BOOKS & ARTS

The art of persuasion

Surprisingly, the rhetoric of the literary artist still has a place in persuasive scientific texts.

The Scientific Literature: A Guided Tour
edited by Joseph E. Harmon and Alan G. Gross
University of Chicago Press: 2007. 312 pp. $29.00 (pbk); $72.50 (hbk)

Steven Shapin

THE ROYAL SOCIETY

Robert Boyle (1627–1691) sometimes used the first-person singular in his scientific writing.

While the term 'scientific literature' is a commonplace usage, few scientists would acknowledge any connection between how they write and the works of novelists or poets. As long ago as the middle of the seventeenth century, the English originators of the scientific journal vigorously set themselves against all forms of fancy writing. The newly formed Royal Society of London separated "the knowledge of Nature…from the colours of Rhetorick". The aim of scientific writing was to report, whereas rhetoric worked to distort. Today, few scientists consider themselves to be rhetoricians. How many even know the meaning of anaphora, antimetabole or litotes?

But it's not that simple. The scientific literature reports, but it also aims to persuade readers that what it reports is reliable and significant. And the arts of persuasion are inevitably literary and, specifically, rhetorical. It is an arduously learned skill to write in the way that *Nature* deems acceptable. Conventions of scientific writing have changed enormously over the past few centuries and even over recent decades. The very big differences between Jane Austen's *Persuasion* and a scientific paper lie in the different patterns of rhetoric used in the latter, not in their absence from it.

There are now many historical and sociological studies of scientific communication. Joseph Harmon and Alan Gross's book, *The Scientific Literature,* is something different — neither a research monograph on the history of scientific writing nor a straightforward compilation of excerpts. Originating from an exhibition held at the University of Chicago in 2000, it includes about 125 examples of scientific writing taken from papers, books, reviews and Nobel speeches, and covers material from the seventeenth century up to the announcement of the rough draft of the human genome in 2001.

An excerpt is rarely longer than 500 words and sometimes as brief as 150, or may just be a diagram. These scientific snippets are embedded in strands of editorial commentary describing, highlighting and interpreting them. The tone is genial: this "guided tour" doesn't threaten arduous intellectual adventure. Rhetorical terms are explained, scientific authors are identified, and pertinent scientific contexts introduced.

There is no single argument embodied in this book — more a selection of sensibilities intended to help readers appreciate the remarkable and shifting set of literary forms that scientific writing has assumed. One theme is historical change. The authors point out that, not surprisingly, specialization has been accompanied by increasingly exclusive scientific writing. There never was a golden age when every educated person could read everything in the scientific literature — Newton's *Principia* defeated all but a small number of natural philosophers and mathematicians. But until the mid-nineteenth century, the general readership of such periodicals as the *Edinburgh Review* might find serious treatments of what was up in geology, astronomy or mathematics, written by notable scientists.

The accelerating incomprehensibility of scientific writing to the average educated person is not merely the fault of the much-lamented 'public ignorance of science'. Specialists have been so successful in constructing and bounding their own audiences that they rarely feel any need to address the laity or even scientists in other disciplines. Indeed, the plant physiologist is likely to be just as poorly equipped as any non-scientist to read a paper on superconductivity.

Another theme is the impersonality of scientific prose. Scientific writing has always been relatively impersonal, but the literary forms of impersonality have changed over time. In the seventeenth century, Robert Boyle used thickly layered circumstantial reporting to portray himself as a modest witness of his experiments, his judgement uncoloured by theoretical interest. He was nevertheless a witness at the centre of his own narratives, not averse to using the first-person singular — "I did X, I saw Y". By the nineteenth century — when the French physiologist Claude Bernard coined the aphorism "Art is I; Science is We" — the scientific author became increasingly submerged in either the first-person plural ("We did X, we saw Y") or in the passive voice now standard in scientific papers ("X was done, Y was seen").

The rhetorical convention here implies that scientific authors do not matter to what they report in the same way that Jane Austen matters to *Persuasion*. Although some insist that scientific research is an imaginative exercise and that its findings have an aesthetic character, the convention of impersonality is testimony to the opposite sensibility. Science is considered to discover; art to create.

