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Disciplinary Variation in the Use of Theme in Undergraduate Essays

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Success in higher education depends on students' ability to meet the writing requirements of their chosen courses, and in many cases this involves adapting to the literacy practices of particular disciplines. While research into professional academic discourse suggests that it may reflect differences in disciplinary culture and epistemology, there has been relatively little investigation of disciplinary difference in student writing. This study is based on an analysis of essays written within an Open University course in the history of science, using a systemic functional approach to examine whether the students' use of theme may vary according to their disciplinary background. Students from an 'arts' background were found to achieve significantly higher grades than those from a 'science' background. This could be related to a greater tendency to present knowledge as constructed, using themes which framed the discussion as a matter of interpretation rather than fact. The results support the hypothesis that students' writing is shaped by their disciplinary background, suggesting that success in writing for one course may be affected by writing experiences in previous courses.

INTRODUCTION

Disciplinary difference

Disciplinary discourse is increasingly regarded as situated in social practice, and shaped by the social actions through which it is produced (Myers 1985). Variation in disciplinary culture is thus reflected in academic writing, leaving its trace in the linguistic and rhetorical features of disciplinary texts (Bazerman 1988; Walvoord and McCarthy 1990; MacDonald 1994; Hyland 2000). Bazerman showed, for example, that articles from different disciplines varied in their representation of the subject matter, the literature, the audience, and the authors themselves, to the extent that 'each text seems to be making a different kind of move in a different kind of game' (Bazerman 1988: 46). Other research has identified a range of features that have been found to vary along disciplinary lines, including cohesion strategies (Lovejoy 1991), types of grammatical subject (MacDonald 1992), length of subject and lexical density (Vande Kopple 1994), generic structure (Holmes 1997), use of citations (Hyland 1999a), markers of stance (Hyland 1999b), and informal features in writing (Chang and Swales 1999).

Table 1: Characteristics associated with pure sciences and humanities

Disciplinary area	Nature of knowledge	Nature of disciplinary culture
Pure sciences (e.g. physics)	Cumulative; atomistic (crystalline/tree-like); concerned with universals, quantities, simplification; resulting in discovery/ explanation	Competitive, gregarious; politically well-organized; high publication rate; task-oriented
Humanities (e.g. history) and pure social sciences (e.g. anthropology)	Reiterative; holistic (organic/river-like); concerned with particulars, qualities, complications; resulting in understanding/ interpretation	Individualistic; pluralistic; loosely structured; low publication rate; person-oriented

Source: Becher 1994: 154.

Such variations exist not simply because they are established by convention, but because they arise out of different epistemologies and social practices. Becher (1989; 1994) suggests that knowledge communities may be identified at several levels, from subdisciplinary specialisms to broad disciplinary groupings, according to their view of knowledge and their associated disciplinary culture. Table 1 illustrates these characteristics with respect to the two disciplinary areas considered in this paper: pure sciences, and humanities/pure social sciences.

One aspect which can be seen to impact in various ways upon disciplinary writing is the degree to which a discipline is concerned with universals or particulars. For example, Biber's analysis of lexicogrammatical features (1988) found that academic writing in the humanities exhibited more 'narrative' features than in technology/engineering, reflecting a greater concern for concrete events and participants, and MacDonald (1992) also found that types of item in subject position reflected disciplinary differences in the relationship between particular and abstract.

Another significant aspect is the view of academic work as cumulative or iterative. This distinction can be related to the extent to which knowledge is constructed on the basis of a framework of shared assumptions (Bazerman 1988; Hyland 1999a). On the one hand, work in the sciences typically involves a shared paradigm within which research moves forward by building on what has come before. By contrast, the lack of such a framework in the humanities and social sciences reflects a view of knowledge as open to interpretation, with research problems often revisited rather than treated as resolved. Evidence of these different orientations to knowledge could be seen in Bazerman's (1988) analysis of journal articles; the shared

assumptions of biology, for example, made reference to the literature and overt persuasion less necessary than in sociology, where the writer had to put more work into establishing the context and guiding the reader through the argument. Differences in the way disciplinary knowledge is constructed have also been shown to underlie variation in subject choices (MacDonald 1992) and citation practices (Hyland 1999a).

