science, both scientific facts and the argument forms of professional science are transformed in the process.

The different purposes and audiences of the two genres mean that writers negotiate proximity and represent science in very different ways to those employed by professional scientists in research journals. This can easily be seen by comparing example 1) with the same research reported in the popular journal *Science Daily*:

(2) The most crowded collision of galaxy clusters has been identified by combining information from three different telescopes. This result gives scientists a chance to learn what happens when some of the largest objects in the Universe go at each other in a cosmic free-for-all. The researchers found that four separate galaxy clusters are involved in a triple merger, the first time such a phenomenon has been documented. Galaxy clusters are the largest objects bound by gravity in the Universe….. "In addition to this enormous pileup, MACSJ0717 is also remarkable because of its temperature," said Cheng-Jiun Ma of the University of Hawaii and lead author of the study. "Since each of these collisions releases energy in the form of heat, MACS0717 has one of the highest temperatures ever seen in such a system." (*Science Daily, Apr. 17, 2009)*

In contrast to the research report, the popularization places an emphasis on the actors and their interpretations with short sentences, congruent grammar and use of first person quotes. Priority is given to the potential payoffs of the research and results, rather than the means of obtaining them.

Criticism of this kind of writing as a journalistic dumbing down of science, disseminating simplified and often sensationalised accounts to a passive mass readership, misses the point. Popular science does not just report scientific facts to a less specialist audience but represents phenomena in different ways to achieve different purposes. Most fundamentally, proximity helps science writers transform beliefs into knowledge, producing evidence for claims to persuade specialists of the reliability of their interpretations and the rigour of their methods. Popular science, in contrast, is concerned with establishing the novelty and relevance of a topic to celebrate scientific results, with their validity taken for granted. Popularizers, then, actually transform the products of an academic culture in the process of appropriating them and so influence the nature of elite science itself.

Facets of proximity

There are various ways writers achieve proximity and I want to discuss five in the remainder of this paper. Drawing on two corpora, a collection of 120 research articles from four science and engineering fields and a sample of 120 popular science articles, I explore how writers use *Organisation, Argument, Credibility, Stance and Engagement* to negotiate proximity with readers.

1. Organisation

There are several aspects of presentation which distinguish these genres. One is the role of visuals, for example, which play a key role as *arguments* in the research papers by giving visibility to information and offering a proof for interpretations, and as *explanations* in the popularizations, where they work mainly to attract the reader and elucidate the text (Miller, 1998). The most striking difference, however, is the way that the genres are organised. Instead of finding the main claim towards the end of the paper as in a research article, it is typically foregrounded at the beginning. Nwogu (1991), for instance, found that journalistic accounts typically open with a background move which contextualizes the research issue as a problem for readers and then follows this with the main outcome, often including reference to the scientists themselves. These examples are typical:

> (3) New moms beware: If you want to shed those extra pounds you packed on while pregnant, you better get your sleep. A new study shows that women are more likely to lose baby fat if they get over five hours of shut-eye a night. (*Scientific American*, Nov 2007)

> When we emerge from a supermarket laden down with bags and faced with a sea of vehicles, how do we remember where we've parked our car and translate the memory into the correct action to get back there? New research identifies the specific parts of the brain responsible for solving this everyday problem. The results could have implications for understanding the functional significance of a prominent brain abnormality observed in neuropsychiatric diseases such as schizophrenia. (*Science Daily*, April, 2009)

This deductive rhetorical pattern highlights the novelty and importance of the topic to lay readers rather than the methodological steps taken to get there, and while this provides a hook to bait the uninitiated, it can be confusing for scientists. Myers (1990: 141), for example, reports how the editor of the *New England Journal of Medicine* published both an original immunology article and a version rewritten by a Science journalist who gave greater attention to organization, explication and clarity. General physicians subsequently wrote applauding the fact that even difficult topics could be made accessible to non-specialists while

immunologists complained that the revised version was harder to read because information wasn't was not where they expected to find it. Both groups therefore had different views about the best way to write immunology based on their own needs, background knowledge, discourse expectations, and reading purposes.

2. Argument structures

Arguments are also structured very differently to shape material for the two audiences, reaching out to dissimilar audiences through distinctive kinds of appeals, focuses, and framings.

