Writing Without Conviction? Hedging in Science Research Articles

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Hedging is a well-documented feature of spoken discourse as a result of its role in qualifying categorical commitment and facilitating discussion Its use in academic writing has received less attention, however, and we know little about the functions it serves in different research fields and particular genres Hedging is a significant communicative resource for academics since it both confirms the individual's professional persona and represents a critical element in the rhetorical means of gaining acceptance of claims Hedges allow writers to anticipate possible opposition to claims by expressing statements with precision, caution, and diplomatic deference to the views of colleagues Based on a contextual analysis of 26 articles in molecular biology, this paper argues that hedging in scientific research writing cannot be fully understood in isolation from social and institutional contexts and suggests a pragmatic framework which reflects this interpretive environment

1 INTRODUCTION

Hedging is the expression of tentativeness and possibility and it is central to academic writing where the need to present unproven propositions with caution and precision is essential Hedging has received a great deal of attention in conversation analysis where devices such as *I think*, *sort of*, *maybe*, and *possibly* are frequently used to create conviviality, facilitate discussion, show politeness, and oil the phatic wheels (e g Holmes 1984, 1995, Coates 1987) Hedges have also been associated with conveying purposive vagueness (e g Powell 1985, Dubois 1987, Channell 1994), treated as a form of metadiscourse (e g Vande Kopple 1985, Crismore, Markkaned, and Steffensen 1993), and as a means of achieving distance between a speaker and what is said (e g Prince, Frader, and Bosk 1982, Skelton 1988) In linguistics, hedging has been the subject of a considerable body of conceptual and empirical research and we now know a great deal about the semantic and formal aspects of epistemic devices, particularly the modal auxiliaries (Lyons 1977, Coates 1983, Palmer 1990)

Analyses of written academic corpora have revealed some of the characteristics of hedging in textbooks (Myers 1992), economic forecasting (Pindi and Bloor 1986), science digests (Fahnestock 1986), abstracts (Rounds 1982), medical discourse (Salager-Meyer 1994), and molecular genetics articles (Myers 1989) Studies have also shown the importance to academic discourse in

general of modal verbs (Hananıa and Akhtar 1985, Butler 1990), ımprecise numeric expressions (Dubois 1987, Channell 1990) and 'commentative' ıtems (Adams-Smith 1984, Skelton 1988) Together, this literature has demonstrated the clear pragmatic ımportance of hedgıng as a discoursal resource for expressıng uncertainty, scepticism, and open-mindedness about one's propositions However, hedgıng ın scientific research writıng represents a little-studied area of pragmatic competence and we still know little about how ıt functions or ıs typically realized ın specific academic domains In particular, greater attention needs to be paid to the fact that hedgıng represents a writer's *attitude* wıthın a particular context There ıs, therefore, a need for an explanatory framework which accounts for ıts pervasıveness ın academic discourse by situatıng hedgıng ın ıts socio-pragmatic contexts

The most cogent attempt to place hedges wıthın a comprehensıve functional structure ıs that of Myers (1985, 1989) who argues that hedges are part of a wıder system of politeness designed to redress the threat research claims contaın to the 'face' of other scientists While writers seek to gaın recognition ın their field by makıng the strongest claims they can, such claims are lıkely to challenge exıstıng assumptions of the discipline and undermine colleagues' research agendas A varıety of devices are therefore employed to mitigate claims and mınımize these ımpositions Myers' work ıs clearly suggestive and central to any discussion of hedgıng, but hıs extensıon of Brown and Levınson's (1987) conversational model provides only a partial account of hedgıng ın scientific discourse The fact that the public reputation and professional position of every scientist depends on the work and acceptance of peers means a failure to observe appropriate norms of conduct will not merely prevent ındıvıduals securıng goals, but will ıncur sanctions wıth concrete consequences Treatıng hedgıng as politeness thus accents the ınstrumental over the normative, thereby underplayıng the ımportance of authority and conformity ın academic discourse communities, and at the same time neglects the multi-functional character of hedges ın gaınıng acceptance for claims

In science, hedges play a critical role ın gaınıng ratification for claims from a powerful peer group by allowıng writers to present statements wıth appropriate accuracy, caution, and humility Hedges help negotiate the perspective from which conclusions can be accepted This paper provides a functional account for the use of hedgıng ın scientific research articles It ıs based on a detailed contextual analysis of a 75,000-word corpus of 26 articles selected from recent ıssues of the sıx leadıng journals ın the field of cell and molecular biology (SCI 1993) A description of the major hedgıng expressions and their distribution ın thıs corpus can be found elsewhere (Hyland 1996) My purpose here ıs to extend and build on previous work to propose an explanatory framework for scientific hedgıng which combines sociological, linguistic, and discourse analytic perspectives The study draws together strands from different studies to reveal a complex overlap of motivations for hedgıng I suggest here that hedges can only be understood ın terms of a detailed characterization of the ınstitutional, professional, and linguistic contexts ın which they are employed

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2 THE SOCIAL CONTEXT OF SCIENTIFIC STATEMENTS

The role of human judgement in data interpretation, widely accepted in the philosophy of science (e g Kuhn 1970, Van Frasen 1980, Faust 1984, Kourany 1987), implies that a study of scientific discourse is central to understanding the creation of knowledge Knowledge is influenced by the basic elements of the communication process writer, audience, language, and reality This is because transforming claims into knowledge requires reader acceptance and therefore linguistic and rhetorical means of persuasion (e g Brufee 1986) This need for community consensus in the ratification of knowledge, I believe, provides the foundation for the expression of tentativeness and caution in scientific writing statements must reflect the certainty the writer wishes to invest in them

In introducing claims, writers rely on evidential support from statements previously confirmed by the discourse community as truths about the world, and these can be expressed as categorical assertions Every other statement, by which the writer asserts the content to be true as far as he or she knows, is a hedged or *non-factive* statement The ratification of knowledge, of a connection between a state of affairs used as evidence in support of a hypothesis and the hypothesis itself, is not self-evident but depends on an audience for whatever epistemic status it achieves Most work in normal science (Kuhn 1970), which contributes to the cumulative extension of the discipline, is of this non-factive character, referring to what is possibly true rather than what is certain

(1) I suggest therefore that D1 degradability must be causally linked to Q_B site occupation which in turn determines PEST region accessibility to
(2) Possibly, phosphorylation of ACC synthase could contribute to the existence of its different pI forms Alternatively, phosphorylation-dephosphorylation may be involved in the inactivation/activation of the enzyme in vivo

