



0889-4906(94)00022-0

# **Success in Research Article Writing and Revision: A Social-Constructionist Perspective**

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*Abstract* — This paper focuses on the textual revisions involved in the creation of one type of 'successful' written product, scientific research articles (RAs) by non-native speaker (NNS) novice researchers. In this case, 'success' can be judged from the processes of peer review, negotiation, revision, and eventual acceptance for publication of RAs in English-language scientific journals. A systemic-functional linguistic framework of text analysis and interpretive commentary from a social-constructionist perspective show how the *hard, norm-developing* processes of interaction between 'inexperienced' novice and 'expert' RA writers of the scientific discourse community are manifested in linguistic and rhetorical terms. Such insights are of particular interest to English for Academic Purposes practitioners who aim to support the initiation of NNS novices into the international research community.

## **Introduction**

In recent years, across a wide variety of both L1 and L2 settings, there has been increasing interest in the nature of 'success' in writing and the many diverse factors which contribute to it. Berry (1989) comments on the continuing need to make much more explicit precisely what it is that has to be learnt in order to produce 'successful' written products. Making explicit what people know about effective texts might be thought to be particularly the job of the discourse analyst:

yet [they] have been slow to focus on the question of what makes a text successful or not, and even slower to investigate this question in the context of the specialised language varieties of the workplace. (1989: 64)

This paper aims to contribute to our understanding of the diverse processes involved in the creation of one type of 'successful' written product. The broader context is that of academic discourse and the specialized setting, one of scientific research writing by non-native speaker (NNS) novice researchers. Here, the concept of 'success' can be considered quite tangible since it is judged from the processes of peer review, negotiation, revision, and eventual

acceptance for publication of research articles (RAs) in international English-language scientific journals.

By observing novice RA writers' interactions with the various external agencies (both NS and NNS research supervisors, co-workers, academics from other institutions, journal editors, and reviewers), we are able to gain insights, not only into the composing processes and strategies of a particular group of L2 writers, but also into the regulating mechanisms of a particular discourse community. In turn, with an increasing interest in genre-based approaches to language education, such insights contribute to our understanding of the development of 'genre-consciousness' (Green 1987), which is of considerable relevance for L2 writing syllabus design.

A close examination and systematic description of the stages of RA drafting and redrafting which are required to create an RA deemed as 'successful' will be made. However, before the presentation of a detailed text analysis which will highlight these processes, I will first briefly outline the theories in which this study of L2 writing is grounded and the method of analysis devised to investigate textual revisions in RA drafts.

### **A Social-Constructionist Perspective of Composition Theory and Research**

It is well known that there has over the last 20 years been a major paradigm shift in composition theory and research whereby the emphasis has moved from the *product* to the *process* of writing. Within the process camp, the cognitivist or 'writing as problem-solving' viewpoint (see, for example, Flower & Hayes 1981) has been particularly influential in L1 research, and Johns (1990) comments on its enormous influence upon L2 classrooms. However, Johns also warns that "we may be doing our students a disservice by strictly adhering to all tenets of this [process] approach" (1986: 251), and indeed much of the criticism leveled against an overconcentration on process comes from scholars and educationalists working within the genre-based framework of English for Academic Purposes (EAP) and from a systemic-functional linguistic perspective.

Reid (1984a,b) suggests that the cognitive process approach neglects variations in writing processes due to differences in writing tasks and situations and, in particular, it neglects the development of schemata for academic discourse. Horowitz (1986) is most succinct in his criticism: (i) the process approach does not realistically prepare students for academic work since it creates a classroom environment which bears little resemblance to the situations in which students' writing will be exercised; (ii) it ignores certain types of academic writing tasks; (iii) it gives a false impression of how academic writing will be evaluated and reflects what Swales (1990a) calls the *soft* process which protects students from the exigencies of external criteria; (iv) a basic tenet of the process approach, that 'content determines form,' is not necessarily true of academic discourse; and (v) it overemphasizes the individual and neglects the sociocultural context, that is, 'the realities of academia' (Silva 1990: 17).

Bizzell (1982) has also most strongly emphasized this latter point, namely, that academic writing cannot be viewed solely as an inner-directed activity, but that it must also be seen as an acquired response to the preferred modes of communication and discourse conventions of a particular academic community—Swales' (1988, 1990a) *hard, norm-developing* process: *hard* since it anticipates and countenances the reactions of the intended readership and *norm-developing* since it is connected to the persuasive reporting task of the outside professional world (as against *norm-developed*, where it is a question of students showing familiarity with a body of knowledge with little need for subtle negotiation with an outside audience). Martin (1985) considers that the process writing approach, which he believes mystifies what has to be learnt to produce effective written products, strongly disadvantages 'outsider' groups. In his Australian context, he cites migrant and Aboriginal children as potential examples; the same disadvantage is evident for those who wish to, or who are required to participate in their international research community through the dominant L2 written medium of English (Baldauf & Jernudd 1983a,b; Swales 1985). Such groups have the status of 'outsiders' on two counts; firstly, as L2 writers dealing with the challenge of a new genre and, secondly, in their apprenticeship as novices in their fields of academic research.

Because of these many criticisms, Johns (1990) emphasizes the important role of another paradigm for composition theory and research which attempts to fill this sociocultural vacuum, the *social-constructionist* perspective. Here, the product is considered a social act that can take place only within a specific context and audience; the knowledge, the language and the nature of discourse are determined by the discourse community for which it is written. In sociological studies of the writing activities of the academic community, for example, of the initial drafting and revising of scientific papers by researchers in response to feedback and criticism, scholars such as Bazerman (1988) and Myers (1985, 1988) have strongly emphasized the very nature of these writing processes as social action.