In terms of *appeals*, both genres are driven by *novelty*, although this is presented differently for the two audiences. Novelty is clearly a key feature of academic advancement and intellectual change in disciplinary communities, a means by which individuals gain credit for themselves, prestige for their field, and growth for their discipline within a shared understanding of what is worth knowing and where to take this. Kaufer and Geisler (1989: 286), in fact, refer to academic disciplines as 'factories of novelty, encouraging members to plod towards their yearly quota of inspirational leaps'.

In research papers novelty is negotiated by being the first to synthesize a contribution with the existing weave of community knowledge, situating local research in the broader concerns of the discipline. To be new, work must recognize the knowledge which has already gained consent and against which it makes a claim for change, so innovation is managed by establishing explicit intertextual links to existing disciplinary knowledge. So while claims for novelty are often made (as in 4), they are also backed up by arguments which relate them to the literature:

> (4) The assays presented herein illustrate <u>two novel approaches</u> to monitor the intracellular dynamics of nuclear proteins. (Bio RA)
>
> This paper proposes <u>a new methodology</u> that <u>further develops</u> Taguchi's method to incorporate multiple objectives and constraints in product design. (Mech Eng RA)

Novelty thus acknowledges what has gone before and builds on the field's organizational structures, beliefs and current hot topics. Topics, in fact are more than a research focus: they represent resources of joint attention which coordinate activities and mark co-participation in communities. Selecting a topic and arguing for its novelty and relevance is thus critical in securing colleagues' interest and in displaying membership credentials.

Popular texts, on the other hand, transform the novel into the *newsworthy*. Journalistic criteria mean that academic claims are changed into scientific breakthroughs and presented in terms of

what is of immediate value or potential benefit to readers. Newsworthiness establishes proximity by suggesting a common enthusiasm for science and a technocratic ideology that our lives are constantly improved through scientific progress. There is a celebration of relentless advancement which science is said to produce and which the current case is just one example:

> (5) Very young brains process memories of fear differently than more mature ones, new research indicates. The work significantly advances scientific understanding of when and how fear is stored and unlearned, and introduces new thinking on the implications of fear experience early in life. (*Science Daily*, March, 2008)

> In contrast to women, men are fertile throughout life. But new research at the Sahlgrenska Academy has now shown that a fertilising sperm can get help from the egg to rejuvenate. The result is an important step towards future stem cell therapy. "We are the first to show that egg cells have the ability to rejuvenate other cells, and this is an important result for future stem cell research", says Associate Professor Tomas Simonsson, who leads the research group at that has made this discovery.
>
> (*Science Today* March 2009)

In both academic and popular contexts, novelty is related to proximity by appealing to what is assumed about readers' knowledge and interests. Newness is not a property of the ideas themselves, but a relation between ideas and communities as professional writers package material for particular readers.

We also find writers managing proximity in the **focus** of the argument, or what writers chose to concentrate on. Quite simply, we can see that science journalism centres on the *objects* of study rather than the disciplinary procedures by which they are analysed. Professional papers construct what Myers (1990) calls a 'narrative of science' which follows the argument of the scientist by arranging time into a parallel series of events and emphasizing the conceptual structure of the discipline in their syntax and vocabulary. The discourse embodies key assumptions of academic practice: impersonality, cumulative knowledge construction, and empiricism, so that readers can relate a current claim to their understandings of the epistemological beliefs, prior findings, and currently approved methods. This is a typical example:

> (6) Leukocyte telomere length was positively associated with increasing physical activity level in leisure time ($P < .001$); this association remained significant after adjustment for age, sex, body mass index, smoking, socioeconomic status, and physical activity at work. The LTLs of the most active subjects were 200 nucleotides longer than those of the least active subjects (7.1 and 6.9 kilobases, respectively; $P = .006$). This finding was confirmed in a small group of twin pairs

discordant for physical activity level (on average, the LTL of more active twins was 88 nucleotides longer than that of less active twins; $P = .03$).

(*Archives of Internal Medicine*, Jan 2008)

A narrative of science, then, traces what is of interest to the discipline, employing rhetorical and linguistic choices which imply anonymity, precision, induction, comprehensiveness, and specialist knowledge of methods.

Popular articles, on the other hand, present a '*narrative of nature'* concentrating on the thing studied. This extract reports the same research in a very different way:

(7) Individuals who are physically active during their leisure time appear to be biologically younger than those with sedentary lifestyles, according to a report in the Archives of Internal Medicine. "Our results show that adults who partake in regular physical activity are biologically younger than sedentary individuals. This conclusion provides a powerful message that could be used by clinicians to promote the potential anti-aging effect of regular exercise." The authors say.