Research into academic writing has tended to confirm the existence of disciplinary differences relating to differing conceptions of the nature of knowledge and disciplinary culture, which may be realized in a variety of textual features. Most such research, however, has focused on the literacy practices of professional academics, particularly the journal article, and the relationship between expert and novice practices is far from clear. As Kelly and Bazerman point out, 'student writing needs to be sensitive to site-specific features of the local educational and disciplinary contexts' (2003: 32). Apart from their own research into written argument in an oceanography course, there has been relatively little analysis of disciplinary issues in undergraduate writing. Although a number of studies have considered the literacy practices of undergraduates (e.g. Faigley and Hansen 1985; Herrington 1985; McCarthy 1987; Walvoord and McCarthy 1990; Greene 2001), they have tended to focus more on process than on product, adopting an ethnographic approach in order to explore the perceptions, beliefs, values, assumptions and interpretations of the participants. While this approach has provided valuable insights, there remains a lack of data concerning the way in which underlying conceptualizations are realized through the text itself.

The research described in this paper is centred on text—the essays produced by students as part of their course assessment. Undergraduate writing typically plays a large part in assessment, and, to be successful, must conform to the requirements of the course. These requirements are likely to vary in line with the disciplinary differentiation already identified in many aspects of undergraduate teaching and learning (see, for example, Neumann *et al.* 2002), and it seems reasonable to anticipate that over time, as students engage with the practices of a particular discipline, their writing will tend to conform more and more closely to disciplinary conventions. Student essays therefore seem a useful entry point for an investigation of emergent disciplinarity, on the assumption that textual analysis may reveal disciplinary differences encoded in the language itself.

The significance of initial position

This research focuses on a textual feature that appears particularly likely to reflect such beliefs and values: the theme, or initial constituent of the clause. The language provides a variety of resources for varying clause structure, as illustrated in the examples below, and the writer therefore has some freedom

in selecting the element which will provide the 'point of departure' for the message (Halliday 1994: 34).

	Theme	Rheme
(1)	Isabella and Ferdinand	established the inquisition in 1480.
(2)	The inquisition	was established in 1480 by Isabella and Ferdinand.
(3)	It was Isabella and Ferdinand	who established the inquisition.

As a device for organizing meanings, theme not only operates at the local level, indicating how the writer has chosen to order information within the clause, but also helps to structure the flow of information in ways that shape interpretation of the text as a whole (Martin 1992; 1995). Despite debate over the nature of theme as a theoretical construct (e.g. Huddleston 1992; Goutsos 1997), it is generally recognized that the association of theme with initial position 'captures the significance of staging in the deployment of meaning in a text' (Goutsos 1997: 8). The selection of theme is bound up with decisions on what to make more or less prominent within a text, and may therefore be expected to reflect ideological and epistemological positioning.

Several studies suggest that certain types of text are characterized by particular types of theme; tourist guides, for example, tend to thematize places, while biographies tend to thematize agents and times (Enkvist 1987; Lavid 2000). The thematic patterning associated with genre and generic structure may also intersect with that typical of particular disciplines. Findings have indicated, for instance, a preference for circumstantial themes in history as compared to science textbooks (Taylor 1983), and in psychology and history as compared to biology (Lovejoy 1998). McCabe compared the way theme was used in both Spanish and English history textbooks, and found overall similarities presenting a picture of 'informationally-oriented, non-interactive explanatory and interpretative discourse' (McCabe 1999: 278) which may be characteristic not simply of textbooks, but more specifically of textbooks in history.

Another clause constituent that has been associated with disciplinary variation in knowledge construction is the grammatical subject, and as I shall discuss in the following section, this too may be incorporated within an analysis of theme. MacDonald (1992, 1994) shows that subject choices can be related to disciplinarity, arguing that 'the subject slot is . . . the most important spot for determining what a writer is writing *about* and how questions about epistemology, construction or agency enter into the writer's thinking' (1992: 539). Her approach has also been applied to student writing, to investigate sub-disciplinary differences between courses in environmental science (Samraj 1995, 2004), and disciplinary engagement at different stages of an undergraduate programme in geography (Hewings 1999).

The literacy practices of a disciplinary community embody different orientations to knowledge construction which can be seen to leave their traces in the written text, at both text and clause level. The initial constituent of the clause appears to have particular significance in the way it reflects the writer's beliefs and values, and thus provides an indicator of disciplinary difference in professional academic writing. This paper considers whether theme use in student essays exhibits disciplinary differentiation suggesting that undergraduates have already to some extent adopted the discursive practices of the disciplines in which they have studied.

CORPUS AND PROCEDURE

Essay data

The data for this research were drawn from an Open University course in the history of science (*The Rise of Scientific Europe 1500–1800*), during the academic year 2002–2003. The Open University is a UK-based distance teaching university, and most of its undergraduates study part-time while in paid employment. The student body is therefore more heterogeneous than that of a traditional university, with considerable variation in age, previous academic study, and working experience. The flexibility of course choices also means that students may have studied subjects from different disciplines, over varying periods of time.

