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## **Constructivism: a case in point**

### **Interactive critique of**

**Parkinson, J. and Adendorff, R.D. (2004) The use of popular science articles in teaching scientific literacy. *English for Specific Purposes*, 23 (4). pp. 379-396.**

Available online: [http://eprints.ru.ac.za/view/people/Adendorff,\\_R.D..html](http://eprints.ru.ac.za/view/people/Adendorff,_R.D..html) 31 Dec 2008

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### **Introduction**

In order to get away from generalities I have chosen one article that clearly takes a Constructivist stance. It is not a difficult article, and was published in the flagship journal of ESP, therefore can be taken to represent mainstream opinion. In interacting with this article I am interacting with widely accepted viewpoints - not a straw men. In short, it serves as a good 'case in point' to focus and develop my disagreements.

### **Original Abstract**

This article considers the use of popular science articles in teaching scientific literacy. Comparing the discourse features of popular science with research article and textbook science – the last two being target forms for students – it argues that popular science articles cannot serve as models for scientific writing. It does, however, suggest that popular articles can make science more accessible to students, and so can play a useful role in the teaching of scientific writing as well as in the teaching of science. This is because popular science articles view scientific findings as provisional rather than as incontrovertible fact as they are presented in textbooks or as they appear to be presented in research articles. Another feature of popular articles is that they are peopled with large numbers of specific scientists, thus representing scientists as ordinary people rather than as a few exceptional people of iconic status in textbooks.

## **Commentary**

### **1. Popular science**

I would agree that popular texts may encourage more informal language, and if that is what you want to teach, then the popular text on science deserves consideration. But I came to this conclusion without any of the convoluted and incredible reasoning of the authors.

My first problem is the definition of 'popular' science. I have no problems when they refer to magazines such as *Time*, and other newspapers as 'popular'. I have problems when they state "popular science journals such as *Scientific American*, *New Scientist*, and *Technology Review*" (p13)

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I do not know Technology Review, but I know Scientific American and New Scientist very well. I was a subscriber to the New Scientist for over 10 years, and in my school and undergraduate days, made extensive use of both magazines. "Semi-popular" would be a much fairer description for Scientific American.

There is a world of difference between the science reported in Time, Newsweek, or the Times newspaper, and the science reported in other newspapers. Time, Newsweek and the Times have science journalists, who may well have a degree or even a higher degree in a science. Their task is a difficult one: to take a subject which is technically extremely complicated and to make it both understandable and interesting to those who may not know any science at all. From what I have seen as a scientist, the big papers usually get their facts right. Time and Newsweek are particularly good at colour illustrations. True, they may glamorise. True, they may interview and tell the human side, but they are non the less interesting and accurate for that.

To compare the New Scientist with Scientific American. Nowadays, the New Scientist uses a lot more colour, so colour does not distinguish Scientific American as it did over 30 years ago. New Scientist is also weekly, and the news items reflect this. The feature articles tend to be shorter, and rarely have references. The journalists are all scientists in their own right. Some feature articles are written by journalists - most are written by experts in the field. The audience of the New Scientist includes businessmen, and anyone with any interest in science who wishes to keep in touch with a wide range of science subjects. Anyone with High School, A level, or Baccalaureate science should be able to follow most of the material in the magazine.

I for one have tried the New Scientist recently, but I am tired of the gloss, and long for the older days with less pictures and more content. I may be wrong, but that is what I feel. In contrast, Scientific American has changed little. Its major selling point is long reviews of a subject, written by leading experts in the field, coupled with fantastic illustrations, following the style of American textbooks which have routinely surpassed British ones in this regard. Some articles are Bac level - many are higher. By their very volume and completeness they are much more demanding.

An important difference never once noticed by linguists is that Scientific American sometimes uses non-metric units, whereas the New Scientist rarely does, and always gives metric equivalents. It is possible that some Expert articles also use non-standard units. Whenever I find them I am irritated - especially when non-metric is given without a metric equivalent. It is not because I do not know the old Imperial system - I once knew it well. I went to school in the pre-decimal days of Pounds Shillings and Pence, and I still own a slide rule since it is the only tool that my family do not want to borrow, hence it is always available. I learned both systems, and the conversion factors between them. However, all my serious science was done in the metric system, in the 1970s, therefore to read about weights in pounds, liquids in gallons etc is very irksome. The use of imperial units definitely places a magazine near the bottom of the expert- popular scale.