(*Science Daily* Jan 2008)

Here the focus is more explicitly concerned with the connection between exercise and aging, which is likely to be of greater interest to lay readers than the precise methodological procedures. Material is assembled to enhance the visibility of information and make the message more convincing through a chronological presentation and highlighting concerns readers may be expected to have about ageing, youthful appearance, and exercise. These different language choices convey meanings which change understandings of both research and of science.

Finally, proximity is achieved in argument by the ways writers *frame* information for their target readers. Framing is achieved by tailoring information to the assumed knowledge base of potential readers, creating proximity for different audiences through language choices which ask readers to recognise something as familiar or accepted. In research papers this is largely accomplished though the use of technical terminology, acronyms, reference to routine craft practices and specialised forms of equipment. This example from physics is typical:

(8) The sample used was 80% H2O with 20% D2O as the lock substance. Two dimensional proton NMR experiments were conducted on a Bruker ARX-500 spectrometer with a 5 mm inverse probe and a 10 mm normal broad band probe tuned at 500.13 MHz using the standard J-resolved and COSY pulse sequences. The transmitter offset was located at 162 Hz up (for SECSY) or down (for COSY) field from the resonance of water for both dimensions. In 2D data acquisition 512 points were used and the number of

tl-increments was changed. Data matrix for Fourier transformation was 512X512 with zero filling in the t domain only. (Phy RA)

Appealing to proximity through this abbreviated, highly specialised reference to shared knowledge is possible in the natural sciences because research is typically characterized by linearity and well-defined and agreed upon problems (Becher & Trowler, 2001). New knowledge is generated from what is known and each new finding inexorably contributes to the eventual solution of the issue under study. Specialism is encouraged by this as research often occupies considerable investments in money, training, equipment and expertise, which means individuals are often committed to particular research areas for many years and build their careers through precise contributions to a highly delimited field. Readers are often familiar with prior texts and research, and can see whether procedures and materials have been used appropriately and what results mean, so writers can describe their work economically.

Popularisations, on the other hand, can't cannot assume this degree of shared knowledge and have to make connections to what readers are likely to already know. This involves constantly defining new concepts as they are introduced and making explicit links between entities. They therefore tend to avoid jargon and offer an immediate gloss where this is not possible. Clarifications are often inserted on-the-fly where the writer assumes an unfamiliar usage (9) or where complex processes are related to more familiar everyday events through simile (10):

(9) Prozac, the popular antidepressant, blocks the action of a pump that sucks serotonin, a key mood-regulating chemical, out of the gaps between two neurons. (*Popular Science*, Nov, 2007)

(10) To get into the brain they must be shuttled across the blood–brain barrier by specialized transport proteins. Like passengers trying to board a crowded bus, amino acids compete for rides on these transporters. Not only does tryptophan have paltry representation among the passengers; it also competes with five other amino acids for the same transporter. Aced out by other amino acids, tryptophan thereby has a tough time hitching a ride to the brain.

(*Scientific American*, Nov 2007)

The unfamiliar is thus made intelligible by brief definitions and explanations which relate complex processes to everyday events, taking the reader's perspective to present the strange and exotic in the terms of the commonplace and unexceptional.

Non-scientists are also accommodated by the writer's management of cohesion. Cohesion

depends on the semantic structure of a text and therefore on the reader's expectations and knowledge, particularly knowledge of lexical relations. However, because scientific texts rarely contain replacement or pronouns for cohesion, non-specialists may struggle to see connections across sentences (Myers, 1991). Journalists, however, make these links explicit by using a variety of cohesive devices to serve as the basis for inferences about the meanings of any unfamiliar terms. In this extract, for example, the writer is careful to ensure that the reader is able to recover the links describing the genetic causes of mental retardation. Through the use of repetition, conjunctive phrases such as 'which means that', determiners (the, those), and synonyms, connections are specified and the passage becomes transparent:

> (11) In humans, the disorder stems from a mutation on the X chromosome as a three-base sequence begins to repeat over and over in a section of the fragile X mental retardation 1 gene (FMR1). The portion of the gene where this error multiplies does not code for a protein, which means that several repetitions of the sequence can occur without damaging the fragile X mental retardation protein (FMRP). People who have a gene with a sequence that is repeated 50 or fewer times are considered normal; those with fewer than 200 repetitions are carriers of the disorder. Individuals with more than 200 triplets, however, have disruptions to the promoter region of FMR1 that block the gene from being transcribed into RNA and forming a protein, thereby prompting onset of the syndrome. (*Scientific American* Nov 2007)

Clearly the 'naïve reader' is unable to learn the cultural system encoded in the language of science merely through reading scientific texts, but the representation of scientific knowledge in popularizations at least provides a basis for understanding the products of that culture.