Although taught within the Arts faculty, the history of science course may form part of either a BA or BSc degree programme, and the presence of students from both arts and science backgrounds makes it a particularly interesting context for investigating discipline-specific orientations towards academic writing. The research procedure involved comparing a group of students whose previous study had involved courses in arts, social sciences, or education, with a corresponding group whose previous study had involved courses in mathematics, science, or technology. In the following discussion, I shall use the terms 'arts' and 'science' to indicate these broad disciplinary groupings, but it is important to remember that students classified in this way for the purposes of the research have their own diverse experiences, quite apart from their Open University study, which may influence their approaches to academic and disciplinary literacy.

Seventy-one students from a variety of locations within the United Kingdom volunteered to participate in the research. From these a sample was selected to provide a contrast in terms of disciplinary background: a group of ten 'science' students whose previous Open University study had included predominantly 'science' subjects, and a corresponding sample of ten 'arts' students matched as closely as possible for age, gender, and formal educational background (see Table 2).

The primary data for this research are four of the essays written as part of the assessed coursework, which was the same for all students

Table 2: Characteristics of student sample

		'Arts' $N=10$	'Science' $N=10$
Gender	Male	3	3
	Female	7	7
Age	35 and over	7	6
	Under 35	3	4
Formal education	A Level and above	7	7
	Less than A Level	3	3
Average number of	Arts	1.90	0.20
OU courses taken	Science	0.00	4.10

Table 3: Details of assignments

Assignment	Length (words)	Question
1	500	What, in your view, are the most important of the reasons Grant suggests . . . for the development of science in western Europe during the period A.D. 1000–1500?
3	750	. . . To what extent did the Inquisition affect the pursuit of scientific knowledge in sixteenth-century Spain?
4	2000	A universe composed of matter and motion leaves no room for God. Discuss this assertion with reference to seventeenth-century French natural philosophers.
6	1500	'With Linnaeus an era in the history of botany reaches its culmination and conclusion: it is the end of scholastic botany.' . . . Evaluate the adequacy of Lindroth's thesis.

(see Table 3). Sixty-one essays were obtained for analysis, 33 from 'arts' students and 28 from 'science' students, amounting to a total of 65,234 words. Although the focus of this research was the student writing itself, I collected other information which would cast light on the context in which the essays were produced and evaluated, including interview and questionnaire data from students in the sample, and tutor feedback comments on the essays. I also talked to tutors, studied course documentation, read the textbook material, and attended tutorials and tutor briefings. Findings from this part of the research are reported elsewhere

(North forthcoming), but have also helped in interpreting the results of the textual analysis.

Analytical framework

As described by Halliday (1994), the theme of a clause comprises everything up to and including the initial ideational element. More recently, however, a number of researchers have suggested that the subject should be regarded as necessarily thematic (e.g. Davies 1994; Berry 1995; Rose 2001; Forey 2002; Martin and Rose 2003), and this is the approach that I have taken in analysing the student essays. The rationale for this decision relates to the distinction often noted between unmarked (subject) themes associated with topic continuity, and marked (circumstantial) themes associated with discontinuity (Lowe 1987; Gosden 1992, 1993; Fries 1995; Davies 1997). Marked themes contribute to text staging, for example by indicating changes in the spatio-temporal setting, as in extract 4 below. Subject themes, on the other hand, contribute to topic continuity by identifying major participants in the text and participating in the identity chains that help to make the discourse coherent. A Hallidayan analysis of extract 4 would identify the themes *In Sweden*, *Constedt and Wallerius*, and *and in the nineteenth century*, but would not reveal the way the text has been structured to foreground the role of *leading researchers*. As MacDonald's research (1992, 1994) has indicated, the role of subject choices in indicating the writer's orientation towards their subject matter may be particularly sensitive to disciplinary difference, and for this reason I decided to use an extended definition of theme to investigate whether such disciplinary variation was observable in the student essays.[1]

(4)   Penny A 6/f/31–33

Marked theme	Subject	Rheme
In Sweden,	leading researchers	tended, like Linnaeus, to organise their observation into systems.
	Constedt and Wallerius	did this in mineralogy,
[and] in the nineteenth century,	Berzilius	followed in chemistry.