Because of only appearing monthly, the review articles in Scientific American are fewer. As an undergraduate I tended to check each month to see if there was something of interest, but I rarely bought it. I learned as an undergraduate to look for review articles of any new subject, as a quick way to pick up the main points. Scientific American was certainly on my list of journals to check. 'Up to date textbook summary' as a description would approximate to many of the articles. There were times when even the subjects that interested me were a real challenge. There is simply no way that Scientific American can be described as popular - ie understandable by readers of the newspapers such as the Sun or the Daily Mail. If you refer to the science in Scientific American as 'popular' then what do you call the articles about science in the Daily Mail? Sub-popular? But they are popular, because by all accounts these newspapers sell, and are extremely popular!!

In short, there is a distinct continuum in my mind. Perhaps it is best illustrated by considering the field of medicine. The easiest way to view it is by qualification. The top end is by doctoral students or those doing postdoctoral research, and publishing in the more narrow and technical journals. Often, though not always, they are working on the forefront of knowledge, and practical applications may be ten or more years away. Many people function at more than one level. Consultants are both specialists and practitioners ie they will be doing pioneer research and dealing with doctors, health care workers, and patients.

It is rare for someone to write for an audience higher than the qualification/rank they have. But an expert can write for a wider audience. For instance, experts writing for Scientific American, or experts calling a news conference and issuing press releases. The table below spells out the range of reporting, from the highest to the lowest, and describes the expected expertise of the reader.

<b>Level of report</b>	<b>Expertise of reader</b>
1. Pioneer research reported for other specialist pioneer researchers	Highest possible level of knowledge and expertise expected of the reader
2. Pioneer research reported for other interested researchers within medicine	Writer knows related fields, and gives more explanation, especially seeking the links between the fields. Reader is a research specialist in a related speciality
3. Research reported for consultants - practitioners	Practical and theoretical for consultants who are both researchers and practitioners.
4. Research reported for General Practitioners	High level of general medicine assumed. GPs have to cover many fields, therefore summarising is important

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5. Research reported for nurses, physiotherapists, nutritionists etc, and others with a degree or similar qualification	Both the level and the focus of interest change.
6. Research reported for people with a degree in a science, such as science teachers	Semi popular
7. Research reported for the educated layman	Semi popular
8. Research reported in the Daily Mail or the Sun	popular. Only basic literacy required for understanding

**All this illustrates a common problem when linguists consider the writings of science: they tend to over-generalise, and to group together writings that have very distinct differences.** [Validity question].

## 2. Target writing forms

Parkinson & Adendorff say that the research article and textbook science are the two main genres which science students need to learn. Surely this varies enormously with the local situation? When studying Human Biology - admittedly a degree which was an unusual combination of life and social sciences - I remember having 3-4 lab reports per week to write, plus 4-5 essays per term. My immediate need was to write lab reports and essays. The lab reports for biochemistry, physiology and I think genetics were formatted as a structured paper in which we filled in the gaps. We had to follow instructions, note down what we saw, make measurements etc then at the end answer a series of searching questions. They in no way approximated to one of the standard formats of Research articles of Introduction, Equipment list, Methods, Results, Discussion/Conclusions, which I had been drilled in for the previous seven years of secondary school. The anatomy report was simply a one page summary of what we did. It was meant to take less than an hour to do and preferably done the same day as a form of reinforcement. It also served as proof we had attended and had been busy! In other subjects such as anthropology, sociology, child development etc we had to produce a 2000 word essay - very close to the five heading essay format. These essays were usually searching questions forcing us to research the answer then formulate and justify our own opinion.

Undergraduates, especially in the early stages, do not usually read research articles. Where they do turn to the journals, the various review articles, the reports of a consensus on best practice, etc, were far more useful. Only in the final year when I specialised and conducted original research did I actually study research articles on a regular basis.

So, with one example from one Science course, while in South Africa in the department the authors worked in the statement may well be true, I can emphatically say, "speak for yourself" - it was definitely not true for me.

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Now, I would not mind if the authors were to say that in their faculty, the target genres are like the textbook or the research article. But they seem to assume their faculty is normative. Also, since the readership of the article will probably not be scientists - not be the type best able to disagree, these readers could easily accept the work unquestioningly, and so error is duplicated. [validity question].

**3. Are all textbooks alike?**

What about the different levels of instruction? Is a school biology text at GCSE level really the same as a monograph used as a textbook at MA level? Is a textbook of statistics written for chemists similar to a textbook of statistics written for sociologists? Even within a subject and within a level, textbooks can vary greatly. Consider for instance the wide range in size of undergraduate anatomy textbooks, how integrated they are with related subjects such as biochemistry and physiology, how applied they are etc. [validity question].