Harmon and Gross are quite right to draw attention to non-verbal forms of communication and the changes produced by both instrumental and representational technologies on the ability of the scientific literature to show as

well as say. Wood or copperplate engravings were important in seventeenth-century science, but such images were expensive to produce and limited in their information content. Now, practically every issue of a scientific journal is a cornucopia of high-bandwidth visual communication sometimes even in online video form. It is becoming easier to envisage present-day science communication without words than without images. It is disappointing then that many of the illustrations in *The Scientific Literature* are so murkily reproduced. Maybe it is easier for humanists to say that visual communication is important than for them and their publishers to act as if it is. ■

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Material metaphors

Origins and Revolutions: Human Identity in Earliest Prehistory
by Clive Gamble
Cambridge University Press: 2007. 362 pp. $80, £45 (hbk); $27.99, £15 (pbk)

Robert N. Proctor

Research into human origins can be thought of as a kind of identity quest. We want to know how 'they' became 'us', which raises all kinds of questions about what it means to be human. To stand upright? To paint the walls of caves or to fashion beads from bone? Or to plant the land and build cities with slave labour? Or perhaps to engage in none of the above, but simply to have that capacity?

Questions such as these do not have obvious answers, nor are they really even empirical. Evolution stretches out the process of anthropogenesis. Once we jettison teleology and discontinuity, it doesn't mean much to say when hominins became 'truly human', any more than to say when aardvarks became truly aardvark. Nor can it even mean much to talk about the 'earliest' humans, or prehistory, as everything will depend on what we want to identify as the important transitions.

Tools (harpoons, awl and needle with eye) from the Upper Palaeolithic.

G. DAGLI ORTI/MUSÉE DES ANTIQUITÉS ST GERMAIN EN LAYE/THE ART ARCHIVE

Upright posture, for example, appeared by about 4 million years ago, but tool making must be much older, albeit invisible as a result of accidents of preservation. The oldest known wooden tools, the famous spears from Schöningen in Germany, date from only 400,000 years ago. Symbolic burial and bead making are younger still, perhaps by an order of magnitude.

Clive Gamble's new book, *Origins and Revolutions*, challenges our current obsession with language and farming as the two principal 'big breaks' in deep antiquity, dating from around 40,000 and 10,000 years ago, respectively. His intention is to avoid all talk of origins, exploring instead what he calls the "material basis of human identity", by which he means how artefacts as extensions of the human body acquire a symbolic force of their own.

He divides the material world into "instruments" and "containers". Here instruments include all edges, blades and points, as well as pestles, ploughs, drills, axes, brushes, writing implements and wheels. Containers include anything that houses or envelops, whether in the form of bowls, barns, bags, caves, clothes, moulds, masks or tombs. Gamble's point is that both are extensions of the human body: instruments extend our limbs; containers extend our trunk. Instruments generally inscribe; containers are more often inscribed upon.

Classifying material culture in this way allows Gamble to question the novelty of both the Neolithic and the Upper Palaeolithic transitions. He argues instead for a more gradual shift over millions of years of hominin evolution, from a life centred around instruments to a life more prominently incorporating containers. Farming, then, is not such a radical innovation. There is no 'sapient paradox' — Colin Renfrew's puzzle over why it took so long to discover agriculture and the virtues of a sedentary life. Symbolism was not suddenly invented when modern humans decided to quit Africa and start painting in southern France. (Paradox seekers might well wonder why the 'modern mind' seems to appear 100,000 years after the 'modern body'.) Instruments and containers always reference the human body, and in this sense carry symbolic force. This means that symbolism does not necessarily have a singular point of origin, whether 40,000 years ago with the 'human revolution' or at any other magical moment.

Palaeoanthropology has become an exciting field in recent years, partly because some really big questions remain wonderfully unanswered. No one really knows whether Neanderthals could speak or think like us, for example, or what it might have been like to live among our *Homo erectus* next-of-kin or the newly discovered *Homo floresiensis*. In the 1960s and 1970s, language, art and symbolism were projected onto ever-older hominin fossils. Now the trend is to (re-) dehumanize early palaeolithic hominins — hence the darkening of the whites of their eyes in recent museum displays.