Where there is uncertainty about the evidential status of the assumptions between data and hypotheses, claims require varying degrees of hedging In fact, my data indicates that few knowledge claims are presented in unmitigated form induction and inference rather than deduction and causality characterize most arguments in scientific discourse Thus, writers may have strong grounds for trusting the relations between accepted premises and new results, but uncertainty, caution, and interpersonal factors prevent the categorical assertion of such claims In most cases, probability is explicit and negatability anticipated Writers must acknowledge gaps and limitations in order to present claims and conclusions in the light of accepted knowledge

3 HEDGING IN SCIENTIFIC RESEARCH ARTICLES

The publication of scientific results seeks to accomplish both institutional and individual goals A research paper not only extends understanding of phenomena and theories that the current paradigm deems worthy of study, but also helps support or establish the personal reputation of the writer As I have noted, in seeking recognition for their accomplishments writers will therefore generally make the strongest claim for which they have epistemic authority

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Research scientists acquire academic credibility by gaining readers' acceptance of the most significant assertions their findings will support Securing this objective involves relating illocutionary acts to perlocutionary effects A writer wants a message to be understood (an illocutionary effect) and to be accepted (a hoped for perlocutionary effect) But no matter how clearly, convincingly, and appropriately reader-centred material may be expressed, the writer's ability to influence the reader's response is severely restricted Longino (1990) argues that there is no independent scientific framework for distinguishing the observational from the theoretical and so interpretation of each change depends on what can be contested and what taken for granted So, if 'truth' does not lie exclusively in the external world, there is always at least one plausible interpretation of particular data Readers may therefore be persuaded to judge a claim acceptable or may decide to reject it

This view distinguishes comprehension from interpretation (e g Perfetti and McCutchen 1987) While lexical and syntactic forms determine text meanings, interpretation is unconstrained and subject to knowledge effects which depend on higher-level reasoning skills and world knowledge which are beyond the writer's control The scientific writer can only guide the reader to a particular interpretation through the use of formal meanings but external factors, particularly the reader's prior knowledge, affect interpretation (cf Bazerman 1985) Readers can always refute a claim All statements require ratification and because readers are guarantors of the negatability of claims this gives them an active and constitutive role in how writers construct them This is why mitigation is central to academic writing, as hedging signals the writer's anticipation of the opposition to a proposition

This opposition can be divided into two types, content- and reader-oriented First, claims have to correspond with what is believed to be true in the world Hedges here will be referred to as 'content-oriented' and concern a statement's *adequacy conditions* the relationship between a proposition and a representation of reality (e g example (3)) Secondly, a proposition which could be presented categorically from an objective perspective may be explicitly hedged because of reader considerations Thus, reader-oriented hedges incorporate an awareness of interpersonal factors, meeting *acceptability conditions* (e g example (4))

(3) This implies that the extent to which the endophyte might effect N metabolism under field conditions could also depend considerably upon other interacting factors

(4) From our investigations we conclude that the data of Wydrzynski et al can be seen in a different light when the adverse effects of CI deprivation are seen in conjunction with

In sum, hedges anticipate a need to justify claims because the writer is dependent on their ratification by the reader The writer must make a hypothesis both about the nature of reality and about the acceptability of the hypothesis to an audience, the question of adequacy corresponding to the

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objective negatability of a proposition and acceptability to its subjective negatability

Content-oriented hedges can be expressed at two further levels of delicacy First, there are two distinct reasons for modifying a proposition so that it corresponds with reality One is an obligation to present claims as accurately as possible, the second concerns the need to anticipate what may be harmful to the writer The two are likely to overlap in actual use but forms will be referred to respectively as *accuracy-oriented* (e g example (5)) and *writer-oriented* reasoning (e g example (6))

(5) These EGTA clots are transparent and possibly comprised of thinner fibres than the
(6) The figures suggest that the determining factor for the protein response was whether

Accuracy-oriented hedges can be further distinguished according to whether they involve a qualification of predicate intensity (*attribute hedges*) or writer confidence (*reliability hedges*) The first reflect the difficulties of using a limited language to describe the variability of natural phenomena (7), while the second indicate writers' confidence in the certainty of their knowledge (8)

(7) Staining was generally confined to the vascular tissues
(8) The photoreceptor involved is somehow related to the photosynthetic apparatus itself

This model is summarized in Figure 1 In summary, this framework seeks to account for the form of sentences by showing how they anticipate possible objections Scientists gain and keep reputations by making the highest level claims they can, demonstrating that they deserve credit for something new But in presenting such claims they must meet both adequacy and acceptability conditions They therefore use hedges to reduce the risk of negation on objective grounds, i e the match between propositional content and what reality is believed to be like, and on subjective grounds, relating to acceptable levels of self-assertion, deference, and willingness to debate Both are epistemically modalized forms of speech where what is said is related to what is meant by a regard for reader perspective

4 A FUZZY CATEGORY MODEL

Analysis of epistemic language use soon reveals that hedging devices are polypragmatic, they can convey a range of different meanings, often at the same time As a result, they do not fit into a neat scheme of discrete categories which allows one meaning to be clearly distinguished from others Moreover, not only is it impossible to relate particular forms exclusively to specific functions, but the expression of simultaneous meanings introduces the problem of *indeterminacy* in specifying cases So while hedging devices express writers' attitudes to both propositions and addressees, the choice of a particular device does not always permit a single, unequivocal pragmatic interpretation Particular forms

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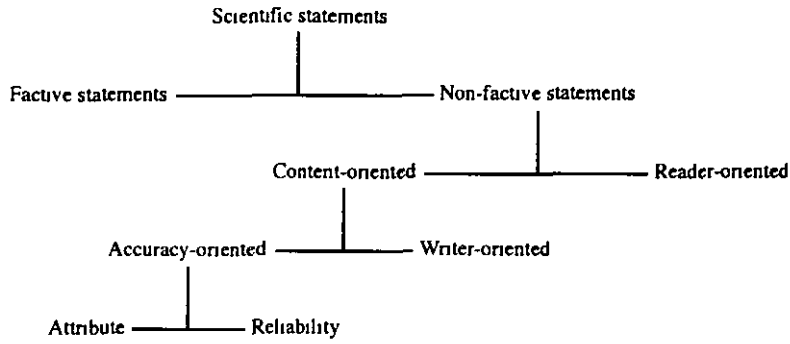