The approach followed in this research involved drawing a distinction between *orienting* and *topical* themes.[2] Topical themes are distinguished from orienting themes in that they fill participant roles within the clause; the topical theme is normally the grammatical subject, or occasionally another element such as a thematized complement or a predicated theme. Elements

that occur before the topical theme are regarded as *orienting themes*, and can be classified under three headings: textual, interpersonal, and experiential. The first two correspond in principle to the categories of textual and interpersonal theme in Halliday (1994), while the third category comprises experiential elements which do not fill participant roles (mainly circumstantial adjuncts). These possibilities are illustrated in example 5 below:

(5)   Wendy A 4/f/44

Textual	Orienting theme *Experiential*	*Interpersonal*	Topical theme	Rheme
However,	given the political climate of the early seventeenth-century	it seems unlikely that	Descartes	would deliberately challenge the Church.

Textual themes comprise conjunctions and conjunctive adjuncts (e.g. *but*, *whilst*, *as a result*), which indicate the relationship of a clause to the preceding text. Interpersonal themes involve expressions of modality, including not only modal adjuncts, but also personal and impersonal projecting (reporting) clauses which comment on the epistemic status of the proposition, and can thus be classified as cases of interpersonal metaphor (Mauranen 1993; Halliday 1994: 340; Whittaker 1995). Recognizing projecting clauses as interpersonal themes normally ensures that the subject of the main proposition falls into the topical theme slot, providing an analysis which helps to elucidate not only topic continuity, but also the writer's stance towards the proposition. In the following extract, for example, the second column allows us to track the thematic progression created through the cohesive items *this* and *they*, while the first column reveals a method of development which frames the propositions as attributed to others.

(6)   Penny A 3/j/47–49

Orienting theme	Topical theme	Rheme
	Every bookseller	was supposed to own an Index of prohibited literature.
Pinto notes	this	put them under economic strain,
but Kamen claims	they	often therefore did not buy it.

Not all projecting clauses, however, can be classified as interpersonal orienting themes. A complicating factor arises from the 'historicized debate'

(Fuller 1998) that forms a significant part of the history of science, in which the conversations of a long dead discipline are represented as themselves an object of study. So the following example represents, not a comment on the epistemic status of a proposition about atomism, but rather a proposition about Gassendi:

(7)   Gassendi believed that atomism was a plausible theory (Ruth S 4/h/45)

In MacDonald's terms (1992), while *Pinto* and *Kamen* in example 6 belong to the epistemic domain, *Gassendi* in example 7 belongs to the phenomenal domain. The nature of history means that the phenomenal domain is typically distinguished by past tense forms in contrast to the present tense forms of the epistemic domain. However, this is not inevitably the case, and it remains necessary to rely on a reading of the text in order to distinguish between projecting clauses which express a comment on a proposition and those which constitute the proposition itself.

   In principle, it is possible to identify theme and rheme at various structural levels (Berry 1996). For the purposes of this research, the t-unit has been adopted as the unit of analysis, defined as 'an independent clause together with all hypotactically related clauses which are dependent on it' (Fries 1994: 229). Analysing theme at the level of the t-unit rather than the individual clause makes it easier to focus on patterns of thematic development in large amounts of text, and can also be justified on the grounds that the thematic structure of a dependent clause is often constrained by the independent clause (Fries and Francis 1992: 47). In the discussion that follows, the t-unit is used as the basis for comparing features, with results reported per 100 t-units, rather than per 1000 words. This gives a better indication of the distribution of themes in different texts, since there must be one thematic component in each complete t-unit, regardless of its length.

   The incidence of different types of t-unit in the student essay data is indicated in Table 4. Although quotations and fragments are listed separately here, they were as far as possible incorporated in the analysis. A t-unit was coded as a quotation if the topical theme consisted of quoted material, but any preceding orienting themes which contained the writer's own words were analysed in the normal way. Fragments which did not comprise a complete clause were classified as thematic or rhematic according to relevant features of the co-text.

FINDINGS AND DISCUSSION

A striking difference between the students was that those with an 'arts' background tended to be awarded higher marks for their assignments. Overall, the average mark was 77.3 for 'arts' students, and 66.9 for 'science' students, a difference which is significant at the 1 per cent probability level

Table 4: Total t-units in the student essays

	'Arts'	'Science'
Quotations	83	17
Fragments	5	7
Interrogative	15	11
Imperative	0	2
Declarative	1785	1452
Total	1888	1489

Table 5: Theme use in the student essays

	Average per 100 t-units		
	'Arts'	'Science'	All essays
Orienting Theme			
Textual	31.50	24.28	28.19
Interpersonal	15.19	9.75	12.69
Experiential	21.67	19.39	20.62
Total orienting themes	68.37	53.42	61.51
Topical Theme			
Subject	82.50	83.35	82.89
Ellipted subject	5.37	4.17	4.82
Existential	1.67	4.68	3.05
Other	6.13	5.66	5.92
Total topical themes	95.66	97.87	96.68