However, in commenting on the harsh realities of becoming new members of a particular discourse community, Johns (1990) notes that its implicitly shared goals and discourse conventions may well be difficult for 'outsider' novices to fathom. The many unwritten 'rules of the game' of academic discourse manifest themselves textually in a multitude of subtle ways—how do these come to be appreciated and appropriately imitated by novices? For many EAP practitioners whose primary pedagogic concern is the initiation and successful participation of such 'outsider' groups in their respective international discourse communities, it is clearly important to understand more fully factors which contribute to the development of their *academic* communicative competence (Berkenkotter, Huckin, & Ackerman 1991) and their 'successful' participation in the international research community through publications.

However, as we move away from the more traditional interests and methodologies of the L2 domain into transdisciplinary areas of applied linguistics and social studies of science, how are such problems and solutions to be most effectively explored? Later sections of this paper present data and commentary

which aim to highlight the social-constructionist nature of the RA writing process in response to feedback and criticism. It is naturally intended here that the present case-study approach to documenting key aspects of NNS novices' RA redrafting processes should provide useful insights for broader application and comparison. As well as highly qualitative, interpretive commentary, it is therefore necessary to present quantifiable, systematic analyses of textual revisions based on a model which seeks to explain 'expert' RA readers' judgements of quality, and subsequently, 'success.' First of all, then, the next section outlines a suitable analytic framework within which a social-constructionist perspective of RA textual revisions may be investigated.

### A Systemic-Functional Model of Textual Revisions in Scientific Research Articles

Couture (1985) emphasizes that any model which attempts to explain how written prose affects readers must meet three criteria. It must (1) allow for an analytic examination of texts as directed, multifunctional, social interaction; (2) show how texts achieve thematic unity; and (3) explain how formal items relate to reader response. Working within a systemic-functional linguistic framework, Couture presents a network for analyzing writing quality based on Halliday's tripartite metafunctional organization of language (see Halliday [1978, 1985]; Halliday & Hasan [1989]) and demonstrates that such a semantic system network is effective in meeting the above criteria for the evaluation of writing quality. This network expresses a range of relationships between the elements that comprise a communicative event—that is, between an author and the subject matter [the *Ideational* metafunction], the audience [*Interpersonal*], and the options for text structure [*Textual*]<sup>1</sup> appropriate for a particular situation. Halliday comments that the “enabling” Textual metafunction “breathes relevance into the other two” (1985: xiii); it is only because we can select the desired form of the message [Textual] that we can also use language effectively, both to represent an experience [Ideational (experiential)] and to interact [Interpersonal] with those around us. In her study, Couture demonstrates that “interdependent realizations of Ideational, Interpersonal and Textual functions account for thematic unity in a text” (1985: 74), and that “texts which maintain thematic unity are more delicate expressions of a network of semantic options defined by register and by genre” (1985: 75).

There are various opinions in the systemic-functional tradition concerning descriptions of register and genre (see Martin 1992 for a review); a stratified representation (based on Ventola 1988 and Martin 1992) of the interrelated social systems and structures of register and genre and their realizations in the systems and structures of language is summarized in Figure 1. In Martin's proposed outline, generic elements of structure (or in a well-known EAP

<sup>1</sup> Halliday's metafunctional terms are capitalized (Textual) to distinguish them from nontechnical meanings (cf. textual revisions).

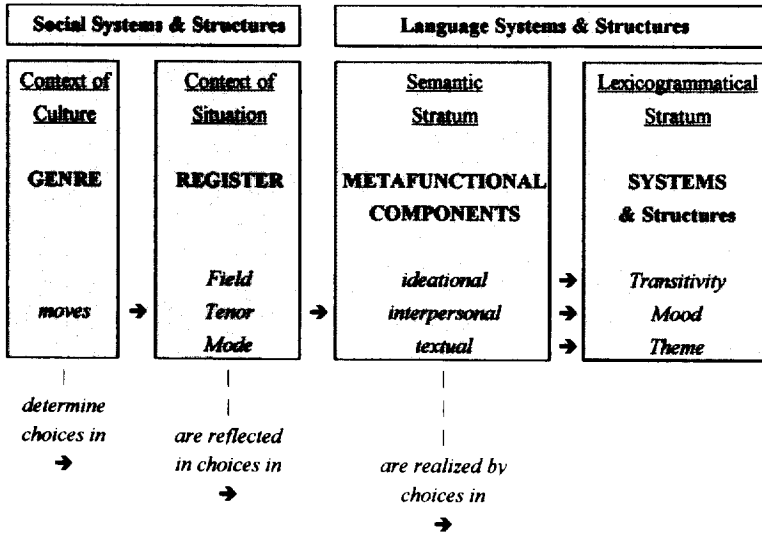


Figure 1. A systemic stratified view of the contexts of genre and register and the linguistic strata of the semantics and the lexicogrammar (after Ventola 1988 and Martin 1992).

context, Swales' familiar Four Moves pattern [1981] or CARS components [1990a]) determine dynamic configurations of the register variables Field (the management of ideas), Tenor (the management of personal relations), and Mode (the management of discourse). RA register configurations are dynamic in the sense that they reflect changing rhetorical purposes as the discourse proceeds. For example, considering its inherent rhetorical goals, an RA Discussion section is clearly more *interactional* (that is, oriented more towards Interpersonal meaning) with its expression of research claims than, say, an outline of Materials and Methods. As seen in Figure 1, register variables themselves (and thereby, the reflected 'higher' order plane of genre and generic moves) tend to be systematically associated with the 'lower' order linguistic system and structures of the lexicogrammar through Halliday's three metafunctional components.