Figure 1 Categorization of scientific hedges

often convey more than one function and a complex overlap of usage suggests that the precise motivation for employing a hedge may not always be clear We cannot assume a given device will always function to hedge propositional content, for example, nor that evidence for a particular function will always be found in the linguistic environment The resulting ambiguity can, of course, become an important strategic option for writers when presenting information

Consequently a theory of fuzzy-sets with graded membership, as proposed by Zadeh (1972) and taken up by Coates (1983), appears to offer a better approach

> A fuzzy-set is a class with unsharp boundaries, that is, a class in which the transition from membership to non-membership is gradual rather than abrupt (Zadeh 1972 4)

Zadeh observes that fuzziness plays an essential role in human cognition and believes that most classes in the real world are fuzzy The essential feature of fuzzy-sets is that they allow the gradual transition to membership so cases are not restricted to binary end-points but can range between them, with some examples denoting a greater degree of membership of one category than another At the core, an expression will most closely approximate to the meaning of that category while examples at the periphery will exhibit less precise meaning Thus, core examples of writer-oriented hedges will involve self-protection by hedging commitment, while examples toward the periphery will show more concern with propositional accuracy

Such a model accounts for the vagaries of my corpus and recognizes the flexibility between language and context which serves several concurrent goals Moreover, analysis reveals the importance of four variables in determining core cases These concern the degree of specification, verification, agentivity, and co-operation Each variable is related to hedging by the assumptions it allows the reader to make about the writer's attitude to the proposition or its context

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The first point concerns the extent to which the propositional content is precisely expressed A high degree of *specification* of propositional elements is associated with content-oriented strategies and particularly with attribute hedges These determine how far the terms used accurately describe the events or states referred to in the proposition *Verification* refers to the acknowledgement of uncertainties about the truth of a claim It indicates the confidence that can be invested in a statement and is associated with reliability type accuracy hedges *Agentivity*, whether the action or state described in the proposition is explicitly associated with the writer, is critical in distinguishing reader- and content-oriented hedges Core examples of content hedges occur in non-writer agent contexts, while reader-oriented cases are generally found in writer agent environments Finally, *co-operative* features, such as invitations, offering alternatives and reference to shared assumptions, indicate the extent to which the writer seeks to involve the reader in the ratification of the claim

The model suggests the following tentative generalizations in determining core cases

1 Where the principal role of the hedging device is to specify the extent to which a term accurately describes the reported phenomena, it is likely to be acting as an *attribute hedge*
2 Where the principal role of the hedging device is to convey the writer's assessment of the certainty of the truth of a proposition, then it is likely to be performing a *reliability function*
3 Where the device occurs in a context which conceals the writer's viewpoint and avoids personal responsibility for propositional truth, then it is probably acting as a *writer-oriented hedge*
4 Where the writer acknowledges personal responsibility for the validity of propositional content or invites reader involvement, then the device is likely to be acting as a *reader-oriented hedge*

However, while these variables greatly assist the identification of discoursal function in many instances, a number of them may be operative in any particular case Indeterminacy remains a feature of hedging devices and cases assigned to one category will often include meanings associated with another I will now describe the model in more detail, beginning with content-orientation

5 CONTENT-ORIENTED HEDGES

Content-oriented hedges mitigate the relationship between propositional content and a representation of reality, they hedge the correspondence between what the writer says about the world and what the world is thought to be like The motivations for these hedges fall into two overlapping categories, concerning the writer's focus on propositional accuracy or on self-protection from the consequences of poor judgement, although there may be an element of both purposes on any particular occasion Accuracy-oriented and writer-oriented hedges will be discussed in turn

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5 1 *Accuracy-oriented hedges*

These involve the writer's desire to express propositions with greater precision in areas often subject to revision Hedging here is an important means of accurately stating uncertain scientific claims with appropriate caution (Rounds 1982, Skelton 1988) and aims at reducing the risk of negation on objective grounds Almost all academic discourse is a balance of fact and evaluation as writers try to present information as fully, objectively, and accurately as possible Such Gricean constraints are important in research articles (RAs) because scientific cognition is often hedged with interpretation The main function of accuracy-oriented hedges is to imply that the proposition is based on plausible reasoning in the absence of certain knowledge, they ask that a proposition be understood as true as far as can be determined These hedges represent the 'institutionalized' language of science since they help convey the state of knowledge They enable readers to distinguish between what is actual and what is only inferential and imply that the writer has less than full warrant for categorial assertion Personal commitment is either not involved or is subordinate to this function The two types of accuracy-oriented hedges, attribute and reliability, have different motivations and realizations

5 1 1 Attribute hedges

Science is predicated on the assumption of a world independent of language, but the ability of words to represent a non-linguistic domain of objective facts is heavily dependent on a shared, conventionalized cognitive schema of what the world is like Natural phenomena do not always dovetail with such models, however, and variations between experimental results and an idealized conception of a particular relationship, behaviour, or procedure are common The use of attribute hedges allows deviations between idealized models of nature and instances of actual behaviour to be accurately expressed They enable writers to restructure categories, define entities, and conceptualize processes more exactly to distinguish how far results approximate to an idealized state, specifying more precisely the attributes of the phenomena described

In these examples, hedges are used to indicate variability with respect to certain descriptive terms In (9), the degree to which the detected response is considered 'normal' for the behaviour of those proteins is hedged, while in (10) it is the comparison between two variables in terms of a given feature In (11) 'essentially' denotes a deviation from an ideal conception of a particular process

(9) The response of the assembly of PSII proteins to the solute environment is unique in some ways, but quite normal and predictable in others

(10) Although variable, the isoelectric point of kunitz seed inhibitor is generally lower

(11) The partially purified PEPc kinase phosphorylates PEPc with a stoichiometry approaching 1 and causes essentially the same reduction in sensitivity

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Attribute hedges indicate a discrepancy between actual results and either an expected state or the concept routinely available to explain it, allowing a better match with familiar descriptive terms Attribute hedges generally cluster around this pragmatic core and involve the use of a finite set of items which Ernst (1984) labels 'degree of precision' adverbs Such devices have received some attention in the literature (e g Powell 1985, Channell 1990 and 1994) and are similar to Prince *et al* 's (1982) 'rounders' A number of these act as 'downtoners' (Quirk *et al* 1972 509) which weaken the force of an attribute and can be graded as to their strength, with those realizing the greatest effect almost negating the force of the term modified (14)

(12) This shift could be partially caused by solvent-exposed α-helical segments of its coiled-coil portion
(13) This appearance of kinase activity correlates quite well with
(14) while in the control, pTACC-C7 ACC synthase was barely detectable

Style disjuncts also function as attribute hedges as these indicate greater precision in conveying the sense in which a proposition may be held to be true

(15) at an acidity that generally guarantees a quite stable assembly of the PS II
(16) decreases by approximately 60% at 44°c.