($t = 4.505$, $p < 0.001$).[3] This discrepancy in marks suggests that previous academic experience had for the 'arts' students facilitated mastery of the discourse required in the course, while leaving the 'science' students less well prepared. The higher marks of the 'arts' students may have been occasioned by various aspects of their essays. However, the analysis also revealed that essays which used more orienting themes were significantly more likely to receive a higher mark ($t = 2.336$, $p < 0.023$), and that orienting themes were significantly more frequent in the essays of the 'arts' students ($t = 2.865$, $p < 0.006$). Course tutors would not, of course, have been directly evaluating the students' use of theme as they marked the essays. Nevertheless, it is possible that thematic choices in the students' essays reflected differing

conceptions of knowledge and of academic writing which themselves contributed to success in course assessment, a possibility that makes it worth investigating further the differing ways in which themes were deployed by 'arts' and 'science' students.

Student use of orienting themes

As described above, orienting themes may consist of textual, interpersonal and experiential elements. 'Arts' students included more of all three types, with average figures of 31.50 textual, 15.19 interpersonal, and 21.67 experiential elements per 100 t-units, compared to 24.28 textual, 9.75 interpersonal and 19.39 experiential for the 'science' group (see Table 5). These figures represent a statistically significant difference between the student groups for textual themes ($t = 2.525$, $p < 0.015$) and interpersonal themes ($t = 2.059$, $p < 0.044$), but the use of experiential orienting themes did not differ significantly between the 'arts' and 'science' students, and was also not related to the mark.

Textual and interpersonal themes, however, provide clear evidence of disciplinary variation, which is exemplified in the contrasting essay extracts in extracts 8 and 9. In the 'arts' extract, the student uses both textual themes to make explicit the structure of the argument and interpersonal themes to indicate her degree of commitment to the views she presents, while the 'science' extract, although dealing with similarly complex ideas, offers a series of bald assertions. The extracts thus seem to embody divergent views of history, one seeing it as constructed through the interpretations of historians, the other seeing it as dealing with an objective reality in which the facts speak for themselves.

Although 'arts' students used significantly more textual themes than 'science' students, the proportions of the main types of conjunctive relationships were broadly similar. A few differences emerged among the less frequent types of conjunction. 'Science' students, for example, were more likely to use reformulation markers while 'arts' students made more use of markers of exemplification and of temporal relations, particularly discourse-internal time (the unfolding of the text itself). The number of cases involved is small, however, and it appears that it is the overall frequency of conjunctive elements, rather than their type, which most clearly distinguishes the use of textual themes in the 'arts' and 'science' essays. Through their use of these themes, the 'arts' students tended to provide more explicit guidance to the reader on how to construct a coherent interpretation of the text.

The use of interpersonal orienting themes was also significantly related to the student's disciplinary background.[4] In particular, the 'arts' students made more use of attribution themes, in ways that set up potentially complex thematic patterning involving more than one line of development.

Consider, for example, the following three extracts. In example 10, Marian (a 'science' student) thematizes Linnaeus and his work, with a line of development running clearly through the topical theme and relating to the object of study. The propositions are asserted directly, with epistemic stance marked only through the modal *can* in the first t-unit. Apart from this, the information is presented as uncontested 'matter of fact'.

(8)   Tracey A 4/j/76 to 4/k/85

Orienting Theme	Topical Theme	Rheme
	The Catholic religion	needed miracles such as the miracle of transubstantiation because a denial of miracles leads to a denial of God.
So	Mersenne	subscribed to a version of mechanical philosophy in order to preserve '...the realm of faith.'
Ashworth says that	Mersenne	had '...no theological problem in Gassendi's proposed revival of Epicurean atomism...'
however Goodman and Coley say that	Mersenne	criticized Gassendi because of his (Mersenne's) '...belief that atomism was an atheistic theory'
On the other hand	Pascal	approached the search for a system of natural philosophy by apparently separating his religious and scientific ideas completely.
Although as Ashworth says 'unlike Descartes,	Pascal	did believe that nature expressed the handiwork of the Creator...'
	Pascal	also thought that the study of nature would not reveal God and his purposes.
A little like Mersenne,	he	believed that '...the mysteries of the Divinity should not be profaned by scientific disputes...'
Nevertheless	he	spent many valuable years conducting experimental science, most notably investigating the barometer, even whilst '...telling Mme Perier that tending to nature is idolatry, the worship of the creation rather than the Creator.'
So although Pascal is described by Ashworth as a Cartesian rationalist	he	does not appear to write God into his system in the same way as Descartes, instead preferring to think that authority plays 'different roles in science and religion.'