3. Credibility

A third way in which popularizations seek to promote proximity with readers and engage with the incomplete knowledge-base of the non-specialist is to emphasize the credibility of the source of the information they report. In professional articles reliability is largely bestowed on findings by the writer's display of craft practices and expert handling of recognized research methods. Attributions to other scientists mainly function to align the writer with a particular camp or reward researchers who have conducted relevant prior work. Popularizations, on the other hand, can't cannot assume this level of knowledge in readers and so bestow credibility on scientists through their position in an institution, only identifying particular scientists when they are directly relevant to the research being reported:

(12) Animal scientist William Dozier, formerly with the ARS Poultry Research Unit in Mississippi State, has been working with colleagues at the ARS Swine Odor and Manure Management Research Unit in Ames, Iowa, and Iowa State University to find ways to supplement animal diets with glycerin.

(*Scientific American*, April 2009)

"By controlling muscle groups instead of individual muscles, we're reducing the variables, but we're not losing efficiency," said Matthew Tresch, assistant professor of biomedical engineering at the McCormick School of Engineering and Applied Science and of physical medicine and rehabilitation at the Feinberg School of Medicine. (*Science Daily*, April, 2009)

Unable to demonstrate the relevance and importance of new work by embedding it in a community generated literature, popularizations import material through the quotes of insiders and give credence to that material by drawing attention to the credibility of its source. Not only is authority given to the research by underlining the status of informants, but scientists are often allowed to tell the story themselves through direct quotes introduced by the verb *say*. These options are hardly ever found in the article genre where imported material is overwhelmingly rewritten as a summary from a single source or as a generalization combining several different studies. In popularizations, then, science is both made intelligible in the characteristics of conversation and brought to life through the voices of those involved.

(13) the two groups compiled drafts of the bovine genome, identifying genes important for fighting disease, digesting food and producing milk. "It gives you a window into what makes a cow a cow," says Harris Lewin, of the University of Illinois at Urbana-Champaign. (*Science News*, April, 2009)

Not only are quotes rare in the articles, but the reporting verb *say* to introduce the work of other researchers is a significant rhetorical choice and almost never found in science and engineering papers (Hyland, 2004). Not only does the choice of reporting verb allow writers to convey the kind of activity reported and to express an attitude to that information, but it also represents a key way of achieving proximity with peers because it signals shared rhetorical practices among disciplinary members. Figure 1 shows the most common forms in a larger corpus of 240 RAs in 8 disciplines, indicating the clear demarcations in the structure of subject-area knowledge systems and the fact that different domains use almost completely different verbs.

Fig 1: Most frequent reporting verbs in articles in 8 disciplines (Hyland, 2004)

Discipline	**Most frequent forms**	**Discipline**	**Most frequent forms**
Philosophy	say, suggest, argue, claim	Biology	describe, find, report, show,
Sociology	argue, suggest, describe, discuss	Elec Eng.	Show, propose, report, describe
Applied Ling.	suggest, argue, show, explain	Mech Eng.	show, report, describe, discuss
Marketing	suggest, argue, demonstrate, propose	Physics	develop, report, study

So while all writers draw intertextual links to their disciplines, they do so in ways which reflect disciplinary distinctions. The humanities and social sciences tend to use verbs which refer to *Discourse activities* (e.g. *discuss, hypothesize, suggest, argue, etc.)* which involve the expression of arguments and evaluation. Engineers and scientists, in contrast, prefer verbs which point to the *research* itself (like *observe, discover, show, analyse)* which represent actions in the real world.

Scientists try to suggest that results would be the same whoever conducted the research and so rhetorically distance themselves from their interpretations. Impersonality is used to give *objectivity* to conclusions through use of *passive voice, dummy it* subjects, and the *attribution of agency* to inanimate tables or results. By subordinating their own voice to that of nature, scientists emphasise the methods, procedures and equipment used, and not the researcher. In other words, in direct contrast to the personalising strategies of popularizations, credibility is increased in science articles through impersonalization; by writers *downplaying* their personal role.