Couture's work shows that "a consistent expression of register and genre as they specify a context in which the text message is relevant is critical to the communication's interpretation and favorable reception" (1985: 75). Since Halliday's tripartite metafunctional organization expresses all dimensions of a writer's control of a text (and, thereby, of textual revisions), it can be suggested that 'success' in scientific RA writing can be evaluated by analyzing textual revisions in relation to a network of Ideational, Interpersonal, and Textual functions as determined by the rhetorical purposes and structure of the scientific RA.

The next section outlines the method of analysis of textual revisions in RA writing adopted here. In light of the above discussion, it is based on a social-constructionist perspective of research writing and relevant work in the soci-

ology of sciences and is applied within a systemic-functional linguistic framework of analysis.

## A Systemic-Functional Framework for the Analysis of Textual Revisions in Scientific Research Articles

In a classic study of scientists' discourse from a sociologist's perspective, Knorr-Cetina (1981) observed the laboratory research and RA writing activities of a group of biochemists. In her detailed analysis of FIRST to FINAL draft revisions of the Introduction to the resulting research paper, she noted three major strategies of textual modification: (a) the *deletion* of particular statements made in earlier versions, either obvious arguments which essentially reinforced a certain point or assertions considered 'weak' or 'dangerous', (b) the *reshuffling* of original statements, leading to a new overall paragraph structure which became 'nested' in the sense that previous topics were resumed at a later stage; and (c) changes in the *modality* of certain assertions, from the necessary to the possible and generally from the strongly asserted to the more weakly asserted.

Analysis of a small corpus ( $N = 7$ ) of NNS novices' FIRST and FINAL RA drafts, on which the present study is based, certainly confirms these same first two strategies, although, in general, the reshuffling of statements on a macro level was relatively more limited in these texts. However, as well as the general *polishing* of texts, the *addition* of technical detail would clearly appear to be a further major modification. Importantly, many additions in FINAL drafts did not simply concern the subject matter, but had important text-organizing properties. In building on Knorr-Cetina's classification, then, five major categories of textual revision are indicated here following initial corpus analysis:

(A) the **deletion** of technical detail or statements [coded in the following analysis as **-TD**];

(B) the **addition** of technical detail or statements [**+TD**];

(C) the **reshuffling** of statements, generally of clauses within the same sentence or of whole sentences [**<R>**];

(D) textual modifications reflecting what Swales (1990a) has referred to as the **rhetorical machining [RM]** of scientific discourse. This major category may be further subdivided according to three basic orientations:

(Di) textual modifications which relate to the rhetorical machining of **discourse structure [RMd]**. A primary resource here is the manipulation of the interrelated structures of theme-rheme and given-new (see Halliday 1985). This category includes the usage of 'minimal' marked Themes as contextualizing frames (Gosden 1992b), such as: *in addition, here, furthermore, now*, as well as more fully lexicalized markers of discourse organisation, such as: *X will be discussed in the next section . . . , as shown in Figure 1 . . . , the first is . . . the second is . . . ,*

- these are summarized . . . .*<sup>2</sup> The addition of markers of contrast, such as: *however, on the other hand, although . . .*, which reflect what Fries (1983) calls the "method of development" of a text, are important components here. At a higher level of discourse reorganization, RA sections may be formally separated and labeled by means of subheading.
- (Dii) changes which relate to RA writers' **claims [RMc]** about their research and which therefore strongly reflect awareness of anticipated feedback from the academic community. As a general defining characteristic, this category includes the addition of a range of hedging devices and the use of modality as originally noted by Knorr-Cetina above, as in: *it can be suggested that . . . , it seems reasonable to conclude that . . . , X may be interpreted as . . . , it is likely that . . . , to our knowledge, possibly, certainly, probably*. In addition, this category focuses on any textual modifications which relate to RA writers' own research hypotheses and limitations, as well as to their research position in relation to other published work: *this evidence leads us to conclude that . . . , more details are required . . . , precise measurement is difficult at this moment . . . , these findings agree with Smith (6) . . .*. Rhetorical machining here thereby reflects increased degrees of writer visibility (Davies 1988; Gosden 1993) and a more dynamic interactional stance as RA discourse progresses to its concluding Discussion.
- (Diii) rhetorical machining which relates to RA writers' **purpose [RMp]** and the expression of reasons for and results of research actions taken and conclusions reached. This category particularly contributes to the necessary "tightly regulated flow of reason" (Knorr-Cetina 1981: 99) with the addition of "minimal" adjuncts, such as: *therefore, consequently, accordingly, thus*, or subordinate clauses, *in order to . . . , because . . . , since . . .*. As with all rhetorical machining of discourse, revisions in this category again indicate an increased awareness of audience expectations.
- (E) The final category of textual revisions noted here concerns the **polishing** of language, generally below clause level. This last category is naturally an important aspect in the final stages of the creation of 'successful' drafts, particularly for NNSs. However, since we are interested in a social-constructionist view of textual revision, the analysis presented here will concentrate on those recognizably *harder* processes involved in categories (A–D) above, with particular emphasis on the rhetorical machining of texts. Instances of polishing, of cleaning up 'careless mistakes,' will therefore not be coded here, although a comparison of FIRST and FINAL drafts would show ample evidence of this.

<sup>2</sup> Examples throughout are taken from the present corpus of NNS novices' FINAL RA drafts.