Finally, a qualification can indicate the precise standpoint from which to judge the truth of a claim

(17) Viewed in this way the concept of lateral heterogeneity becomes obsolete because the distinction between granal and stromal lamellae for
(18) Finally, from a practical point of view, the $tRNA^{asp}$ extended transcript could serve to produce large quantities of wild type $tRNA^{asp}$ transcripts

In each case, the hedge acts to qualify the predicate intensity or the validity of the state of affairs expressed in the proposition In sum writers use attribute hedges to seek precision in expression, and core examples encode variability, rather than writer perspective

5 1 2 Reliability hedges

Reliability hedges indicate the writer's confidence in the truth of a proposition They acknowledge subjective uncertainties and are motivated by the writer's desire to explicitly convey an assessment of the reliability of propositional validity They deal with the epistemically possible and contingent although such subjective inferences can be confused with objective possibilities and often only participant understandings can disambiguate a hedge from a verifiable possibility Reliability hedges suggest the writer's reservations concerning whether the situation actually obtains, keeping interpretations close to findings, where claims may be less tenuous

(19) However, the opposite is also possible, and it cannot be ruled out that the 21-kD polypeptides seen in the bacteroid lane and in the soluble proteins lane are

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(20) Together these results are consistent with the possibility, although do not prove that the capacity to mediate the FR-HIR may be an intrinsic property of phytochrome A

The principal motivation here is a desire to clarify the state of knowledge, a hedge against complete accuracy, rather than protection against overstatement In these core cases, acknowledgement of factual uncertainties predominates over attempts to disguise the author's opinion

Reliability hedges are most commonly expressed by epistemic modal verbs, epistemic adjectives, nouns, and adverbs These examples all seem to be largely concerned with precision

(21) the high activity of NAIV raises the possibility that the molecule of interest may be IAA-valine
(22) Oscillations in fluorescence and O_2 evolution activity are probably an expression of this short-term adjustment capacity
(23) it appears possible that the mechanism causing the light-activated fluorescence quenching may be triggered by either photosystem

Content disjuncts are commonly used to mark reliability as they comment on the probability of propositional truth They include both adverbs of certainty, which simply convey doubt on the information (24 and 25), or of mental perception which show how results are understood (26)

(24) These screens were performed in white light, presumably precluding detection of mutants in the FR-HIR
(25) This modification could possibly play a role in substrate binding
(26) Inactivation of the plastid genes is apparently not due to major recombinational events at the level of ptDNA, since restriction enzyme patterns

As reliability hedges specify the actual state of knowledge, there may be some hesitation about the strength of the connection between observed and assumed events, as these two examples show

(27) Slow PS I turnover may favour Q_B binding to PS II or at least not prevent it
(28) This single mismatch may simply represent a *Taq* polymerase error, or it may result from amplification of a transcript from a different member of the PEPC gene family

In both cases, confident conclusions are avoided by proposing alternative formulations of a claim

All reliability hedges express a conviction about the truth of a statement as warranted by the available facts, relying on inference, deduction, or repeated experience Some examples, however, are difficult to distinguish from a defensive lack of commitment While writer-oriented hedges similarly display a reluctance to stray from the data, they carry an *additional* unwillingness to make a commitment to conclusions Reliability hedges, on the other hand, essentially make claims contingent due to knowledge limitations, and this is occasionally made explicit

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(29) It is not known whether such a weak temperature response
(30) The mechanisms involved in the control of conductance through the stomata are poorly understood The guard cells could respond to messages from the leaf mesophyll, or have their own CO_2 sensing mechanisms because they possess chloroplasts

In summary, accuracy hedges contribute precision and work to specify a state of knowledge rather than hedge the writer's commitment Both accuracy and reliability types are principally concerned with interpretations of the world via laws of reason and seek to increase the exactness of a claim, either by modifying the sense in which terms describe reality or by stating a more precise appraisal of certainty In either case, core examples focus on propositional precision The writer's desire for protection from the possibility of error is either not implied, as in attribute hedges, or is of secondary importance However, the line between hedging confidence in the accuracy of statements and hedging commitment to them is often blurred, and core cases, where either uncertainty or protection can be exclusively distinguished, are relatively rare Contextual and formal considerations can only identify the *predominant function*, rather than offer a definitive categorization

5 2 *Writer-oriented hedges*

These limit the writer's commitment to statements Writer-oriented hedges enable writers to refer to speculative possibilities while at the same time guard against possible criticism, they are therefore often associated with higher-level claims than accuracy-oriented ones Because the writer is seeking to place results in a wider context and demonstrate a contribution to the scientific pool of knowledge rather than simply interpret findings, such claims carry a greater risk and an element of self-protection may be necessary Simply, greater generalization and interpretation require a greater degree of hedging (cf Hunston 1994) Writer-oriented hedges therefore create a clear pragmatic contrast with other content hedges accuracy-oriented hedges are *proposition-focused* and seek to increase precision by referring to the exact state of knowledge or to how a proposition is to be understood, writer-oriented hedges are *writer-focused* and aim to shield the writer from the consequences of opposition by limiting personal commitment These hedges thus *diminish* the author's presence in the text rather than *increase* the precision of claims As suggested by the fuzzy-set model, this is necessarily a matter of degree

While this usage follows Lakoff (1972) in associating hedges with 'fuzziness', scientific writers do not seek acceptance for claims through purposive vagueness or fudging What is made fuzzy is the relationship between the writer and the proposition, rather than the claim itself These hedges help minimize the scientist's personal involvement and thereby reduce the probability of refutation This allows writers to 'anticipate and discountenance negative reactions to the knowledge claims being advanced' (Swales 1990 175) Prince *et al* (1982), Rounds (1982), Powell (1985), and Nash (1990) have all suggested that hedges may serve as an insurance in helping writers protect their

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reputations and limit the damage which may be incurred from categorical commitments

In core examples, care is taken to avoid assuming explicit responsibility for an assertion while seeking to secure 'uptake' by moving the reader to the writer's standpoint

