

## GUEST EDITORIAL

### On Writing Actuarial Science

By R. J. Thomson

One of Nietzsche's major contributions to the philosophy of science was that all science is riddled with the perspectives of its authors (Schacht, 1995). Actuarial science is no exception, and I write this editorial, without apology, from my own perspective.

Helpful books have been written on research methods (e.g. Booth *et al.*, 1995). The purpose of this editorial is not to contribute to that literature, but to take the reader along some of the highways I have ridden and some of the byways I have trodden in the course of reading and writing actuarial science during the past 45 years. I leave it to my readers to criticise my text and to challenge the boundaries of the actuarial paradigm as they perceive them.

#### **What actuaries do**

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No scientific discourse can be defined without reference to what its readers and writers do. This is particularly true of actuarial science, which consciously refers to the 'traditional areas of actuarial activity' (e.g. Booth *et al.*, 1999) and to 'wider fields' or 'avenues of the future' (e.g. Menzler, 1963 and Martin, 1992). There has been discussion in the actuarial literature about what constitutes the essence of the actuarial profession (e.g. Akhurst, 1992). On the websites of the actuarial profession, the domain of the actuary is defined with reference to what an actuary does rather than to what an actuary knows: the science is defined with reference to the profession, not the other way round. There is nothing wrong about this. In itself, this feature does not detract from the standing of actuarial science as a scientific discourse.

As I have argued elsewhere (Thomson, 2004), actuarial science is not a 'science' in the traditional sense of the word:

“It fits more comfortably into the modelling approach to science than into the traditional approach.”

Its ultimate purpose is neither to explain phenomena nor to search for truth, but to develop and use models to facilitate decision-making in the fields in which actuaries work. Whilst explanations of phenomena and inferences of truth may be helpful in this task, they cannot be seen as the ultimate objectives of actuarial science.

#### **Paradigm shifts and normal science**

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No doubt all actuaries have their favourite papers. Mine are those that have shifted the paradigm within which I had previously been working. Prime among them is the conversation between Wise

(1984a, 1984b, 1987a, 1987b) and Wilkie (1985) about the matching of assets to liabilities and portfolio selection. That conversation, together with the publication of Wilkie's (1986) stochastic model, enabled me to question the actuarial paradigm of the time that returns on investments were the subject of deterministic assumption. This was heady stuff for a young actuary to whom the idea of stochastic modelling of liabilities was quite foreign. It led first to my involvement in actuarial research within my consulting practice, and some six years later to my transplant to the freer and more fertile soil of academia and to my emulation of Wilkie's approach, with some conceptual differences, to produce a stochastic investment model for South Africa (Thomson, 1996). Another paradigm-shifting paper that stands out for me is Exley *et al.* (1997)—particularly its pathway through the quagmire of confusion surrounding the valuation of defined-benefit pension schemes. This too had a strong influence on my subsequent work, again because it challenged the paradigm of actuarial science as expressed in what actuaries were doing, and in particular what I was doing.

Not all actuarial research is ground-breaking work. Much of it is what Kuhn (Enç, 1995) refers to as 'normal science.' There is nothing wrong with normal science; in fact it serves not only to "hone, refine and elaborate" our models, but also to "solve... the puzzles" that they raise (*ibid.*). But whether a contribution to our literature challenges our paradigm, or whether it is just normal science, it must be truly scholarly: its science must be scholarly and its writing must be scholarly.

## Scholarly science

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Scholarly science requires scholarly research. As a reader and editor of such science, I look for originality, authority and integrity. Other authors (e.g. Booth *et al.*, 1995) have listed other elements; my choice is personal.

Except for the purpose of argument or review, no author has the right to write what has been written before. First, unless it is acknowledged, it is plagiarism. Secondly, it is a waste of paper, ink, disk space, bandwidth and time. And thirdly, by ignoring the authority of published writing, the authors undermine the credibility not only of their own work but also of the journal in which it is published. A scientific article is a work of art: it should not be derivative or self-indulgent. It must be genuinely original. By the same token, a journal is part of the scientific commons; it should not be abused.