All of these categories of textual revision reflect the continual reconstrual of the context in which RAs are written and revised for publication. But how can they be related to a linguistic framework for analyzing writing quality and 'success' based on Halliday's tripartite metafunctional organisation of language? Linguistic categories are rarely cut-and-dried, and Halliday stresses the need to talk in terms of *tendencies* and not rules—thus, Figure 2 indicates that the addition (+TD) and deletion (-TD) of technical detail tend to relate to the subject matter at hand, as realized in Ideational (experiential) meanings through the system and structures of transitivity. The rhetorical machining of RA writers' claims (RMc) and expression of purpose (RMp), as seen in RA writers' efforts to convince their audience about the worth of their research, tend to reflect Interpersonal meanings as realized in the systems of mood and modality. The reshuffling of technical detail (<R>) and the rhetorical machining of discourse structure (RMd) tend to reflect Textual manipulation, principally by means of thematic (theme-rheme) and information (given-new) structures and cohesive relations.

Having established a methodological approach, we can now outline the major findings from the application of this systemic-functional network of textual revisions to a corpus of NNS novices' RA drafts. Before this, however, some brief details on the pedagogical background to this study and its corpus of RA drafts are presented.

### Background to the Study

The pedagogical setting in this study is the independent writing of first RAs in English by a group of NNS novice researchers, doctoral students (L1 Japanese) at a science and technology university in Tokyo. Their major fields of research were in the broad areas of the physical and life sciences, more specifically Applied Physics, Chemistry, and Cell Biology. Following task and needs analysis, courses in Academic Writing Skills were set up and mixed groups of 8–10 graduate students attended weekly classes for two semesters. Some of these graduate students (usually MSc or 1st year PhD) attended classes in anticipation of later L2 writing activities; however, since it is a requirement for many doctoral students at Tokyo Institute of Technology that they publish papers (which typically become PhD dissertation chapters) in English-language scientific journals *prior to* graduation, a number of students

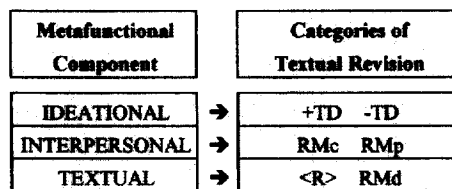


Figure 2. Categories of textual revision as realizations of Halliday's metafunctional components of language.



(2nd/3rd/4th year PhD) were actively involved in writing and redrafting their first scientific RAs in English. In this situation, and importantly, supported by novices' NNS research supervisors, who acted as subject specialist informants (Huckin & Olsen 1984; Selinker 1979), the EAP practitioner takes on teaching and research-oriented roles as both participant in and observer of the many stages involved in the L2 research writing process.

As a method of social research, one of the ideal strengths of participant observation is that the researcher becomes a participant in a naturally occurring social activity, without the introduction of artificiality into social observation and investigation. In settings where the social action under investigation may be generally characterized as covert, as is often the case amongst the academic tribes, participant observation is seen as a particularly valuable research method, as evidenced by the classic ethnographic studies of scientists' discourse and laboratory life by Latour and Woolgar (1979), Knorr-Cetina (1981), and Gilbert and Mulkay (1984). In this approach, data are collected informally in the course of researchers' interactions in normal social life and the accurate recording of data and systematically focused interviews of key informants are normally an essential feature of the approach (Jary & Jary 1991).

In a survey (Gosden 1992a) of NS science journal editors ( $N = 136$ ), 74% indicated that there was a danger for NNS researchers that the value and quality of their research may be disguised by the quality of its reporting. Consequently, the main purpose of EAP-oriented language and research support is simply to assist NNSs compete *on an equal research basis* in L2 English. As part of this process, there is naturally the potential for the participant-observer EAP practitioner to play quite an intrusive role, in terms of assisting in rewriting RA drafts and polishing texts prior to submission to journals. However, an important long-term aim in teaching preparatory courses in Academic Writing Skills is clearly to train NNS novices to become increasingly more independent RA writers rather than to train them to see EAP teachers and other available NSs in a short-term role as proofreaders. On the other hand, one-to-one tutoring and consultations with research students about their RA drafts is naturally a desired (from the NNS's point of view with the burden of having to compete in an L2) and desirable (from the NS's point of view in helping NNSs compete on an equal research basis) part of the role of EAP teacher in providing L2/research support.

Nevertheless, for the present exploratory purposes of a systematic description of textual revisions in RA drafts, it appeared important to discount initially the direct effects of the EAP classroom and one-to-one tutoring, since this may represent the introduction of a kind of artificiality into social observation and investigation. Consequently, analysis here is based on a small number ( $N = 7$ ) of NNS novices' FIRST available RA drafts in English and FINAL versions accepted for publication prior to their participation in an Academic Writing Skills course. Importantly, of available drafts, these seven sets contributed to a complete record for analysis made up from the following accumulated sources: (1) post-process interviews recorded with the NNS doctoral students and their immediate NNS research supervisor about revisions at different stages of

redrafting; (2) correspondence from NS and NNS journal reviewers following initial submission; (3) notes on drafts from other NS and NNS co-workers, co-supervisors, and colleagues from other institutions; and (4) the various English-language drafts (typically three or four in total) themselves.