**4. Do textbooks present findings as incontrovertible fact?**

Again, it depends on the textbook. Sometimes there is more than one theory, and all of them are discussed. Some textbooks refer directly to the research. Others are collections of readings, in which controversy is deliberately included. There are textbooks of readings where the key papers over twenty or more years are presented and commented.

**5. Do textbooks ONLY include the great names in science?**

...(the 'great names' of science, such as Einstein), who are the 'only' scientists found in textbooks. (p13)

I have to wonder how many science textbooks have been read by Parkinson & Adendorff. Have they not noticed how many Eponyms exist in science? [There are thousands]. Have they not noticed that theories are often labelled by the names of the main advocates? Are all of these 'iconic' and well known? I can assure Parkinson & Adendorff that it is not just the iconic scientists who get named in textbooks. [validity question + ontological reductionism]. A student of mine, Hajer Zarrouk Hamrouni, in 2004 presented an MA thesis in Tunis "A comparative study of the English and French medical eponyms". When she started she wanted to study all of them, but fast found that she had to restrict herself to the 600 or so beginning with the letter A. She first consulted the website *whonamedit.com* which has over 15 000 eponyms in English with about 450 or so medical ones starting with the letter A, and then she found more from other sources.

**6. Do research articles present findings as incontrovertible fact?**

Most of the argument in a research article concerns not the data (the facts) but the interpretation of the data and the implications. Facts in the world of science are discovered, refined, and confirmed by repeated analysis, inspection of the methods and the reasoning, and by replication. Experiments are devised to distinguish between conflicting explanations. [Questionable observation and generalisation].

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7. **Do ‘(semi)-popular science articles view scientific findings as provisional’?**

I have a problem here. I need to distinguish between what I call ‘semi-popular’ and what the authors say is ‘popular’. **Apparently the semi-popular articles view knowledge as provisional.** Again, the problem of generalisation appears. My impression, if anything is the opposite! Maybe sometimes these magazines show the provisional nature of pioneer science, simply because they are interested in reporting not just the facts, but the people and the process. [Questionable observation and generalisation].

8. **Genuinely popular genres**

The general public expects ‘facts’ and is confused when conflicting information is presented - such as in the advice for reducing weight or eating healthily. The way that scientists cannot predict when the next flu pandemic is coming, and how severe it will be, leads to the public to distrust science. There is a whole literature and discussion on this subject of the public impression of science, and the New Scientist regularly comments on it. Maybe some popular science articles do take this provisional stance, but scientists complain how difficult the public has to understand scientific uncertainty. Note that scientific uncertainty is about predictability and limitations to knowledge - it is NOT about constructing knowledge. These limitations account for a large part of the so called provisional nature of science.

9. **Note the logic errors**

Parkinson & Adendorff consider the use of popular science articles in teaching scientific literacy. Comparing the discourse features of popular science with research article and textbook science – the last two being target forms for students – they argue that [semi-] popular science articles cannot serve as models for scientific writing. They do, however, suggest that [semi-]popular articles can make science more accessible to students, and so can play a useful role in the teaching of scientific writing as well as in the teaching of science. Parkinson & Adendorff say that **this is because** [semi] popular science articles view scientific findings as provisional rather than as incontrovertible fact as they are presented in textbooks or as they appear to be presented in research articles. Another feature of [semi] popular articles is that they are peopled with large numbers of specific scientists, thus representing scientists as ordinary people rather than as a few exceptional people of iconic status in textbooks.

Let us analyse the logic:

Parkinson & Adendorff	Commentary
a. So called ‘popular’ articles in Time, Scientific American, and the New Scientist, are compared with Research Articles and Textbooks. The two bands are distinctively different.	Agreed, but not so simple.
b. The target writing forms in lab reports and examinations resemble Textbooks and Research Articles.	This means the <b>local target writing forms</b> . There is no evidence presented that this is anything but a local phenomenon, and I would disagree with this totally.
c. Therefore [semi] popular articles are poor models of writing for the students.	Under the local conditions reported, this is obvious, and rather banal.
d. [Semi-]‘Popular articles can make science more accessible to students’.	Again, the statement is banal and is rather obvious.
e. ‘ <b>This is because</b> popular science articles view scientific findings as provisional’.	So, ‘findings presented as provisional’ makes them more accessible to the general public. If I say “ $E=mc^2$ ” that is technical. But if I say “it is quite likely that $E=mc^2$ ” then that is more accessible. The absurdity of such a statement beggars belief.
f. Provisional findings make the teaching of science easier.	The same absurdity applies. ‘It is quite likely that $E=mc^2$ ’ is far easier to teach than the statement ‘ $E=mc^2$ ???’.