Gamble's refocus on instruments and containers is a refreshing break from archaeological convention. But how far back can we go before such proxies for the hominin body cease to have symbolic force? Birds' nests are containers, so when do the hominin counterparts start to signify something more to their makers? When do the instruments of early hominins start to serve as material metaphors? How would we ever know whether, say, the invention of symbolism wasn't rather sudden, even from a geological point of view? How would we ever know whether a light went on in some hominin head (or gene), causing language to spring into being?

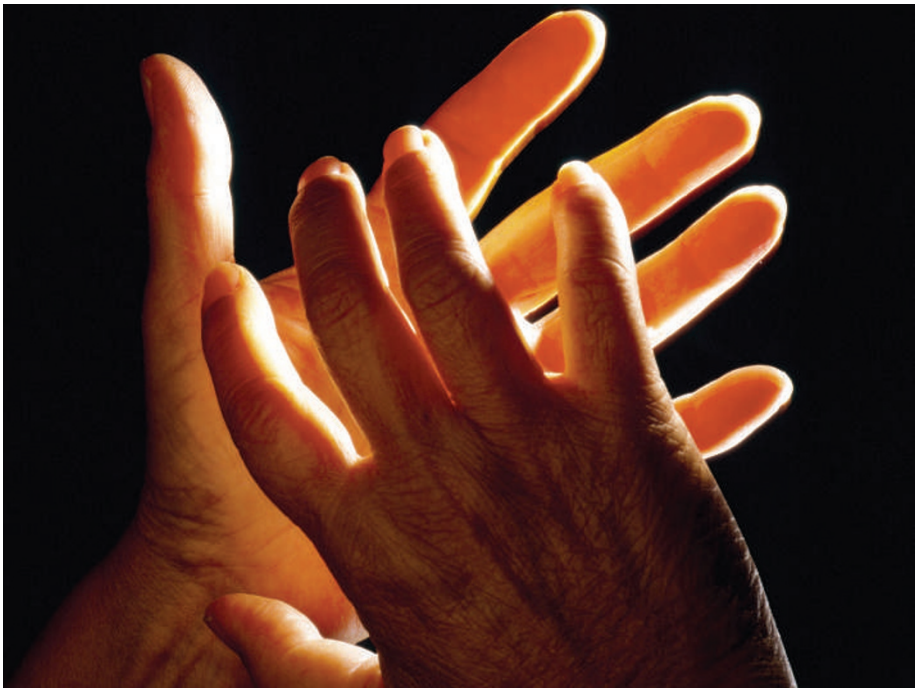
Gamble shows that the rate of invention grows slowly over the long haul of human evolution, and reminds us that absence of evidence is not evidence of absence. But how long should we search the Middle Palaeolithic for painted caves or sculpted figurines before concluding that none was ever done, and not for lack of interest, but for lack of capacity? For many years, geologists were reluctant to recognize catastrophes, postulating 'missing strata' to account for apparent jumps. The rehabilitation of catastrophes over the past few decades owes much to a renewed appreciation that absence of evidence can be evidence of an absence. I think it is fair to ask whether the situation might not be similar for palaeoanthropology.

Origins and Revolutions is an effervescent read that skillfully challenges many of the sacred cows of archaeology. It is rich and deep in the philosophical acumen and attention to social theory for which Gamble is known. He also writes with an admirable sense of humour and irony; he knows how to join humanistic flair with empirical rigour at the dig.

I think he is right that our bodies are a kind of social technology, and that artefacts should be regarded as embodied metaphors. The question then arises of how to understand changes in interactions between artefacts, with

Linguistic gem or just another pidgin?

Talking Hands: What Sign Language Reveals about the Mind
by Margalit Fox
Simon & Schuster: 2007. 368 pp. $27


O. BURRIEL/SPL

Can the emergence of a new sign language tell us anything about the innate properties of the mind?