(9)   Sue S 4/e/21 to 4/f/31

Orienting Theme	Topical Theme	Rheme
	That the universe contains matter which moves	was not debated by these scientists,
	the debate	concerned the make up of matter, the way in which it moves and how that motion comes to be.
	Gassendi and Descartes,	contemporaries in 17th century France, had radically different ideas about this.
	Aristotle's theories of matter and motion	were that matter is made up of corpuscles which can move and that all matter has a purpose and that all matter will move towards its 'natural place'.
	The purpose of matter	he defined as its motion.
	The motion of an acorn	is to grow to be an oak tree.
	This teleological argument	was rejected by Descartes.
	René Descartes (1596–1650)	was not satisfied with any of the theories he had been taught by the Jesuits.
and therefore		tried to develop a whole new system to explain the universe.
	He	believed, like the ancient Greeks, that logic and reason would enable him to develop his theories.
	He	proposed a dualistic theory of matter consisting of thought and extension.

(10)   Marian S 6/c/14–19

Orienting Theme	Topical Theme	Rheme
	The notion of a 'chain of being' evident within Linnaeus's writings	can be related directly back to Aristotle; that there is little division between living organisms and minerals.
	This	was a popular eighteenth century belief
and	Linnaeus	saw that some organisms, especially some sea-creatures were on this dividing line between living and non-living beings.

Linnaeus	borrowed the term 'zoophytes' from Aristotle to describe these life forms, such as corallines that appeared to be part-animal, part-plant.
These distinctions	were very important to Linnaeus in enabling him to devise a classification of the living world.
This notion of an orderly chain of life	is reminiscent of our twenty-first century idea of an ecological food chain or web.

In example 11, Bridget (an 'arts' student) also takes Linnaeus as her topic, and again there is a clear line of development through the topical theme. However, these propositions about Linnaeus are mediated through a secondary source, Lindroth, who appears in the orienting theme 'framing' the projected clauses.

(11)   Bridget A 6/e/43–47

Orienting Theme	Topical Theme	Rheme
Lindroth also concedes that	Linnaeus	was a brilliant observer
and	he	credits his empirical work.
He notes that	Linnaeus	was filled with rapture in his writings about the position of plant leaves in sleep.
and says	Linnaeus	'stands in the midst of living nature and takes its pulse'.
	The thoroughness of his study of the host plants of insects and the life and habits of the tapeworm	is acknowledged by Lindroth.

We can see, then, two lines of development running side by side, one in the phenomenal domain (Linnaeus's empiricism) and another in the epistemic domain (Lindroth's critique), both of which contribute to the coherence of the paragraph. In the second t-unit, however, the two lines meet and merge, where Lindroth (*he*) constitutes the topical theme, and the secondary source itself becomes the object of study. Such reflexivity may be maintained over extended sections of text, as in example 12. Here Linnaeus fades into the background as the spotlight settles on the historian rather than the history.

(12)   Tracey A 6/b/11–14

Orienting Theme	Topical Theme	Rheme
So perhaps	he	is not completely free of any hero worship of Linnaeus even though on the negative side he also says his influence 'probably delayed the development of modern biology'.
Whether 'as the single handed reformer of botany or the solo delayer of development of modern biology'	Lindroth	is portraying Linnaeus as a heroic figure who alone has caused the course of science to be altered.
	This	is now considered to be an outmoded view of the historiography of science unlike the more modern view of individuals, as only part of a whole social context.
So	Lindroth	is perhaps overemphasizing the part played by one Swedish botanist in the ending of an era of botany.

Analysis of the shifting patterns of orienting and topical theme can thus throw light on varying ways of writing history, ways which reflect not simply stylistic variation, but differing conceptions of the nature of history. Baynham (1999) discusses a similar issue in connection with the writing of nursing students, showing how higher-rated essays tended to draw on the literature, and to thematize writers or their arguments. The use of attribution, however, is affected by disciplinary variation in the structure of knowledge, and tends to be more visible in soft disciplines, which are open to multiple interpretations, than in hard disciplines, which build upon an established framework of assumptions. The tendency of the 'arts' students to attribute statements to others, and of 'science' students to present them as factual, may therefore derive from their experience of writing in their previous courses.

   Disciplinary conceptions of knowledge may also affect the use of textual themes. If knowledge is seen as a matter of interpretation, then the writer must do more work to persuade the reader than if the text is seen as a straightforward representation of reality. Writing in the arts, then, may be viewed as more of a rhetorical performance, and the 'arts' students may be following disciplinary conventions in intervening more overtly in their texts. However, this does not provide a complete picture of the use of textual themes, as it fails to explain another finding: a highly significant age effect, with students over 40 years old using 32.59 textual themes per 100 t-units, compared with an average of 23.93 for students under 40 years old

($t = 3.144$, $p < 0.003$). Age did not emerge as a significant factor in any other aspect of theme selection.

