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The Medium of Natural Language

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You are now completing a splendid piece of research. Your final data are ready, and your illustrations and tables, complete with legends. Your special features may even include separate scientific languages like mathematics, or computer languages, and Keywords. But all these you will introduce in words of natural language.

And now comes the terrible question: can you — or any of us — put it across? Can we write so that our information will make a fresh and immediate impact on our readers? Or will we spoil it all by wrapping it up in impressive language, or by groping our way to express thoughts that are not quite clear in our own minds? In any case, does this matter — isn't 'You know what I mean' good enough?

We find that it does matter, because we (as well as you) do *not* always know what you mean. Billings[1] contends 'that more battles have been lost because of misunderstood orders than because of the failure of strategy, tactics or logistics; but the most important tool of the manager is not the computer ... and other devices, but the language itself ...' Fortunately, putting it across is not as difficult as we have come to believe, for what we must use is the natural, everyday language of communication and explanation. This is by far the most important form of English or any other language, and the only instrument that all scientists have in common. In fact, writing is as truly logical an exercise as any other aspect of research and good writing is not just a matter of taste. (See also King[2], pp. 3-4) We ourselves find that the best scientists are also the best scientific writers and believe, as Woodford[3] believes, that the best writers learn to be the best thinkers.

In this article, therefore, we shall examine our difficulties with particular reference to scientific writing in South Africa. These are classified informally, and are briefly discussed to show *how the sense or the effectiveness of a passage may be upset,* for that, and not the writer's 'literary style', is what matters here. If we can disentangle the threads of some interwoven constructions where trouble-makers overlap, we may be able to discover what each can contribute to confusion. Other examples may surprise us with new insights or jolt us into applying our own neglected knowledge.

Most of our examples come from unedited texts, but some – to smack an occasional point home – from the press, or especially from the daily offering of broadcast errors that undoubtedly influence our use of language. There is also much bad scientific publication, which others feel they must imitate.

There are of course many comprehensive works on language, but few scientists know where to locate information or even have the time to try. However, many of the most troublesome faults can be described in simple words, and these faults the author can correct for himself if he is made aware of them. A few grammatical and other points of style are also mentioned to help us identify our problems (editors' as well as authors'), so that we can all look them up in the passages pinpointed here in authoritative texts.

Language background

Some of these authoritative texts are old and some very new, for the treatment of English is continually under review. Works with the traditional approach (Fowler's[4] for instance) contain much that is still essential for writers of English today, though a large part of the Latin-based 'grammar' on which they were founded has been discarded. However, reformers who either fear or hope that the baby and its grammar will be thrown out with the anti-Latin bathwater, apparently fail to see that when the Latinized framework has been cleared away, the English that emerges has sturdy forms and conventions of its own, though they are very different from those of the old Latin models.

In fact, these forms and conventions characterize a completely different kind of language: 'analytic', in which words are related by the order in which they appear as opposed to 'synthetic' in which they are related by inflections as in Latin or German. (See for example Davies[5], p. 31 and on, and Costello[6].) Linguistic

studies of modern English structure (like those of Strang[7], or Crystal[8]) have given us a new approach to the analysis of today's English. The familiar nouns and verbs, subjects and predicates, adjectives and adverbs, etc., are still recognized by those names, but rather as functional parts of sentences (i.e. by the work they do), than as fixed 'parts of speech'.

There is widespread interest today in the functioning and management of English; and this concerns not only the linguists, but also scientists in their search for ways of mechanically indexing, storing and retrieving the information recorded in written documents of all kinds. It is interesting to note that the point of departure for both is the syntax of natural language. As is clear from our discussion of Keywords, information broken down into keyword concepts, each represented by (say) 1-3 words, cannot be intelligibly reconstituted unless functions have been assigned to these words, removed now from their meaningful positions in sentences. Functions may be indicated, as in the E J C System[9] and the CSIR system[10] derived from it, by giving 'role' numbers to the extracted words; in fact Costello[6] described 'roles as syntactical control devices' – artificial, obviously, but workable.