Neil Smith

Al-Sayyid Bedouin Sign Language (ABSL) is a system of communication, created some 70 years ago by ten deaf people living in a village in Israel. In her elegantly written book, Margalit Fox claims that ABSL is "a language that is free of the influence of other languages, signed or spoken", and uses it as the starting point for an inquiry into whether innate properties of the human mind could be reflected in the emergence of this 'new' language over three generations.

Fox intersperses the account of her investigation with a masterly and accessible overview of sign languages and research into them over the past half century. Although they share their linguistic properties, sign languages are independent of spoken languages. For example, American Sign Language is more closely related to French Sign Language than it is to British Sign Language, and is unrelated to spoken American English. They have phonology, expressed through the shape, location, movement and orientation of the hands, and typically exhibit a rich morphology — for example, the sign for 'give' can be modified to portray repeated giving, continuous giving or giving to many recipients.

Most sign languages have a complex system of verb agreement, allowing signers to keep track of who does what to whom, and to exploit word-order variation for rhetorical effect, rather than to encode grammatical relations such as subject and object. Their syntax allows the formation of questions, negations, conditionals and so on, and they have a compositional semantics. Whatever can be said in spoken language, deaf signers can convey in sign language.

"Signed languages allow for a degree of simultaneity not possible in spoken language."

The evidence for this comes from analyses of sign languages and their historical development, and from psycholinguistic and brain-imaging experiments. Parallels between the signed and the spoken in every domain are so close that it is hard to tell from a linguistic description which kind of language is being discussed. The genetically determined human faculty of language seems to be largely neutral between the two modalities.

There are differences. Signed languages are more iconic and allow for a degree of simultaneity not possible in spoken language. You can frequently tell, *post hoc*, why a sign has the shape it does, and you can sign more than one morpheme — the smallest meaningful linguistic unit — at a time. Yet deviations from iconicity are frequent and signed words, like spoken words, typically consist of linear sequences of 'locations' and 'movements'. The most striking difference lies in the importance of facial expression: in signed languages this can have many of the functions that grammar and intonation do in spoken languages.

Deaf people not exposed to sign languages may invent their own restricted system of communication, known as 'home-sign': a pidgin, which lacks many of the properties of a real language. In being passed on to succeeding generations, a pidgin may become a creole (the speaker's or signer's native language), and eventually turn into a full-fledged language. Pidgins have minimal morphology, creoles somewhat more, and full-fledged languages may be morphologically rich.

This progression, if it occurs without influence from other languages, is what Fox suggests can reveal innate properties of mind, and is what motivated the expedition to examine ABSL. But there are problems. Influence from other languages, both signed and spoken, has been considerable. Moreover, although pidgins are typologically identifiable, creoles are not linguistically well defined, and it is a fallacy that languages generally develop a rich morphology over time: some do (French), some do not (Chinese), and some lose much of their morphology (English).

Nevertheless, ABSL would indeed provide evidence for the operation of the human language faculty if it really had become "without doubt a fully functioning language". Suggestive evidence for the claim comes from the marking of grammatical relations, demonstrated syntactically by use of word order, or morphologically by use of agreement. Most sign languages rely on the latter, but ABSL chooses the former — a rigid subject–object–verb order.

Beyond this, the conclusions drawn by Fox and the team of four linguists she accompanied on the expedition are disappointing. ABSL has a large vocabulary but makes no use of spatial morphology and has no verb agreement, apparently because it is "too new". More surprisingly, "the language seemed to lack phonology" and "holistic words serve the communicative needs of their users admirably". So we are asked to believe that we have a 'language' with some (minimal) syntax but no morphology and, amazingly, no phonology.

Fox's conclusion that "spontaneously, naturally and with no outside influence, the deaf villagers created a new human language" is overstated. ABSL seems to be not so much a language, as a pidgin that is being creolized under the pervasive influence of Israeli Sign Language. ■

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Correction
In the Book review "The art of persuasion" (*Nature* **448,** 751–752; 2007) the image erroneously portrayed Isaac Newton instead of Robert Boyle.