Besides other authors' findings, there are only two sources of authority: data and argument. In order to satisfy the reader, both of these sources must be properly handled. Data must be properly sampled and processed. The argument must be persuasive. The authors' perspective is a limitation to be acknowledged, rather than a gospel to be proclaimed. Except to criticise the authors' perspectives, the reader is not generally interested in what the authors believe, but in what they can prove, show, find, infer or otherwise convincingly argue.

I use the word 'integrity' in all three of its defined senses (Little *et al.*, 1973). First, and most importantly, I look for 'material wholeness.' The work must be complete. No pillar of the edifice must be missing. This includes the refutation of counter-arguments or suggestions for further research that might result in the rejection of the authors' conclusions. Where relevant, the authors' perspective must be acknowledged. Also, where relevant, the authors must show that they have seen both the wood and the trees. In particular there must be an understanding of the socio-political context and how it relates to the paradigm within which the authors are writing. One thing that

white South Africans had to learn from the anti-apartheid struggle here was that every decision and every action was taken within a context that was ethically, socially and politically charged. There could be no such thing, whether in one's business, one's profession, one's social activities or one's family life, as political neutrality. Political neutrality favoured the apartheid regime. Today, actuarial work is waged globally in the theatre of a capitalist system that has failed to distribute wealth outside of wealthy capitalist nations. Does our writing ignore this? Do we hitch our wagon to the star of capitalism in general, or, even worse, to that of market fundamentalism (Soros, 1998) in particular? If so, we are part of the problem. Similar concerns relate to gender, the environment, Zionism, the arms trade, child soldiers and a host of issues that demand our life options. Recent focus on the 'triple bottom line' (Elkington, 1997) must take actuarial science beyond the realm of financial risk and financial soundness; otherwise we shall be painting the profession into a dead corner. Actuaries as writers must not only be ornaments to our profession, but also critics of its discourse and its paradigms; indeed, such criticism is essential to the adornment that our profession requires of us. In order to be materially whole, an article must also make it clear how it relates to actuarial decision-making processes or to models or criteria used for the purposes of actuarial decision-making.

Secondly I look for an 'unimpaired' article (Little *et al.*, *op. cit.*). I need to be satisfied that the authors have not made a mistake. Thirdly, I need to be satisfied that the research methods have been 'ethically sound' (*ibid.*) and that the authors have no conflicting interest in the outcome of their research. These two requirements are to some extent matters of trust, at least in the journal's review process, but also in the authors themselves. Just as an economy requires trust (Fukuyama, 1995), so does a profession.

## Scholarly writing

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When I was an actuarial student working in a life office, my boss, Mr. J. H. van der Linde, told me:

"The first step in learning to be an actuary is to learn the jargon. The second step is to learn to use the jargon. The third is to forget the jargon."

An actuary must be able to write for a non-actuarial audience. That is what the U.K.'s CA3 and South Africa's A302 are all about. However, unlike the writing of actuarial reports to clients, the writing of actuarial science is addressed to actuaries and to students of actuarial science. For the most part it is also written by actuaries: not only by academic actuaries, but also by actuaries in practice. Indeed, the actuarial profession being a learned profession, its students need to learn how to write scholarly actuarial science. Practitioners as well as academics need to be part of the processes of reading and writing, and of defining questions for future research. For these purposes, the jargon of the profession may, of course be used. But even here it should be used with care and alien species of untried jargon should not be released uncurbed into the actuarial environment.

For me, good scholarly writing distinguishes itself by two characteristics: clarity and beauty. Again, my choice is personal.

Actuarial science is a complex field. It is the task of the writer to simplify it. To this end, clear writing is essential. Clear writing requires clear, well-ordered thinking. Both the principal argument and subsidiary arguments in an article must be unfolded with clarity and precision. Words must be carefully chosen. When a particular expression is used to refer to a certain concept, the same

expression must be used whenever reference is made to that concept; interchangeable use of expressions and ‘elegant variation’ (Fowler, 1930) merely spawn confusion.

Of course, clarity and beauty are not distinct virtues. During a lecture on mathematical analysis in my third-year mathematics class some 40 years ago, a fellow-student in the back row put up his hand. “Dr. Schlagbauer,” he asked our lecturer, “what is the use of this math?” Schlagbauer put down his chalk. “This is not useful math,” he retorted; “this is beautiful math.” Fortunately for actuaries, though, useful math may also be beautiful. Macdonald (2006) and Wilkie (1993) rightly challenge the profession to keep up with mathematical advances affecting it. In South Africa I have repeatedly heard actuaries of my own vintage asserting with pride that they no longer either need or understand mathematics. This inverted snobbery digs a grave of ignominy for the intellectual future of the profession.