As indicated above, the seven NNS novices were 2nd, 3rd or 4th year doctoral candidates. It was ascertained that none had spent extended periods of time in an English-speaking environment; they had all had compulsory General English language education up to the 2nd year undergraduate level, traditionally using grammar-translation methodology; none had had any previous training, in Japanese or in English, in “how to write scientific papers.” Beyond these brief details, there was no attempt to objectively measure any degree of homogeneity amongst this group in terms of their English language proficiency. Recent research (albeit in a different educational context) by Cumming (1989) has raised interesting questions concerning the nature of the interaction between writing expertise and L2 proficiency and how relevant it is to distinguish between these two. Since the process of initiation into the international academic community through publications is common (although not at all equal) for all novice researchers around the world, irrespective of L1 origin, it is suggested here that developing awareness of the social-constructionist nature of the *hard, norm-developing* processes of RA drafting, feedback, negotiation, and redrafting is of primary importance to ‘success’ in research publication. In respect of writing expertise, then, all novices (and, in particular, these seven NNSs) are at a similar stage in their academic-professional careers. On the other hand, although Gosden’s (1992a) survey indicated that a great deal of unsolicited language assistance is given to NNS researchers by NS editors and referees (of 127 replies, only 5 said “no language corrections” were given), it would be simplistic to underplay the influence of L2 proficiency on the extra time, effort, and patience required to get NNS researchers’ papers published. Greater expertise is inevitably demonstrated in the development of greater linguistic control over the new genre and its manifest socio-rhetorical goals—an analysis of the functional nature of textual revisions between RA drafts can therefore provide insights into aspects of this development.

### Findings — A Quantitative Perspective

Table 1 below indicates a quantitative overview of data for textual revisions in the seven sets from the FIRST available draft in English to the FINAL published paper. The analysis here focuses on Results & Discussion (R&D) sections only since they reflect text-based analytic and synthetic writing skills compared to the activity-based skills of the Experimental/Methods section (Casanave & Hubbard 1992). Importantly, being subject to the negotiation of “the status that the scientific community will assign to the text’s knowledge claim” (Myers 1985: 593), R&D sections are more typically the focus of revision and rhetorical manipulation since they are the crux of a scientific RA’s potential contribution to the state of current knowledge.

In Table 1, the individual NNS novices’ drafts are numbered 1–7; A–D

**TABLE 1**  
**Overall Percentages for Categories of Textual Revision from NNS Novices' (*N* = 7)**  
**FIRST to FINAL R&D Drafts**

#	N/T	A -TD	B +TD	C (R)	Di RMd	Dii RMc	Diii RMp
1	31/95	0%	23%	6%	42%	26%	3%
2	50/89	14	20	8	28	20	10
3	54/100	2	48	4	24	11	11
4	69/78	12	26	7	26	22	7
5	62/57	19	5	10	24	19	23
6	36/50	9	28	0	33	19	11
7	20/31	5	20	10	10	35	20
Mean %	322/500	9%	24%	6%	27%	22%	12%
Standard deviation		7	13	4	10	7	7
Rank		5	2	6	1	3	4

represent the four major categories of textual revision (for coding key see above); the first column, N/T, indicates the Number of revisions coded per total number of T-units (an independent clause together with all hypotactically related clauses which are dependent on it) counted in R&D sections. For example, NNS novice #1 made 31 textual revisions in categories A–D in the 95 T-units of the FINAL R&D draft. In 4 of the 7 novices' drafts, the R&D sections were formally separated; in the other 3 they were presented as one section with an appended Conclusions. For the present exploratory purposes, these sections were combined in analysis since the rhetorical goals of both formulations as manifested in their move patterns can be considered identical and all R&D textual revisions are expected to reflect a reworking of the perceived rhetorical goals of this particular RA section (see Appendix).

As seen in Table 1, 61% of textual revisions occur under the category of **rhetorical machining**, in particular relating to RA **discourse** structure (**RMd**: 27%) and the expression of science researchers' **claims** (**RMc**: 22%). It is also clear that the addition of **technical detail** (**+TD**: 24%) is implicit in the redrafting process. Individual novices' data and standard deviations indicate a wide range of textual revisions; a larger corpus would therefore be required for more reliable generalizations. Nevertheless, it is suggested that the data in Table 1 reflect the linguistic and sociopragmatic concerns of 'expert' RA readers whose criteria these NNS novices are attempting to satisfy, since as 'experts' they have participated to a greater or lesser extent in the preparation of the manuscripts for publication.

To elucidate the exact nature of such concerns, a group of 'expert' NS editors (*N* = 116) were asked to prioritize 10 language-related aspects which may influence their judgment of the merits of NNS RA submissions and, thereby, acceptability for publication (Gosden 1992a). The 10 aspects covered the *clause/sentence* level (e.g., mechanical accuracy and lexis), the *discourse* level (e.g., topic/theme and paragraph development), and a broader *socioprag-*

TABLE 2  
Overall Percentages of R&D Textual Revisions from NNS Novices' ( $N = 7$ ) FIRST to FINAL RA Drafts as Realizations of Halliday's Metafunctional Components of Language

Metafunctional component		Categories of textual revision
Ideational	→	+TD - TD = 33%
Interpersonal	→	RMc RMp = 34%
Textual	→	(R) RMd = 33%

*matic* dimension (e.g., the language of claims). In editors' replies, the top four aspects most likely to influence judgment were: (1) the logical and clear linking of sentences for the reader; (2) the development of the topic from sentence to sentence in a coherent way; (3) the use of grammatically correct sentences; and (4) the ability to manipulate skillfully the language used in making claims. It is evident from Table 1 that textual revisions between FIRST and FINAL drafts focus on the manipulation of aspects (1) and (2) by means of the rhetorical machining of **discourse** structure (**RMd**) and on (4) by means of the rhetorical machining of the language of **claims** (**RMc**). Grammatical correctness (3) counts because it is time-consuming to rectify "simple syntax problems, poor sentence structure (and the incorrect) use of definite/indefinite articles," which accounted for 54% of language errors most frequently corrected by editors and reviewers according to the survey.