### 10. Objectivity linked with the use of the passive

As Myers (1989) shows, the authors of research articles establish their objectivity by removing people from the account. This extends the western cultural association of reference to the personal with emotion, the polar opposite of reason and logic. A proposition associated with a person may be viewed as that person’s subjective opinion, perhaps influenced by emotion. Propositions made impersonal by removal of people (often achieved by passivisation and nominalisation) give the impression of objectivity. Textbooks take impersonalisation even further than do research articles, with few person references. (p4)

I understand Myers to have shown that scientists sometimes use the passive as a stylistic device. There was subsequent discussion, and I have not seen a consensus on this even among the linguists. The views of Myers have not been accepted in full by linguists. Now that would be a subject to study - how some linguists were convinced!

To present Myers in a factual way as having incontrovertibly proven that objectivity is

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established in science by removing people from the account is again to commit a huge error in reasoning. Why should the views - even speculations - of a few linguists receive more factual credence than the massive foundation of realism upon which science is built?

The way that a scientist goes about tackling such a question is to establish a list of the variables. A list of the possible and probable explanations is then established. Evidence is then collected, and experiments performed to distinguish between the several explanations. In this example, it would be perfectly possible to assert that some scientists use the passive to express objectivity, and some do not. It is quite possible that the same writer, with the same material, will use the passive differently depending on the genre they were writing. Also, within a genre there can be variation, and, given two experts writing an article based on the same data, the use of the passive may well vary.

There is also the question of what is meant by objectivity, and do real scientists choose the passive as the only way in order to express that? Are scientists even aware of the distinction between the active and passive tenses (or to be strictly correct, 'voices')?

The use of the passive may be the linguistic expression of objectivity, sometimes, for some writers. But that is only one possibility, and a minor one in my view as a scientist turned linguist. Whatever the explanation, it is simply **case not proven** to assert that the passive is related to objectivity in science. **Maybe the passive gives the 'impression of objectivity' to the authors, but not to me, because I know that objectivity is established through other means. If the linguists had not mentioned it, I would never have thought that the passive was firmly linked with objectivity.** Objectivity is not established through linguistic devices such as the passive. Objectivity is established through repeated testing and evaluation. To say otherwise is like saying that smoke causes the fire. **Objectivity in science exists independent of the linguistic expression of it.** If passive voice clauses were rewritten in the active voice that would not make the reported science subjective! There are plenty of other reasons why scientists choose to use the passive voice, including style, editorial preferences, economy of words and readability. To a non-scientist, passive clauses may look more dense than active clauses, but not necessarily to a scientist. Once again, who is more likely to be right, the scientist who understands the text, or the linguist who does not?

## 11. Power relationships

The projected reader of the textbook is a student who thus is assumed to be less powerful than the writer. In the research article, as Myers (1989) has argued, the reader is assumed to be more powerful. The readers represent the powerful research community and, as a group, have the power to accept or not accept as fact the knowledge claims of the article. Latour and Woolgar (1979) argue that the proposition proposed by a research article becomes fact only when accepted, cited, and used by members of the discourse community; that is, the readers of the research article. Thus the reader of the research article and the writer of the textbook acquire their power from the same source: both represent the research community. Another difference between textbooks and research articles is that the research article must propose new information. The textbook by contrast contains nothing new but summarises the received

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information that has been accepted as fact by the research community. In doing so it reifies the fact, buries the individual researcher, and completes the objectification of the fact by removing it not only from time and place (as in the research article) but from the individual researcher as well. The appearance of information in a textbook is its stamp of having become a fact.

The projected reader of the textbook is a student who thus is assumed to be less powerful than the writer.

### **Commentary**

This whole subject of power relationships is probably a sidetrack. A more important feature is the level of knowledge. If you do not get the right level, the textbook will not work because the student will either not understand it, or find the textbook too easy. Textbooks are written by professors for students. They are not just storehouses of knowledge, they are also presentations of material that make it easier for the student to learn. The textbook writer is assumed to be both more knowledgeable in the field, and to be a good explainer - a good teacher. Naturally, a teacher does not want to be forever referencing and defending every statement they make. It is a convention of textbook writing that, unlike the research article or thesis, statements generally do not need referencing.