Recently a student of mine (whom mercy compels me to cite anonymously) wrote:

“Listed group undertakings may be shown at net asset value plus a factor applied to the difference between fair value and net asset value. The factor is the minimum of the actual holding and 20%.”

I challenged him to formulate what he actually intended to convey. After some discussion, he expressed it as:

“Listed group undertakings may be shown as:

$$G = aN + \min(a, 0.2) \max(F - N, 0);$$

where:

$a$  is the proportion of the group undertaking held by the insurer;

$N$  is the net asset value of the group undertaking;

$F$  is the fair value of the group undertaking.”

To me this was both clearer and more beautiful.

But mathematics itself can be abused. Actuaries are bad at observing the conventions of algebraic usage, particularly in the naming of variables and the use of fonts and symbols.

The first lesson in beauty is to avoid ugliness. To me the ugliest feature of actuarial writing is to be found in word-strings, which deserve the equally ugly name ‘techno-speak.’ Short word-strings can be tolerated if (as in ‘ill-health retirement’, ‘fixed-interest securities’ and ‘risk-mitigating actions’) they are appropriately hyphenated. But long ones are generally irredeemable by means of hyphens. My favourite howler is “rapid unfunded liability emergence scenario.” Such word-strings can only be recast with the aid of the humble preposition, a threatened species in the evolution of the names of technical concepts.

The second-ugliest feature of our writing similarly deserves a bad name: I call it ‘concept-processing’. Conventional word-strings, usually abstractions, are themselves strung together to make whole sentences. Thus, for example, “Conduct an investigation of the data integrity to

establish the existence of any systematic data errors” would be far better written: “Check the data for systematic errors.”

Actuarial writing is also prone to certain hanging participles, the most prolific being ‘based on,’ as in: “The present value [whatever ‘present’ means] is calculated based on market-related assumptions.”

An actuarial writer recently wrote: “This is acceptable for the purpose of market-consistent valuation because of the arguments presented in section 5.” The tacking on of afterthoughts like this is symptomatic of failure to think before we write.

Particular traps for the unwary are: ‘in terms of’ something vague like ‘scenario’ that has no terms; ‘look at’ (or even worse, ‘relook at’); ‘as such’, used as a deliberately vague conjunction, where ‘such’ refers to nothing at all; ‘such that’ where ‘so that’ is required; and ‘with regards [sic] to’.

In the fertile soil of actuarial writing, circumlocutions like ‘on an annual basis’ (why not just ‘annually?’), ‘at that point in time’ (why not ‘then?’) and ‘the question as to whether’ (why not ‘as to?’) crop up as regularly as weeds.

Examples of ugly actuarial writing are too numerous to categorise here. More are given in Thomson (unpublished). But beauty is more than just the absence of the ugly. As Churchill (1930) stated, “The essential structure of the ordinary British sentence is ... a noble thing.” We (even those of us who are not British) must honour that nobility. Mathematics, parentheses and points must not be left hanging in empty space or fragmented in isolated particles of text; they must all be comfortably tucked into proper sentences. Every sentence must be composed so that it draws on the understanding and the imagination of the reader to convey its message. The figures must be well presented. (Booth *et al.*, 1995, gives good guidance on this subject.) The whole must be constructed so as to take the reader on a journey that will delight them; not only by its content, but also by its style. (Again, Booth *et al.*, 1995, is helpful.)

## Concluding reflections

I am the first to acknowledge that I have not lived up to the standards I have suggested in this editorial. My editors and scrutineers have invariably—and quite justifiably—found fault with what I have written. I hope that I am learning in the process. In the mean time, I shall aspire to these standards and I offer them to my fellow-writers in the interests of the science of the actuary.

We need to contextualise our science and our writing in what actuaries do: particularly in the development of models and criteria for actuarial decision-making. Wherever it is relevant, we also need to contextualise our science and our writing in the social, ecological and political environment in which we work. Whether we are challenging the paradigm of our discipline, or whether we are just doing normal science, our science and our writing must be scholarly.

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