These findings may perhaps be related by considering the interconnectedness of textual and interpersonal functions in creating texture and structure. Thompson and Zhou suggest that disjuncts (a type of modal adjunct),

> by overtly appealing to the reader,...invoke negotiation and the reader's co-operation in constructing coherence, whereas conjuncts reflect a more dominant role for the writer in that they guide the reader towards the type of conjunction which the writer has already decided on. (Thompson and Zhou 2000: 141)

From this perspective, both textual and interpersonal themes can be seen as involving writer intervention in the text, with textual themes having a more overtly directive function. It may be that the ability and willingness to take a more authoritative stance is affected by maturity as well as by familiarity with the discourse of the discipline.

Student use of topical themes

While the use of orienting themes provided a clear contrast between the writing of the 'arts' and 'science' students, topical themes were in general used in a similar way by both groups (see Table 5). The great majority of topical themes (82.89 per cent) were subjects, and the proportion was very similar for both 'arts' and 'science' students across all four assignments.

There was, however, a significant difference ($t = 3.056$, $p < 0.004$) in the use of existential themes such as:

(13)   There were problems associated with this policy. (John A 3/c/14)

Existential clauses are generally associated with the function of presenting new information. The 'science' students used such clauses not only more often than the 'arts' students, but also in slightly different ways. 'Arts' students used a higher proportion of negative existential clauses (29.6 per cent compared to 17.9 per cent for 'science' students), such as:

(14)   However,...there would appear to have been no concerted program of atheistic objections to seventeenth French science (Carl A 4/g/65)

Since one normally denies only what the reader might plausibly assume (Wason 1965), it is clear that the information in the rheme of such clauses is *not* being presented as new; rather the writer is responding to anticipated reader expectations. A second point of difference was that 'science' students made more use of paragraph-initial existentials (25.0 per cent of occurrences compared to 7.4 per cent for 'arts' students). One might expect an existential clause in this position to function as a hypertheme or 'topic sentence', prospecting the information in subsequent clauses. Yet despite this, it

was the 'arts' students who more often used existential clauses prospectively (18.5 per cent compared to 16.1 per cent), as in example 13, which introduces the topic of 'problems' before going on to develop it in more detail over the remaining nine t-units of the paragraph. The 'science' students were more likely to include existential clauses to introduce an idea that was not discussed further, as with the following example, which occurred in paragraph-final position:

(15)   There were developments in areas of science associated with navigation and map-making. (Lloyd S 3/d/32)

These differences suggest the possibility that the 'arts' students tended to use existential clauses as part of an interactive process of negotiation with a reader, anticipating and guiding their interpretation. The 'science' students, on the other hand, more often used them simply as a means of introducing a new piece of information, as part of a point by point presentation of facts. This use of existential clauses appears to reflect a view of knowledge as straightforward and uncontested, and may also represent a rather leisurely style of presenting information, rather than the more compact writing required when working to the tight word limits of an assignment essay.

   Apart from existential themes, non-subject topical themes in declarative clauses (e.g. thematized complements or predicated themes) represent highly marked choices. These occurred infrequently in the student essays, with no significant difference between 'arts' and 'science' students. Yet despite their low occurrence, the overall frequency of such themes still appears to be relatively high in comparison with other studies of academic writing. Differences in methodology make exact comparison difficult, but highly marked topical themes appeared to be considerably more frequent in the student essays than in Gosden's corpus of research articles (1992), McCabe's corpus of history textbooks (1999) or Crompton's corpus of undergraduate essays (2002). Francis and Kramer-Dahl associate the use of marked themes with a 'literary' style, as opposed to the 'objective' style more typical of science, in which there is 'no room for the overt mediation and persuasion associated with marked themes' (Francis and Kramer-Dahl 1991: 354–5). If there is a distinction between a more marked literary style and a more objective scientific style, then one might expect less use of highly marked themes among 'science' students. This, however, is not the case. Instead, what emerged from the analysis was a tendency towards more pronounced individual variation, with highly marked topical themes likely to be either unusually common or unusually sparse in the 'science' students' essays. This is a pattern that could perhaps be associated with attempts to cope with writing in an unfamiliar genre. On the one hand, 'science' students might continue to use the more 'objective' style which had become familiar from their writing experiences in previous courses, with relatively little use of highly marked topical themes. On the other hand,

they might try to emulate what they perceived to be the appropriate style for a history essay, and in this case might overuse such themes (see North forthcoming).