How do the data in Table 1 correlate with textual revisions as defined (in Figure 2) by Halliday's tripartite metafunctional organization? Table 2 indicates that each of the groupings contributed approximately one-third of textual revisions. According to Martin's (1992) formulation (see Figure 1), genres and generic moves are themselves not metafunctionally organized, due to their progressively changing rhetorical goals, and their realization is thus seen to cut across metafunctional components. From the data in Table 2, the parallel can clearly be made that, in the process of textual revision, an RA writer needs to draw to varying degrees on the different linguistic resources represented by the three metafunctions: the addition of purely technical 'content' (Ideational), the balancing of technical *topic-based* and interactional *human face* discourse (Interpersonal), and the manipulation of the structuring of discourse (Textual) for the desired form of the message.

To illustrate the social-constructionist nature of textual revisions in scientific RA discourse from a more qualitative perspective, the next section presents a brief analysis of selected extracts<sup>3</sup> from the FIRST full R&D draft in English available and the FINAL published version of Haga, Nakamura, Sugawara, and Nittono (1991), one of the seven NNS RAs whose data were presented under #5 in Table 1.

<sup>3</sup> Due to limited space, comments are based on only brief extracts of R&D section 3.1 of Haga et al. (1991); total counts do not therefore match the full R&D data given in Table 1.

## Findings—A Qualitative Perspective

Illustrative comments on the different categories of textual revisions are made from the viewpoint of the supposed or evident rationale for changes from the base FIRST draft in English when compared to the FINAL published version. Revisions naturally included the cleaning up of ‘careless mistakes,’ but of particular interest are those which anticipate and countenance the reactions of the intended readership in the light of criticism and feedback.

Sentences from extracts of the two drafts of Haga et al. (1991) are numbered for convenience of discussion, with those from the FIRST draft in round brackets (13), and those from the FINAL draft in square brackets [13]. As part of the interpretive commentary, particularly interesting background observations made by the novice’s NNS research supervisor are integrated in [“quoted square brackets”]; other comments are synthesized from the sources mentioned above; cross-references to other relevant literature are made in {these brackets}; the coding key for textual revisions is as above — each mention (e.g., [RMc]) is taken here as one count for the purposes of quantitative analysis.

### *R&D: FIRST draft (3)–(6)*

(3) The loop shape indicates that the films prepared by this apparatus have a uniaxial magnetic anisotropy in the plane. (4) We guess that this uniaxial anisotropy might be introduced during sputter deposition in this apparatus, because the incident direction of sputtered atoms was not perpendicular to the substrate plane. (5) A magnetic structure of Fe thin film (about 20 nm) observed by Lorentz microscopy with TEM (200 kV) is shown in Fig. 2b). (6) Ripple fringes were observed and magnetization direction was found to be parallel to the average easy axis which was measured by VSM.

### *R&D: FINAL draft [2]–[5]*

[2] The loop shape indicates that the film has a uniaxial magnetic anisotropy in the film plane. [3] In order to check the above anisotropy, an Fe thin film about 20 nm thick, prepared in the same apparatus, was observed by Lorentz microscopy, as shown in Fig. 2(b). [4] Ripple fringes are observed and the magnetization direction is found to be parallel to the average easy axis measured by VSM. [5] Therefore, we guess that this uniaxial anisotropy might be introduced during sputtering deposition in this apparatus, because the incident direction of sputtered atoms was not perpendicular to the substrate surface.

### *FIRST > FINAL redrafting commentary*

(4) This is speculation before adequate description of the Result which comes later in (5 + 6), so delay this comment {see Appendix for patterns of Results and Comments}. Now with the reshuffling [<R>] of FIRST draft sentences (5 + 6 + 4) > [3 + 4 + 5], this speculation can be more clearly contextualized with our reason [RMp] for the speculation; *therefore* . . . in [5].

(5) Why did we observe this *Fe thin film*? — to check the anisotropy mentioned in (3); so in [3] contextualize the purpose of our research action [RMp]: *in order to check the above anisotropy*. [“The correlation between the sentences is not clear, (Haga) only wrote the results not the *purpose* — the readers cannot understand the results if you don’t explain the purpose of the study”].

{Research on expository writing in Japanese draws an interesting parallel here — Hinds noted a common style which he described as “delayed introduction of purpose” (1990: 98). Hinds analyzed texts translated first literally from Japanese, then translated for an English-speaking audience. In the first case,

the purpose of the article is not seen until the final paragraph. On the surface at least, this is an indication of an inductive style of writing . . . . The translation for English readers has a clear statement of purpose as its initial sentence, and the following sentences develop or expand on this statement of purpose. (1990: 91)

Martin points out that a teleological perspective on text function and genre is “useful in accounting for the way in which texts typically move through stages to a point of closure” (1992: 503). In relation to the present R&D draft, this novice RA writer may lack appreciation of the fact that scientific reporting is deductive in style (in English, at any rate) and, following Swales (1990b), that RA readers have discursual expectations about the expression of an RA writer’s underlying purpose. In addition, Knorr-Cetina (1981) makes the important point that in writing up scientific research there is commonly a reversal of the reality of the “laboratory process” and the “story of the paper”:

the impression of a problem-pushed solution which has been researched, rather than encountered by chance, is created in the text through the hierarchical organisation of arguments through which the solution appears derived rather than original. However, this reversal is not the effect of misrepresentation, but part of the literary strategy of the text. (1981: 101)

The increase of cause-purpose Context Frames (Davies 1988; Gosden 1992b), such as: *in order to* . . . from FIRST to FINAL drafts contributes to the creation of this *rhetorical* rather than *scientific* reality}.