(31) The present work indicates that the aromatic ring to which the carboxyl group is bound is not necessary, provided that a bulky substituent is present
(32) Although it is premature to answer this question it might be suggested that synthetases present in nuclei [33] could be involved in the regulation of the processing of

The most distinctive signal of writer-oriented hedges is the absence of writer agency The author's responsibility can be reduced by the use of passive constructions (33), clausal subjects (34), or the construction of 'abstract rhetors' which nominalize a personal projection (35–37)

(33) The BS fraction is assumed to originate from the center of the
(34) It might be speculated that the lack of crDNA methylation in cv Platenese could

(35) These data indicate that phytochrome A possesses the intrinsic

By foregrounding 'These data' (35), the writer presents a view where data, vested with agentivity, are attributed with primary responsibility for an interpretation, they become the source of the claim

Judgemental epistemic verbs, particularly speculative (e g *assume*, *predict*, *propose*) and evidential verbs (e g *appear*, *seem*), in impersonal phrasings are a principal means of withholding personal commitment The tentativeness relates mainly to the commitment the author wishes to bestow on the statement rather than a strict concern with the truth of its propositional relationships

(36) Circumstantial evidence indicates specific shifts in the mRNA levels for
(37) The theoretical line assumes that the partial pressure of CO_2 is the same in the
(38) The model implies that the function of granna is to shield
(39) From this discussion, then, it would appear that some of the changes in amino acid concentrations

Another strategy to achieve distance from a claim is to attribute its source, or underpinnings, elsewhere Thus, writers may refer to wider bodies of knowledge when moving away from what can be confidently implied by their results or methods

(40) This hypothesis seems plausible because UV-B-absorbing flavonoids accumulate in leaf epidermal cells, where they may protect the inner cell layers from UV-B damage (Caldwell et al 1983, Beggs et al 1986)

Writer-oriented hedges often accent the procedures and methods of science, a feature less salient in other forms of hedging Indeed, reference to methods, the models employed, or the conditions under which the results were obtained are an important means of hedging personal commitment

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(41) Under these conditions phosphorylation of PEPc by the partially purified kinase caused a concomitant 3- to 4-fold increase in the

(42) The prediction of this model is that aminooxyvalerates with aromatic rings characteristic of potent synthetic auxins would be good candidates for active molecules

(43) Despite the limitations of this method, the results suggest that the protein mentioned

In sum, these devices function to hedge the writer's commitment to propositional content while leaving its truth value open The avoidance of a strong alignment with a proposition is the defining feature of writer-oriented hedges They allow authors to seek acceptance for the highest-level claim they can for their results while protecting them from the full effects of its eventual overthrow Indeed, a hedge can alter the context of the statement in which it occurs so that the resultant claim is very hard to falsify Writer-oriented hedges diminish personal responsibility for a variety of reasons (e g Latour and Woolgar 1979 75–87), but they are often the result of the preliminary character of much scientific research, which accordingly has to be hedged against later falsification Often results are presented in areas where hypothesis testing is extremely difficult, but the forces of discovery and recognition provide a context in which productivity is a measure of professional worth and which results in the need for early and frequent publication

5 3 *Summary of content-oriented hedges*

Overall, content-oriented hedges are a major communicative resource as they enable scientific writers to both negotiate the precision of claims and convey an attitude to them On one hand, the writer seeks to present statements with appropriate accuracy, on the other, to make the strongest claim possible while limiting the damage of error This is principally achieved by a repertoire of lexical markers and various hedging strategies, although it is difficult to exclusively assign specific devices to particular functional categories. Frequently, statements include several functions, thus in (44) the presence of an abstract rhetor, evidence, and supporting testimony indicates writer-orientation Reference to the limited state of knowledge and alternative readings carries reliability functions

(44) Thus the evidence strongly favours the conclusion that phytochrome A is the primary, if not exclusive, FR-HIR photoreceptor, consistent with previous physiological studies (Beggs et al 1980, Holmes & Schaffer, 1981, Smith & Whitelam, 1990) On the other hand, the possible involvement of phytochromes C, D, or E in an interactive or synergistic manner with phytochrome A cannot presently be ruled out

The blurred distinction between qualification of confidence and of commitment means particular forms will invariably carry elements of both meanings In terms of a fuzzy-set model, core examples of content-oriented hedges will

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contain proposition-focused meanings, but the majority of cases are likely to occur at the periphery and convey shades of writer-focused meanings

6 READER-ORIENTED HEDGES

While hedging is traditionally linked with the objective dimension, securing ratification of scientific claims also involves reducing the risk of negation on subjective grounds Core examples of reader-oriented hedges confirm the attention writers give to the interactional effects of their statements

6 1 *Motivation for reader-oriented hedges*

It was argued above that the functional similarities of illocutionary mitigation in conversation and research writing suggested by Myers (1989) neglects important differences between the two domains A straightforward application of imposition, distance, and social power cannot fully explain scientific hedging I suggest that collegiate deference occurs both as a response to discourse norms of communication and the fact apodictic statements are *inherently* face threatening to peers

Essentially, in presenting claims a writer also projects a *persona* which carries information concerning the writer's professional attitudes to the discipline (cf Campbell 1975) This professional personality is crucial to achieving rhetorical goals as it also conveys an attitude about the reader and his/her role in the negotiation of knowledge claims Presenting claims as ex-cathedra assertions displays an unacceptable deviant persona as it ignores any involvement by the reader in the ratification of claims Categorical assertions leave no room for *negotiation they imply an assurance in the certainty of arguments that require* no feedback, and this relegates readers to a passive role Hedged statements, on the other hand, mark claims as provisional, they invite the reader to participate in a dialogue Hedges solicit collusion by addressing the reader as an intelligent colleague capable of participating in the discourse with an open mind Good arguments are only 'good' from a particular perspective and hedges work to create this perspective Once this is achieved, arguments can be based on other criteria

Together with this interpersonal dimension, there is a normative aspect of reader-oriented hedges Acting as a scientist involves implicit and informal 'rules' of communicative behaviour (e g Becher 1989) These rules also govern scientists' communication styles, where expectations include an obligation on the writer to defer to the views of colleagues, adhere to limits on self-assurance and engage in debate with peers So while a paper must carry conviction, it must also appeal to the reader as a knowledgeable scientist, able to decide about the issues presented

Convention, rather than calculation of personal cost, may drive this system, but it is underpinned by the possibility of sanctions which can influence one s career These operate through the peer validation of claims The fact that knowledge accreditation is a social process means the achievements and reputation of every scientist are in the hands of colleagues Having research