“In the research article, as Myers (1989) has argued, the reader is assumed to be more powerful.” (Parkinson & Adendorff)

- in terms of accepting or rejecting the ‘knowledge claims’ of the article.

Hedges are mentioned. Linguists who study ‘hedges’ have looked at the language used to express the degree of confidence of scientists in their findings. Some of this is tact and deference, but not all.

Scientists reading research articles within their speciality know very well what is new and needing confirmation, and what can be assumed. When submitting an article for publication it is the editor and the referees who have power. They have power to accept or reject, and the opportunity to write (often very critical) comments. Similarly, a reader has power to write to the editor, or, in a subsequent article of their own to criticise the writers, rather like I am doing with the current paper. Many aspects can be contested. Commonly it is the methodology itself, the accuracy of the data, the way the data is presented etc. Also, has the writer taken into account facts from another article, or have they overlooked a variable? Have they given due prominence to one or more variables? Crucially, were the results due to the variable being studied or due to some other variable? Writers who can stand up to this battering, deservedly get published.

Why is it that “the proposition proposed by a research article becomes fact only when accepted, cited, and used by members of the discourse community; that is, the readers of the research article”? Parkinson & Adendorff.

The simple answer is that it is because it has passed the tests of experiment and clear logic. What pushes the acceptance is the facts. Scientists are inherently sceptical.

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Research goes through a rigorous analysis, not because the community is deciding in some mystical subjective way what to label and accept as fact, but because the quality of research is often poor. The power scientists have is to turn a critical eye on another. This is largely acquired through knowledge and training.

**12. ‘ the research article must propose new information’**

Or a new argument. In addition, the literature review - an integral part of the research article, can present original summaries and evaluations of the evidence. [questionable generalisation]

**13. The over-concern by linguists with the ‘research article’**

Any look at journals in science will see a great variety of articles, and variety within the genre of research article.

**14. Textbooks present only information believed and accepted as facts**

The textbook, in complete contrast to the review article, supposedly contains nothing new. Instead, the textbook supposedly summarises the received information that has been accepted as fact by the research community. In doing so it apparently reifies the fact, buries the individual researcher, and completes the objectification of the fact by removing it not only from time and place (as in the research article) but from the individual researcher as well. The appearance of information in a textbook is its stamp of having become a fact.

I agree, textbooks summarise - that is their role and purpose. But they also deal with uncertainties. If at the time of writing there are two or more competing theories then the writers may well present them both and argue for and against both of them.

I insist that facts are not ‘objectivised’. By definition a fact must be objective, otherwise it is no longer a fact. The way that information appears in a textbook shows that this has passed the rigorous tests and has passed into the general knowledge of the experts, and now has to be passed on to other learners.

**15. Examination papers as similar to textbooks (p5)**

By now this should need little comment. Under the local circumstances, maybe even related to the person who set the examination question, then there might well have been some similarities. A different set of data could have led to different conclusions. I question the validity of such a statement.

**Concluding remarks**

The final sentence of the analysis above was in the active voice. Does this mean I am admitting that my comment was not objective? What if I had written “the validity of this statement is questionable”. Does the use of the passive voice really suddenly turn a subjective statement into an objective statement?

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In science there is great concern with validity - how widely applicable a summary statement can be. Linguists presumably aspire to high standards of rigour in their reasoning. Why then do I not see such standards applied in this article? Some linguists do an excellent job, but the profession needs to avoid sloppy work which brings linguistics into disrepute.

As an addenda, while finishing this article I was, for pleasure, studying a book about the literature of medicine. According to Trisha Greenhalgh, in her excellent, readable, informative and authoritative book, *“How to read a paper: the basics of evidence-based medicine”* (Blackwell, third edition 2006)

“Many, if not most, medical review articles are still written in journalistic form”.  
(p114)

Here is recognition from a major teacher of doctors that there are different styles used, and she thinks many reviews are journalistic ie:

“an overview of primary studies which have not been identified or analysed in a systematic (ie standardised and objective) way”. (p114)

**Here is an example of what an insider thinks about their own publications.**

**‘Journalistic’, to Greenhalgh means too much reliance on the expert and personal selectivity in the use of evidence.** Insiders are aware of the problem of objectivity, but they tackle it from directions seemingly unknown to linguists. Surely outsiders should listen to insiders like Greenhalgh, and study the way they understand and solve a problem.

It is also interesting to see how she regards ‘Review Articles’ as ‘journalistic’. Could this be close to ‘semi-popular’? But **how many linguists could have come to the same conclusion?**