4. Stance

The use of direct quotes, relevant topics, researcher identification and a sense of immediate value all reaffirm the role of personal activity in scientific research which is usually rhetorically airbrushed in professional academic discourses. In addition, journalistic practices also intrude into popular articles through more emphatic claims about the findings and a fuller expression of personal attitude. In other words, writers also establish proximity with readers ~~is~~ by taking a clear stance. Here we draw closer to core notions of interpersonality and the fact that statements don't do not just communicate ideas, but also the writer's attitude to those ideas and to their readers.

Modality is a much discussed feature of interpersonality (Hyland, 2004; Martin & White, 2005) and is important in constructing proximity by allowing writers to use language flexibly to adopt positions, express points of view and claim affinity with readers. Hedges and other devices which allow writers to comment on the factual status of propositions are therefore abundant in research genres, indicating the degree of caution or assurance that can be attached to a statement. Writing

for a peer audience, academics must carefully handle their claims to avoid overstating their case and risk inviting the rejection of their arguments. By withholding complete commitment to a proposition, hedges imply that a claim is based on the writer's plausible reasoning rather than certain knowledge while opening a space for readers to dispute interpretations. This example from a research paper is typical of this recognition of alternative voices:

> (14) An early flowering response to high temperature is maintained in *pif4* mutants, suggesting that architectural and flowering responses may operate via separate signaling pathways. The role of PIF4 in temperature signaling does not, however, appear to operate through interaction with either phytochrome or DELLA proteins, suggesting the existence of a novel regulatory mechanism. We conclude that PIF4 is a potentially important component of plant high temperature signaling and integrates multiple environmental cues during plant development.
>
> (*Current Biology*, 2009; 19 (5))

The frequent use of hedges therefore marks out a modest and careful researcher trying to keep interpretations close to the data and unwilling to make overblown claims.

But scientists see their work as far more tentative and mediated than journalists, who take a very different view towards facts. The process of transforming research into popular accounts involves removing doubts and upgrading the significance of claims to emphasize their uniqueness, rarity or originality. This can be seen in the way that the same research is reported in a popular science journal, with the tentativeness removed in favour of unmodified or boosted assertions which amplify the certainty of the claims and, in so doing, the impact of the story:

> (15) Researchers at the universities of Leicester and Oxford have made a discovery about plant growth which could have an enormous impact on crop production as global warming increases. Dr Franklin said: "This study provides the first major advance in understanding how plants regulate growth responses to elevated temperature at the molecular level. This discovery will prove fundamental in understanding the effects of global climate change on crop productivity." (*Science Today* April 2009)

For the science journalist, hedges simply reduce the importance and newsworthiness of a story by drawing attention to its uncertain truth value, but in glamorizing material for a wider audience, popular science texts do not help readers to see how scientific facts can be questioned.

In addition to using hedges to manipulate proximity to an audience and distance from a text, scientists also reduce their use of explicit attitude. My science RA corpus contains one

expression of attitude every 350 words in engineering and one every 200 words in the sciences. This works to increase the objectivity of claims and the persuasiveness of the argument, and where they do occur it is typically to express significance (16) or to comment on results (17):

(16) The interaction of light with the scanning tunneling microscope (STM) junction should provide an important tool for the characterization of surfaces. (Phy RA)

ATP plays a central role not only in the energy status of the cell, including microorganisms, but also as a regulator of enzyme activity. (EE RA)

(17) This result was unexpected as the degree of internal colonization by the mycoparasite was greaer in sclerotia of the latter fungus. (Bio RA)

There is one important limitation in working with systems of only a few hundred particles. (Phy RA)

In contrast, the popularizations are littered with attitude markers, indicating the writer's affective responses to material, pointing out what is important and encouraging readers to engage with the topic. Unlike their role in research papers, however, these markers do not signal the writer's affiliation to shared disciplinary attitudes and values. Instead, they help to impart an informal tone and underline the accessibility of the material. In fact, the attitudes are often not the writer's at all, but those which the interested lay reader might be expected to hold:

(18) In May this year astronomers announced the first weather report for an alien world. Although fairly crude, it hints that some pretty wild weather is blowing on a giant Jupiter-like planet. (*New Scientist*, Sept 2007)

Physicists at the University of Toronto have cracked the mystery behind the strange and uncannily well-ordered hexagonal columns found at such popular tourist sites as Northern Ireland's Giant's Causeway and California's Devil's Postpile. (*Science Daily*, Dec 2008)

After digging their way out and molting into adults, billions of the big, clumsy, red-eyed insects will sing their ear-splitting love songs.