Thus, in order to communicate, linguists and scientists are both working towards the control of natural language in all its biological variability. To achieve this aim, we all need to understand how our words work.

As editors who must solve many problems for ex-students, we believe that young scientists would be greatly helped if their training had given them:

firstly, much practice in critical reading and quick recognition of essentials, especially for the writing of synopses;
secondly, a far more thorough knowledge of sentence structure and its modern analysis;
thirdly, greatly enriched vocabularies, both general and scientific, with special attention paid to word derivations; and
fourthly, some awareness of the influence of other languages, especially Afrikaans, German and Latin. (See also 'Dictionaries') in the Appendix.)

There are other needs, of course, but it is worth noting how many trouble-makers would be eliminated if we concentrated on these alone.

In recent years, science has become divorced from the language that gives it life – often with disastrous consequences for its status and its credibility. Teachers of English, and scientists themselves, have both been blamed for this state of affairs. (See opinions 11-14). Today, scientists and also university teachers are moving to restore an essential wholeness to scientific training. Moreover, while advice on most aspects of report-writing has been available for a number of years, some of the more recent publications (2, 15, 16) are especially concerned with the training of students, post-graduates, and even writers in professional practice.

The CSIR Guide does not offer any formal training. Rather, it should be read as an indication, as brief as is consistent with clarity, of what can make S A scientific writing good or bad, and also as a record of what we ourselves have done. We hope that you will be entertained by our hints, and also helped to put your achievements across to readers who matter.

Difficulties will be discussed under the following headings:

1. Too many words
2. Wrong words and meanings – Vogue words – Jargon – Words commonly confused
3. Order of words
4. Nouns, Pronouns, and Modifiers
5. Prepositions
6. Conjunctions and other linking words
7. Verbs and Verbals
8. Miscellaneous difficulties – Enumeration – Comparisons – Some Afrikanerisms
9. Dictionaries and other guides to English Usage

1 TOO MANY WORDS

Wordiness spoils more scientific reports than any other fault does, and several faults contribute to it as will be seen below. Descriptive reports especially, in many disciplines, are often clogged with dead words.

At some time in our careers we all experience the thrill of recording a bright idea in inspired phrases – only to find that these are left high and dry as the tide of thought moves on. We try to work them in, not to waste them – but 'Murder your darlings', said

'Q'[17](p. 203), who knew this agony many years ago. And our examples show that we, as today's scientific writers, need the same advice.

Natural language is of course a lively and living thing that can never be treated as only a series of mechanical devices. Nevertheless sentences *are* the functional units in any normal communication, and as a machine with too many parts is unworkable, so a sentence should have only as many parts as are necessary to fulfil its function.

We all disregard this maxim at times, and the dissections below will show authors why and how some of their work may have to be edited. If we have sometimes counted words to make our points quickly, we do not wish to imply that the word-count is necessarily a relevant judgement on quality.

(a) Repetition in the same or different words; padding

These may be evident in single words or many words (which the EDITOR will mark), or even in long passages or chapters (which any good REFEREE will reject before they reach the editor).
Examples:

(i) 'The investigation was undertaken to establish whether the installation of water meters is scientifically justified or not. Although there are, of course, considerations other than those of a purely scientific nature which influence the decision as to whether water meters should be installed, this report is specifically only concerned with the scientific implications.'
(This is a bad example of over-emphasis; the passage could have ended at 'justified': the whole message in 15/55 words.)

(ii) 'The process of evaluating the relative importance of the various economic factors in each particular case is, however, essentially subjective and the importance of these economic aspects of the problem must be decided upon by each authority in relation to its own particular circumstances obtaining at the time'.
('Evaluation of the various economic factors is, however, essentially subjective and must be made by each authority to suit its own circumstances': a suggested restatement in 21/48 words.)