One of the 'science' students, Kevin, may perhaps provide an example of this pattern. As illustrated in extract 16, his writing is lexicogrammatically unusual in several respects, and it seems possible that he may be aiming at a self-consciously 'literary' style:

(16)   Kevin S 6/l/66–70

Theme	Rheme
However, the putative thesis of Lindroth that aquiescence of Linnaean botany delaying the development of modern biology	is less certain,
& perhaps	overstates his position.
Implicit in this assertion	is a tenet of internalist historicity, ie. that entities such as scientific theories & procedures conform to a logical progressive development within science itself independently of factors such as time or geographical/social disposition.
Not only is this view of history	considered to be outmoded,
but it	overlooks an important salient fact—the positivist perception that the purlieus of science, as in other fields of human endeavour, is enriched, expanded & matured as much through fault & error as by its more strident successors.

Throughout his essays, Kevin appears to be attempting to write in a style that is not natural for him, and although his is the most conspicuous case, there are indications elsewhere of the students' struggle to appropriate an unfamiliar language. Moving from one disciplinary context to another makes it particularly difficult for students to find a writing position from which they can confidently express their own views. In these circumstances, some may face the dilemma of writing either in a familiar style that is inappropriate to the discipline, or in an appropriate style that is unfamiliar to them.

CONCLUSION

The most striking feature of the assignments considered in this study was the highly significant difference in the grades awarded to students from

different academic backgrounds. This supports the hypothesis that students with previous experience of 'arts' courses at undergraduate level are better able to meet the requirements of essay writing in the history of science, but it also raises the question of what it is in their essays that causes them to be evaluated more favourably.

The results suggest that the higher marks of the 'arts' students may be related to a greater tendency to present knowledge as constructed and contested, rather than as plain matter of fact. The 'arts' students were significantly more likely to use interpersonal orienting themes commenting on the epistemic status of the following proposition. In particular, they thematized other writers much more than the 'science' students, who tended to make more use of unqualified assertions. These differences in the students' discursive practices may derive from the different views of knowledge in soft and hard disciplines, as constructed from varying interpretations, or as deriving from external reality. The literature on historiography, the course documentation, and the comments of the course tutors all point to the importance within historical studies of building an argument through weighing up the competing interpretations of different writers in a field where 'what is said is inseparable from who said it' (Greene 2001: 527). The writing of the 'arts' students suggests that they are better able to achieve this by presenting the phenomenal content of history within an epistemic framework. The more frequent use of orienting themes in the 'arts' essays creates space for the 'interplay between data and argument' seen as a significant feature of writing in history (Becher 1989: 87), with the orienting theme providing an epistemic framing of the phenomenal content. The writing of the 'science' students' essays, on the other hand, may diverge from disciplinary conventions by presenting an oversimplified view of history in which meanings can be made plain and simple, rather than complex, contingent, and mediated.

At the beginning of this paper I drew attention to the disciplinary orientations to knowledge described by Becher, which could be seen to shape particular aspects of disciplinary writing. This research has demonstrated that such differences may also be observed at undergraduate level, in the writing of students from 'arts' and 'science' backgrounds on an Open University history of science course. Even when writing essays on the same topics, the students deployed theme in ways that reflected the views of knowledge typical of their disciplinary background.[5] Although undergraduates are not and may not even intend to become full members of a disciplinary community, it appears that they have already begun to adopt disciplinary ways of thinking and writing, which may facilitate their further studies within that discipline, but conversely, may disadvantage them in an unfamiliar disciplinary context.

ACKNOWLEDGEMENTS

NOTES

1 Student text is identified by a pseudonym followed by A or S to indicate 'arts' or 'science'; then the number of the assignment, a letter indicating the paragraph, and a number indicating the t-unit. Quotations are given verbatim, including any errors present in the original, but with the omission of non-integral citations.

2 These terms are taken from Mauranen (1993), although my analysis differs in some respects from hers. My use of the term 'topical theme' highlights the role of theme in topic continuity, but is not intended to imply an invariant relationship between theme and topic.

3 All significance levels have been calculated in SPSS using a two-tailed t-test for difference between means, with equal variances not assumed. Average figures are given based on the mean of the essays in the sample.

4 The frequency of interpersonal themes also varied from one assignment to another, suggesting that a task effect may be involved, in addition to a disciplinary effect.

5 The fact that they were writing on the same topic may, however, explain the similarity in their use of topical theme, and the lack of any evidence suggesting differences in the relationship between particular and abstract.

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