(*Scientific American*, 2004)

Proximity with readers is, then, achieved by writers attributing attitudes to them. This is what a lay audience might think and believe on the basis of a community-endorsed common sense.

5 Reader Engagement

Finally, proximity is negotiated through the ways writers explicitly address their readers. *Engagement* (Hyland, 2005) is an alignment dimension of interaction where writers acknowledge and connect to others, recognising the presence of their readers, pulling them along with their argument, focusing their attention, acknowledging their uncertainties, including them as discourse participants, and guiding them to interpretations. I only have space to mention two aspects of engagement here, reader pronouns and questions, both of which are far more common in the popular texts.

Reader pronouns offer the most explicit ways of achieving proximity by bringing readers into a discourse, and while *you* and *your* are actually the clearest way a writer can acknowledge the reader's presence, these forms are rare in research papers. Instead, inclusive *we* is prominent. There are several reasons for using this form, but most centrally it identifies the reader as someone who shares a point of view or ways of seeing with the writer. It sends a clear signal of membership by textually constructing both the writer and the reader as participants with similar understanding and goals, as we see here:

> (19) We would expect that over time, plant genotypes that maximize mycorrhizal benefits would be at a selective advantage. (Bio RA)
>
> At the moment we tend to accept that the incident light, or at least most of it, is bounced twice before returning and re-emerging outside the eye. (Phy RA)

This emphasis on binding writer and reader together through inclusive *we* is also a feature of popular articles, where it functions less to claim community solidarity than to insinuate a shared, taken-for-granted way of seeing the world. This helps guide readers towards a perceived relevance of the reported research, aligning the reader with the writer, and perhaps against an institutional 'they':

> (20) On the list of things we're supposed to do but generally don't, nothing ranks higher than eating well. And no wonder, considering that they keep changing the rules on us. Margarine was once supposed to be better than butter — until it turned out to be worse. Low-fat eating was supposed to be the way to lose weight — until it was low-carb, then back to low-fat again.
>
> (*Popular Science* April, 2009)

While this shades into a positioning of the reader, the considerable use of the second person does this more explicitly, directly involving readers in the topic of the article through common experiences or drawing them into a credible, but unknown, world:

> (21) You're just about ready to buy a pair of tickets on Ticketmaster, but before you can take the next step, an annoying box with wavy letters and numbers shows up on your screen. You dutifully enter in what you see—and what a robot presumably can't—in the name of security. But what you may not know is that you also have helped archivists decipher distorted characters in old books and newspapers so that they can be posted on the Web.
>
> (*Scientific American* Aug 2008)

> One look at the effects of a bomb blast suggests that you'd have to be extremely lucky to emerge from one unscathed. If you were not burned by the explosion or blasted by shrapnel, the chances are you'd be hit by the shock wave. Travelling at several hundred metres per second, this causes massive fluctuations in air pressure which can knock you unconscious, rupture air-filled organs such as eardrums, lungs and bowels, and stretch and distort other major organs.
>
> (*New Scientist*, April 2009)

A final way that writers build a connection with readers is through the use of *questions*. These are a key strategy of dialogic involvement in many registers but are almost non-existent in science and engineering research papers. Their role in manufacturing immediacy with readers is viewed with suspicion by professional scientists, although they are common journalistic devices, representing an important way of managing proximity:

> (22) Solix must struggle for answers before it can sell a thing: Which species of algae will produce the most oil? What's the best way to grow it? And not least, how do you extract the oil from the algae once it's grown?
>
> (*Popular Science*, April 2008)

Presenting the researcher's problems as questions achieves proximity with readers by engaging them in the scientific enterprise, bringing them closer to the concerns of the scientist at the same time as making the science real and intelligible.

Conclusions

Science journalism illustrates the ways proximity (and interpersonality) work as writers set out material for different purposes and readers. Popularizations represent a discourse which establishes the uniqueness, relevance and immediacy of topics which might not seem to

warrant lay attention by making information concrete, novel and accessible. Findings are therefore invested with a factual status, related to real life concerns, and presented as germane to readers with little detailed interest in the ways that they were arrived at or in the controversies surrounding them. Readers, in fact, experience the academic world and its discourses as a succession of discoveries in the relentless advance of inductive science. In sum, science journalism works as journalism rather than science. It is written in ways which make the research accessible and allow non-specialists to recover the interpretive voice of the scientist.