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contributions accepted in reputable journals being cited by others, acquiring research grants, receiving professional honours, etc are badges of success which depend on adherence to scientific norms The mere act of participating in the formal communication system emphasizes the extent to which the individual's investigations and discoveries are dependent on the work and acceptance of others Publishing a paper involves entering into an interactional contract with one's readers concerning the conduct of scientific debate, the elaborate communication system which manages publication and validates knowledge thus also regulates authors and helps enforce stylistic conventions This framework of institutional obligations enables participants to get on with the task at hand

6 2 *Forms of reader-oriented hedges*

Again, the data does not allow functions to be unequivocally distinguished since many devices are used to convey both reader- and writer-based hedges Core cases of reader-oriented hedges are most obvious, however, in managing substantive disagreement and avoiding conflict

(45) We do not know the reason for the discrepancy between our results and those of Ngernprairitsin et al, but it might reflect genetic differences in the cultivars employed

(46) Quick et al also noted that there was no consistent effect of reduced Rubisco ( ) Our results do not support the latter observation, because conductance decreased with increasing p_i in both control and anti-SSu plants (fig 5)

(47) There has been some disagreement concerning whether illumination increases the V_{max} of PEPc (eg refs 1, 2, 4, 11) In our hands, there was no significant change in V_{max} on illumination

A variety of devices is used here to soften the effect of criticism While modal auxiliaries and an admission to a lack of knowledge express an uncertainty which avoids direct criticism, it is the choice of personal subjects which is critical The frequency of first person pronouns (whether singular, or, in the case of multi-authored papers, plural, as here) in science is confirmed by Banks (1993) who found they occurred four times more often with hedging verbs than other verbs But while Banks believes this serves to 'trim' or reduce the force of the hedge, my interpretation is that an overt acceptance of personal responsibility mitigates the expression of a proposition and signifies a reader-oriented hedge

As Myers points out, expressions of personal belief weaken claims because they are inconsistent with the supposed universality of scientific knowledge (Myers 1989 14) Reference to the writer's direct involvement in the research is therefore a conscious strategy to subtly hedge the generalizability of a claim and mark a position as an *individual* interpretation Reference to the writer explicitly marks a statement as an *alternative view* rather than as a definitive truth, the hedge signals a personal opinion, allowing the reader to choose the more persuasive explanation The use of *impersonal* expressions to comment

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on others' work, on the other hand, suggests a writer-oriented hedge Where writers are more concerned with protecting their credibility than with the non-ratification of their argument criticisms are often more diffuse, with a tendency to avoid attributing what is criticized to a particular source

(48) Thus the existence of multiple gene families and expression of multiple ACC synthase isoforms question the validity of earlier results obtained with either crude plant extracts or partially purified enzyme preparations
(49) In spite of its shortcomings, the method has been widely employed to evidence this type of modification in a number of genomes including plastid and nuclear ones

In addition to weakening criticism, personal attribution is also used to soften claims This makes frequent use of epistemic verbs, particularly verbs of judgement (50 and 51) and deduction (52 to 54)

(50) Thus we propose that this insert is the major site of interaction with the membrane
(51) I believe that the major organisational principle of thylakoids is that of continuous unstacking and restacking of sections of the membrane
(52) Of this percentage, we calculate that more than half is present in the coiled-coil portion and the rest in the globular domain
(53) We infer that the rate becomes limited by the rate of regeneration of RuBP-saturated Rubisco kinetics,
(54) Our interpretation of these results is that the total level UV-B

Thus, by specifying a personal source, the writer leaves the claim open to the reader's judgement, often combining with a writer-oriented hedge to specify the limits within which the claim holds

(55) Under these conditions, we predicted that seedlings would respond through the action of phytochrome B, and thus allow

Deference to the reader may also be achieved by offering a claim as one possibility among many, using the indefinite article (56) or hypothetical conditionals (57) to suggest alternatives

(56) a model implying almost complete lateral heterogeneity in the thylakoid membrane
(57) If we assume that the apparent molecular weight obtained by SDS PAGE is correct, this suggests that only a few amino acids are missing from the N-terminal end and that a leader sequence may be encoded

Questions may also serve as hedges These appeal to the reader as a fellow scientist involved in the problems of empirical research and engaged in the communality of the scientific quest

(58) Could such a putative interaction of an aminoacyl-tRNA synthetase with precursor tRNA have a physiological significance?
(59) How is it, then, that this gene from a species that never forms nodules has the capacity to be expressed at elevated levels in nodules?

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The writer thereby hedges the claim to be made by explicitly drawing the reader into the deductive process, rhetorically treating the audience as capable of making the same logical inferences

In sum, these hedges recognize the need for reader acceptance in accrediting knowledge and respond to the possibility of opposition to claims on interpersonal grounds Here, writers consider both the reader's role in confirming knowledge and the need to conform to community expectations regarding deference to colleagues' views Core examples are therefore distinguished by features addressed to the needs of an audience which anticipates involvement in negotiating claims

7 FUNCTION AND FORM IN SCIENTIFIC HEDGING

Scientific writers are oriented both to what they say and who they are saying it to and the type of hedge used conveys a choice in how to best negotiate the ratification of their claims Three main functions of hedging in scientific RAs have been suggested First, to present claims with greater precision with respect to both the terms used to describe real-world phenomena and the degree of reliability the writer invests in the statement Second, to signal reservations in the truth of a claim to limit the professional damage which might result from bald propositions Third, to give deference and recognition to the reader and avoid unacceptable over-confidence The first two relate to the strictly epistemic functions discussed by Lyons (1977), Palmer (1990), and others, and express doubt in statements The third concerns the writer's contribution to the development of a writer–reader relationship in gaining reader ratification These functions are summarized in Table 1

Because it is writers, not sentences, that hedge, contextual understandings play a crucial role in the design and interpretation of scientific arguments In particular, the confirmation of claims and the rewards of publication help clarify the use of hedges in science Essentially, writers seek agreement for the strongest claims they can for their evidence while neutralizing the possibility of opposition by meeting both adequacy conditions, between the proposition and the world, and appropriacy conditions, between the proposition and the reader Whether a writer will choose to hedge or present information categorically therefore depends on an assessment of the non-linguistic context, the extent to which the proposition corresponds with what is believed to be true of the world and its potential for eliciting a required reader response