*R&D: FIRST draft (10)*

[10] In addition, similar steps were observed in the films deposited on glass slide and mica.

*R&D: FINAL draft [9]–[11]*

[9] Similar steps were also observed for the films deposited on glass slides and mica. [10] Therefore, it was concluded that the appearance of such steps was independent of the thickness ratio and the substrate species, for Fe-layer thicknesses within the examined range. [11] To our knowledge, there has to date been no detailed analysis of such steps on the M-H loops, although similar steplike loops have been reported(6).

#2 Result has been given (in [6]–[9]), but as yet there is no accompanying #2 Comment i.e., explanation/speculation {see Appendix}. [“At first, a lot of Japanese students only ever write Abstract, then Experimental and Results, without Discussion sections in English”]. As in [5], Comment #2 needs to be introduced with a clearly signalled reason [RMP] for their conclusion [RMc] in [10]: *Therefore, it was concluded* . . .

The background to their research action (*analysis of such steps on the M-H loops* . . .) needs to be clearly stated; so, in [11] indicate the comparative gap in research {see Appendix} and thereby the justification for their own work: *there*

*has to date been no detailed analysis* [RMc].<sup>4</sup> The negative tone of this can be better contextualized and softened with: *to our knowledge*, as well as with the additional reference. [“We did a KEYWORD computer citation search but the reference list is nevertheless short — it’s a relatively new field; if we don’t include the statement, *to our knowledge*, this (search) effort is not clear”].

R&D: *FIRST draft* (25)–(28)

(25) And the dependence of Hc on the total thickness deposited under the Fe layer concerned were investigated as shown in Fig. 6. (26) The values of Hc increased when the total thickness under the Fe layer increased. (27) And when the thickness of Fe layer was constant, the values of Hc were on similar line. (28) And the dependence was clearer in a) than b).

R&D: *FINAL draft* [23]–[27]

[23] As a result, it was found that Hc depended on the total thickness of layers inserted between the substrate and the Fe layer concerned, as demonstrated in Fig. 6. [24] When the thickness of the Fe layers is constant, the values of Hc show a linear dependence on the total thickness of the underlying layers. [25] This trend is observed more clearly in Fig. 6(a) than in Fig. 6(b). [26] Consequently, from the analysis of these results, two conclusions can be reached concerning the coercive force of each Fe layer sandwiched in the Fe/Ag multi-layer film: [26a] the first is that, when the thickness of each Fe layer in a film is equal, the Hc increases as the total thickness of layers inserted between the Fe layer and the substrate increases. [27] The second is that, when the total thickness of layers inserted between the Fe layer and the substrate is constant, the Hc of the Fe layer increases as the thickness of the Fe layer increases.

(25) The connector *And* is multifunctional, delete [RMd]. {See Quirk, Greenbaum, Leech, & Svartvik (1985: 930–932); Eiler (1986: 58)}. *And* gives little indication of the Statement of Results {see Appendix A} to come, so as in [5][10], the connection in [23] should be more explicit — for variety: *As a result* [RMp].

{In the scientific RA genre in English, *And* would be highly marked sentence-initial, but [“the equivalent in Japanese is OK”]. In her corpus of L2 writing, Johns (1980) found that the most frequent errors involved those elements which students probably learnt first, for example, the conjunctions *and* and *but*. Eiler (1986) comments that the extensive presence of *and* reinforces the oral nature of discourse, while Bloor and Bloor (1992) noted that inexperienced NNS writers may incorporate features of intonation and stress into their mental perception of writing. Pettinari (1985) commented on the overproduction of certain linguistic forms in her NNS data and hypothesized that as NNSs learn the relevant discourse organization (in this case, of surgical reports), they “fill in” the discourse functions with more appropriate linguistic forms}.

(26) The major Conclusions and implications of this subsection can be clearly grouped together in [26 + 27] [<R>]; they can then be signalled more

<sup>4</sup> The one count of [RMc] coded here illustrates possible difficulties in assessing textual revisions per T-unit quantitatively. A case could be made for three separate counts with the addition if (i) *there has to date been no detailed analysis*; (ii) *to our knowledge*; (iii) the extra reference (6) in [11]. However, from a functional viewpoint, they can be seen to serve the same overall rhetorical purpose at this stage of the discourse — hence the one count registered above.

effectively starting in [26a] with: *the first* [conclusion] *is that* . . . [RMd] and later in [27]: *the second is that* . . . [RMd].

(27) The same weak sentence-initial connector *And* — delete [RMd].

(28) As before, delete minimal *And* [RMd]: consecutive *And And And* — [“poor style”]; signal to the readers in [25] what the graphs collectively show: *this trend is observed* . . . [RMc].

Having decided to group major Conclusions in [26] and [27], this section can now be clearly signalled: *Consequently, from the analysis of these results, two conclusions can be reached* . . . [RMp] [RMc].