There are several advantages for EAP practitioners in considering how proximity operates across genres. First it helps us see the way different features combine to orchestrate interpersonality. Writers position themselves through rhetorical choices which emphasize a relationship to content and to readers, displaying an audience sensitivity through the way the material is organised argued and attributed as well as choices concerning writer and reader visibility in the text. Simply, both scientists and journalists have to evaluate their audiences as they write, and this means that texts tell us something about how writers see their readers. Understandings of readers' goals, interests, knowledge and processing capabilities are indexed in rhetorical choices so that context is constructed in text.

Second, genre comparisons suggest that proximity is important not only to analysts of academic writing but also to teachers of it. Clearly, analyses caution us to take care in using popular texts as models for scientific writing as differences in constructing proximity mean that they will not help students see how scientific facts can be questioned or modified. Comparisons, however, can have an important consciousness raising function by highlighting features of scientific discourse for learner noticing. Their study, moreover, may help students see something of the importance of audience. In recontextualizing academic research for a lay audience, much popular science portrays research as an immediate encounter of a scientist with nature. Scientists become actors and claims become a discovery event; jargon is evicted or roughly glossed; certainties replace tentativeness, and nouns regain their verbal status. Such a reconfiguration of discourse reminds us that science is a communicative activity so science once again becomes ideas to be discussed rather than information to be received.

Most importantly, the study of proximity in these genres helps us to see how each group appropriates and transforms science by presenting the same material for different purposes and readers. In popular science proximity is achieved by making research accessible and allowing non-specialists to recover the voice of the scientist which is absent in professional papers. In research science writers position themselves as competent colleagues by displaying familiarity with methods and a disciplinary literature, presenting research with caution, and supporting

claims with evidence. Ultimately the insights into academic writing which these kinds of contrasts reveal makes the study of interpersonal proximity a highly productive and valuable activity for researchers and teachers of academic discourses.

References

Becher, T. and Trowler, P. (2001). *Academic Tribes and Territories: Intellectual Inquiry and the Cultures of Disciplines.* Milton Keynes: SRHE and Open University Press

Berkenkotter, C. and Huckin, T. (1995). *Genre Knowledge in Disciplinary Communication.* Hillsdale, NJ: Lawrence Erlbaum.

Casanave, C. and Vandrick, S. (eds). (2003). *Writing for Scholarly Publication*. Mahwah, NJ: Lawrence Earlbaum

Hoey, M. (2001). *Textual Interaction*. London: Routledge.

Hyland, K. (2004). *Disciplinary Discourses: Social Interactions in Academic Writing*. Ann Arbor, MI: University of Michigan Press.

Hyland, K. (2005). 'Stance and engagement: a model of interaction in academic discourse'. *Discourse Studies*, 6(2), 173-91.

Hyland, K. (2009). *Academic discourse*. London: Continuum.

Kaufer, D., and Geisler, C. (1989). 'Novelty in academic writing'. *Written Communication*, 6(3), 286-311.

Martin, J. and White, P. (2005). *The Language of Evaluation: Appraisal in English.* London: Palgrave/MacMillan.

Miller, T. (1998). 'Visual persuasion: a comparison of visuals in academic texts and the popular press'. *English for Specific Purposes*, 17(1), 29-46.

Montgomery, S. (1996). *The Scientific Voice*. New York: The Guildford Press.

Myers, G. (1990). *Writing Biology: Texts in the Social Construction of Scientific Knowledge*. Madison, WI: University of Wisconsin Press.

Myers, G. (1991). 'Lexical cohesion and specialized knowledge in science and popular science texts'. *Discourse Processes*, 14(1), 1-26.

Nwogu, K. (1991). 'Structure of science popularizations: a genre analysis approach to the schema of popularized medical texts'. *English for Specific Purposes*, 10, 111-23.

Pellechia, M. (1997). 'Trends in science coverage: a content analysis of three US newspapers'. Public Understanding of Science, 6, 49-68.

Sacks, H., Schlegloff, E. & Jefferson, G. (1974). A simplest systematics for the organization of turn-taking in conversation. *Language* 50: 697-735

Swales, J. (2004). *Research Genres*. Cambridge: CUP.