However, a principal feature of hedging is indeterminacy The maximally efficient exchange of information in science means that particular forms are always likely to carry more than one meaning Any classification scheme inevitably distorts reality by imposing hard and fast categories on the fluidity and indefiniteness of natural language use, but a fuzzy-set model captures this feature by enabling salient aspects of membership to be identified while conceding that individual cases are likely to express several meanings simultaneously These observations allow us to identify the devices most often associated with the expression of core cases (Table 2)

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Table 1 Principal functions of statements in scientific writing

Type	Function	Main hedging effect of core examples		
		content	commitment	assertiveness
Categorical assertion	full commitment to p and truth value	×	×	×
Reader-oriented	hedges expression to gain reader acceptance of p	×	×	✓
Content-oriented	hedges the extent to which p accounts for phenomenon			
Accuracy-oriented	hedges correspondence of p to reality	✓	×	×
Writer-oriented	hedges writer commitment to p	×	✓	×

✓ = presence of a feature
× = absence of a feature

Table 2 Summary of hedging functions and principal realization devices

Content-oriented		Reader-oriented
Accuracy-oriented	Writer-oriented	
Hedges propositional content	Hedges writer commitment	Hedges assertiveness
Attribute type Precision adverbs content disjuncts style disjuncts downtoners Reliability type Epistemic lexical verbs Epistemic modal adjectives Epistemic modal nouns Content disjunct adverbs Limited knowledge	Epistemic lexical verbs judgemental evidential Impersonal expressions passive voice abstract rhetors empty subjects Thematic epistemic device Attribution to literature Impersonal reference to method model experimental conditions	Epistemic lexical verbs judgemental deductive Personal attribution Personal reference to methods model Offer alternatives conditionals indefinite articles Involve reader direct questions reference to testability Assumption of shared goals Hypothetical e g *would*

8 HEDGING IN SCIENCE AND IN OTHER DOMAINS

A further important question is whether these functions are specific to scientific RAs While a comparative analysis was not undertaken, it is uncertain whether this would reveal conclusive evidence of distinctiveness, as particular varieties

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or genres may not actually be characterized by particular language conventions (e g Paltridge 1993) However, some tentative conclusions can be drawn based on those domains which have received attention in the literature

Hedging has received the most attention in casual conversation where it is perhaps twice as frequent as in written discourse and represents a significant resource for speakers (e g Coates 1987, Holmes 1995) Conversationalists, like scientists, employ hedges to convey both affective and referential meanings, but there are important differences in these functions While it is apparently common in speech, for example (e g Powell 1985, Channell 1994), scientific writing exhibits little use of deliberate vagueness in the sense of withholding necessary information Vagueness is simply not a viable communicative option in most scientific writing where propositional precision is central to persuasive argument as it is the only control a writer has in influencing the reader's views Nor do writers seek to create conviviality or acknowledge power differences, and while hedges in scientific writing involve sensitivity to addressees, this differs considerably from conversational goals of negative politeness or phatic communion

Functional differences also exist between science RAs and other spoken genres Dubois (1987), for example, found hedges in bio-medical conference presentations served to deliberately diminish precision in order to hedge accuracy, foreground more exact figures, and cite theories believed to be in error These functions play a very insignificant role in molecular biology RAs, however, and again, it is doubtful whether the genre encourages such uses Similarly, the use of hedges in doctors' discussions to explicitly indicate that more precise terms are not relevant (Prince *et al* 1982) was not observed in my data In addition, the use of hedges to help structure organizational roles and negotiate discourse statuses between participants in academic counselling encounters (He 1993) does not occur in the RAs Writer–reader relationships in science RAs are institutionally and normatively defined by conventions of interpersonal conduct and underlined by community sanctions Hedges may therefore help to project a *persona* and demonstrate adherence to the 'rules' of communication, but this is simply to achieve higher-level functions of gaining acceptance of knowledge claims, rather than to structure interpersonal relationships *per se*

Several written genres also contrast with biology RAs in the use of hedges Textbooks, for example, reserve hedges for matters which lack a consensus (Myers 1992), while a taxonomy of hedges in medical case reports and research papers (Salager-Meyer 1994) admits a very reduced role for the expression of doubt compared with the scheme described here The role of hedges to convey uncertainty in medical RAs has, however, been confirmed by Adams Smith (1984)

Nor is the rhetorical manipulation of hedges to present uncontroversial material and deflect criticism from more contentious areas, found in the literary criticism of F R Leavis (for example, Simpson 1990), appropriate in scientific contexts In science, readers place interpretive reliance on the use of hedges to

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distinguish the credibility of claims (reliability hedges) and the extent of writer commitment to them (writer-oriented hedges) Similarly, the use of hedges found in economics RAs (Channell 1990) to support claims by deliberately fudging accurate numerical information, without violating the conventions of truthfulness, is not a feature of my data However, Channell's observations concerning the need to balance persuasive writing and factual reporting certainly apply in science The journal corpus suggests that while data are presented as precisely as required for the practical purposes of convincing peers of a claim, expectations of exactitude may be higher in this discipline

Thus, while hedging is found to be important in a variety of domains, the circumstances recognized as appropriate for its use and the functions it is seen to fulfil often differ markedly Confirmation of these differences, however, awaits further research

9 CONCLUSIONS

I have argued that hedges in scientific texts are the result of informational, rhetorical, and personal choices which cannot be fully understood in isolation from social and institutional contexts Linguistic analyses alone cannot provide a rationale for such choices and the framework proposed here seeks to reflect this interpretive environment Research articles clearly reveal the relationship between a discourse community, standards of knowledge, and textual representations, and it is these in combination which motivate the use of hedges

Hedges are abundant in science and play a critical role in academic writing more generally They constitute an essential element of argumentation in presenting new claims for ratification, and are among the primary features which shape the research article as the principal vehicle for new knowledge An understanding of their use therefore has important implications for a number of areas, and can contribute to the growing literature on the rhetoric of science, revealing important insights into how science establishes its claims to knowledge and how scientists carry out their work Information about hedging can also advance our understanding of the practice of evidential reasoning and also has practical consequences in ESP where textbooks often emphasize the impersonality of scientific discourse and either ignore hedges or advise students to avoid them completely (Hyland 1994) Most importantly, however, the analysis demonstrates the dynamic and interactive nature of scientific writing It contributes to a growing sociological and linguistic interest in professional writing by providing a discourse analytic understanding of one means by which scientific discourse is both socially situated and structured to accomplish rhetorical objectives

(Revised version received November 1995)