### Concluding Remarks

Knorr-Cetina comments that the process of negotiation which precedes publication:

illustrates the fact that the content of a published paper is not merely the result of an author adhering to the conventions of scientific writing . . . technical critique and social control are inseparably intertwined. This implies that the published paper is a multilayered hybrid co-produced by the authors and by members of the audience to which it is directed. (1981: 106)

The analysis of this R&D subsection above shows that a critical part of the *hard, norm-developing* process of redrafting this RA extract entailed the creation of a text which was much more strongly oriented towards reflecting the idealized hypothetico-deductive methodology of science research and towards satisfying the perceived target rhetorical goals of the scientific RA genre. As indicated by the R&D move patterns in Appendix A, different generic and rhetorical constraints operate in discrete RA sections and at different stages of those sections. A clearer awareness of the social control implicit in appropriately realizing these stages is manifest in the attempts in the FINAL draft to strengthen the rhetorical machining of RA discourse, a term which has been adopted here within a systemic-functional framework to serve in the analysis and description of major textual revisions. In this specific case, revisions are primarily concerned with the addition throughout the R&D subsection of Context Frames (Davies 1988; Gosden 1992b) signalling the causes [reason, result, purpose]: *therefore, thus, consequently, as a result, in order to* . . . , for research actions, outcomes, and speculations on their significance.

Other evidence of this individual NNS novice RA writer's growing awareness of audience and writing as social action is seen in Table 3. In the complete R&D section of Haga et al. (1991) (see the full data for #5 in Table 1), textual changes reflecting the rhetorical machining of the registral variable of Tenor (RMc + RMp) accounted for 42% of tallied revisions. For novice RA writers, it is evident that such textual modifications can only become an integral part of



TABLE 3  
Overall % of R&D Textual Revisions in Haga et al. (1991) as Realizations of Halliday's Metafunctional Components of Language

Metafunctional component		Categories of textual revision
Ideational	→	+TD - TD = 24%
Interpersonal	→	RMc RMp = 42%
Textual	→	⟨R⟩ RMd = 34%

a 'successful' scientific research article under the interactive influence of external sources, in anticipation and countenance of feedback and criticism.

The qualitative data of the participant-observer commentary above indicate how the redrafting process reflects the transformation of a once relatively immature, unpublishable piece of writing into a relatively more mature version, now acceptable to the 'expert' RA readers who function as the gatekeepers of the academic community (given, of course, that the scientific research content merits publication). In emphasis of this, we can see from the brief extracts above that the R&D FIRST draft showed evidence of recognized features of 'immature' writing (for example, a greater degree of simple coordination of structures by multifunctional connectors such as *and*) which, by means of redrafting, were emended towards recognized more 'mature' features (a greater range of cohesive devices and subordinate structures).

For EAP practitioners, whose role it is both to participate in and to observe the L2 research writing activities of NNS novices, it is clearly important to understand better how the processes of interaction between relatively unempowered 'novice' and all-powerful 'expert' members of the discourse community are manifested in linguistic and rhetorical terms. The analysis and commentary presented in this paper indicate the kinds of issues which need to be integrated into the EAP writing syllabus as part of the development of novice RA writers' *academic* communicative competence (Berkenkotter et al. 1991). It will not be news to many EAP practitioners that writing process fundamentalism has little to offer their students in dealing with the demands of their highly standardized L2 writing task. The present work represents a strongly product-oriented, functional approach to the learning and teaching of these new genre skills. However, it must be made clear that an outdated process *versus* product mentality also has little relevance here. Since technical critique and social control are inseparably intertwined (Knorr-Cetina 1981) in the research writing process, a central place for the written product in the EAP classroom must translate into developing social awareness of the manipulative potential of academic discourse.

There are clearly limitations to the present exploratory study, particularly concerning the scope of data, the undifferentiated range of RA subject areas, and the highly individualistic nature of textual revisions; in addition, the criteria for distinguishing between categories of revisions are certainly not cut-and-dried. However, the study has attempted to build on the work of Couture (1985) and has addressed the criteria for a model which attempts to explain

perceptions of writing 'quality,' and thereby 'success,' namely: (1) allowing for an analytic examination of texts as directed, multifunctional, social interaction; (2) showing how texts achieve thematic unity; and (3) explaining how formal items relate to reader response. The social-constructionist perspective adopted here, which integrates attention to the scientific RA both as written product and as social process, not only meets Couture's criteria, but suggests the potential for a more strongly genre-based approach to the teaching of 'successful' writing and rewriting skills across a broad variety of both L1 and L2 contexts.

(Received June 1994)

*Acknowledgements* — I am grateful to two *ESP* reviewers for comments on an earlier version of this article.

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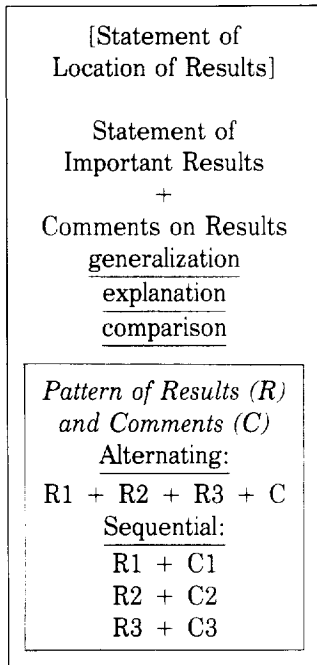
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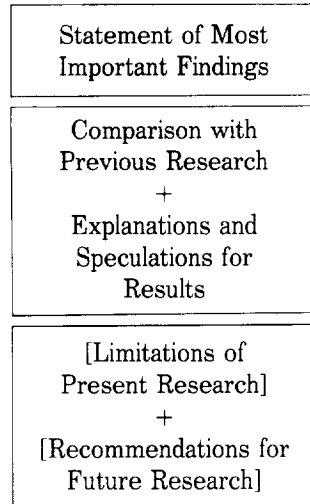
## Appendix

Obligatory and (optional) moves of the scientific RA genre — R&D sections (after Weissberg & Buker 1990 and Swales 1990a).

### Results Moves



### Discussion Moves



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