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REFERENCES

Adams-Smith, D. 1984 Medical discourse Aspects of author's comment' *English for Specific Purposes* 3 25–36

Banks, D. 1993 'Hedges and how to trim them' in M Brekke O Anderson, T Dahle, and J Myking (eds) 1993 *9th European symposium of LSP* University of Bergen

Bazerman, C 1985 'Physicists reading physics Schema-laden purposes and purpose-laden schema' *Written Communication* 2/1 3–23

Becher, T 1989 *Academic Tribes and Territories Intellectual Inquiry and the Cultures of Disciplines* Milton Keynes SRHE/Open University Press

Brown, P and **S Levinson** 1987 *Politeness Some Universals in Language Usage* Cambridge Cambridge University Press

Brufee, K 1986 Social construction Language and the authority of knowledge A bibliographical essay' *College English* 48 772–9

Butler, C 1990 Qualifications in science Modal meanings in scientific texts' in W Nash (ed) 1990b

Campbell, P 1975 The personae of scientific discourse' *Quarterly Journal of Speech* 61 391–405

Channell, J 1990 'Precise and vague expressions in writing on economics in W Nash (ed) 1990b

Channell, J 1994 *Vague Language* Oxford Oxford University Press

Coates, J 1983 *The Semantics of the Modal Auxiliaries* Beckenham Croom Helm

Coates, J 1987 Epistemic modality and spoken discourse *Transactions of the Philological Society* 85 100–31

Crismore, A, R Markkaned, and **M. Steffensen** 1993 Metadiscourse in persuasive writing A study of texts written by American and Finnish university students' *Written Communication* 10/1 39–71

Dubois, B 1987 ''Something on the order of around forty to forty four' Imprecise numerical expressions in biomedical slide talks' *Language and Society* 16 527–41

Ernst, T B 1984 *Towards an Integrated Theory of Adverb Position in English* Indiana Linguistics Club

Fahnestock, J. 1986 'Accommodating science The rhetorical life of scientific facts *Written Communication* 3/3 275–96

Faust, D 1984 *The Limits of Scientific Reasoning* Minneapolis University of Minnesota Press

Hanania, E and **K. Akhtar** 1985 'Verb form and rhetorical function in science writing A study of MS theses in biology, chemistry and physics' *ESP Journal* 4 49–58

He, A. 1993 'Exploring modality in institutional interactions Cases from academic counselling encounters' *Text* 13/2 503–28

Holmes, J. 1984 'Modifying illocutionary force' *Journal of Pragmatics* 8 345–65

Holmes, J. 1995 *Women, Men and Politeness* London Longman

Hunston, S 1994 'Evaluation and organization in a sample of written academic discourse' in M Coulthard (ed) 1994 *Advances in Written Text Analysis* London Routledge

Hyland, K 1994 'Hedging in academic writing and EAP textbooks' *English for Specific Purposes* 13/3 239–56

Hyland, K. 1996 'Talking to the academy Forms of hedging in science research articles' *Written Communication* 13/2 251–81

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Kourany, J. A. 1987 *Scientific Knowledge Basic Issues in the Philosophy of Science* Belmont, CA Wadsworth

Kuhn, T 1970 *The Structure of Scientific Revolutions* (2nd edn) Chicago University of Chicago Press

Lakoff, G 1972 'Hedges A study in meaning criteria and the logic of fuzzy concepts' *Chicago Linguistic Society Papers* 8 183–228

Latour, B. and **S. Woolgar** 1979 *Laboratory Life The Social Construction of Scientific Facts* Beverly Hills Sage

Longino, H. 1990 *Science as Social Knowledge Values and Objectivity in Scientific Inquiry* New Jersey Princeton University Press

Lyons, J. 1977 *Semantics Vols 1 and 2* Cambridge Cambridge University Press

Myers, G. 1985 'The social construction of two biologists' proposals' *Written Communication* 2/3 219–45

Myers, G 1989 'The pragmatics of politeness in scientific articles' *Applied Linguistics* 10/1 1–35

Myers, G. 1992 'Textbooks and the sociology of scientific knowledge' *English for Specific Purposes* 11 3–17

Nash, W 1990a 'Introduction The stuff these people write' in W Nash (ed) 1990b

Nash, W (ed) 1990b *The Writing Scholar Studies in Academic Discourse* Newbury Park, CA Sage

Palmer, F 1990 *Modality and the English Modals* (2nd edn) London Longman

Paltridge, B 1993 'Writing up research A systemic functional perspective' *System* 21/2 175–92

Perfetti, C A and **D McCutchen.** 1987 'Schooled language competence Linguistic abilities in reading and writing' in S Rosenberg (ed) 1987 *Advances in Applied Psycholinguistics Vol 2* Cambridge Cambridge University Press

Pindi, M and **T Bloor** 1986 'Playing safe with predictions Hedging, attribution, and conditions in economic forecasting' *Written Language* BAAL 2 CILT

Powell, M 1985 'Purposive vagueness An evaluation dimension of vague quantifying expressions' *Journal of Linguistics* 21 31–50

Prince, E., J Frader, and **C. Bosk** 1982 On hedging in physician–physician discourse in R D Pietro (ed) 1982 *Linguistics and the Professions* Hillsdale, NJ Ablex

Quirk, R, S Greenbaum, G Leech, and **J Svartvik** 1972 *A Grammar of Contemporary English* Harlow Longman

Rounds, P 1982 *Hedging in Written Academic Discourse Precision and Flexibility* The University of Michigan Mimeo

Salager-Meyer, F 1994 'Hedges and textual communicative function in medical English written discourse' *English for Specific Purposes* 13/2 149–70

SCI. 1993 *1992 Journal Citation Reports (JCR)* Philadelphia Public Institute for Scientific Information

Simpson, P 1990 'Modality in literary-critical discourse in W Nash (ed) 1990b

Skelton, J 1988 'Comments in academic articles' in P Grunwall (ed) 1988 *Applied Linguistics in Society* London CILT/BAAL

Swales, J. 1990 *Genre Analysis English in Academic and Research Settings* Cambridge Cambridge University Press

Van Frasen, B 1980 *The Scientific Image* Oxford Oxford University Press

Vande Kopple, W. 1985 'Some exploratory discourse on metadiscourse *College Composition and Communication* 36 82–93

Zadeh, L A 1972 'A fuzzy-set-theoretic interpretation of linguistic hedges *Journal of Cybernetics* 2/3 4–34

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