(iii) 'Recommendations regarding the desired direction for future action ...' ('Recommendations for future action ...': without padding, in 4/8 words).

(iv) 'With the exception of those instances in which the compound contained impurities ...'
('Except when the compound contained impurities ...': 6/12 words).

(v) 'The problem is inherently of such a nature that ...' ('inherently' and 'of such a nature' mean the same: use one, but not both).

(vi) 'Long-term policy aims and objectives are directed towards ...' ('Long-term policy is directed ...': 'policy' includes 'aims and objectives').

(vii) 'Possible potential resources are ...' ('Potential' includes 'possible').

(viii) 'The first prototype ...' ('Prototype' *is* the first).

(ix) 'A most unique and perfect example ...' ('Unique' and 'perfect' are absolute and nothing can be more or most unique or perfect. For other absolute words see Partridge[18] p. 77).

2 WRONG WORDS AND MEANINGS – VOGUE WORDS – JARGON – WORDS COMMONLY CONFUSED

(a) Wrong words and meanings

A writer may use words (even simple ones) but be ignorant of their exact or full meanings. Thus he may use word-combinations to add meanings which are already there, or invent unnecessary new words. Much verbosity (as under Trouble-maker 1), much unjustifiable jargon and many verbal monstrosities originate in this way.

Examples:

(i) *'Level of ability'* (A psychological term that contains no more meaning than the single word 'ability', as this is defined in any dictionary. Some leading psychologists admit this.)

(ii) 'This brings about the *solubilization* of x in y.' (Say 'solution of x in y': use the good existing word, not a new monstrosity.)

(iii) 'When *dissolution* of salt was complete ...' (Prefer 'When salt was completely dissolved ...' Say 'Parliament was dissolved' and 'dissolution of Parliament', but 'solution of salt'.)

(iv) 'A modified procedure was *conceptualized* by the team.' (Use 'devised' or other good existing words, as in (ii). New words ending in '-ize' or '-ization' often sound childish. See also Abstract Nouns.)

(v) 'The Institute earns a third of its *budget* by undertaking contract work.' (Use 'income' instead of 'budget': budget is an estimate of revenue and expenditure, not the revenue itself.)

(vi) 'The availability of *finance(s)* also regulated the demand for services.' (Say 'funds', 'capital', 'financial resources', but not 'finance' or 'finances'. Say 'The State's *finances* were well managed by the Minister of Finance'.)

(vii) 'The aim is to build *valid* houses.' ('Valid' applies only to abstract concepts like 'reason', 'objection', 'argument', etc., not to material objects like houses, wheelbarrows, etc.)

(viii) 'A programme was prepared to *enable* the calculation of results by computer'. 'Steam curing was used to enable the use of moulds'. (Say 'make possible' OR 'make it possible to calculate or use'. A person is 'enabled to do' something; but an action or result is 'made possible'.)

(b) Vogue words

A 'vogue word', perhaps once an inspired choice, is one that has taken the popular fancy, but, through repetition, may have become stale or even misapplied. Such words today are 'pragmatic', 'concept', 'viable' and many others. Vogue words are so obviously the products of other people's thinking that they should be avoided if possible.

Fashionable metaphors that can also be taken literally have led to the absurdities recorded in examples (x) to (xiii); the supposedly fashionable 'timeous' and 'presently' in examples (xiv and xv) merely sound affected; while lazy vogue words like 'high', 'optimize', 'maximize', etc. in examples (xvi) to (xvii) have become so worn that they have lost all meaning.

(x) 'In the factory catalogue there is a *breakdown* of chairs under men, women and children'. (Say 'classification' or 'analysis').

(xi) 'After the holiday, he was hit by a heavy *backlog* of work'. (Not hurt, we hope?).

(xii) 'There were many taxis, but the Council had placed a *ceiling* on buses.' (High enough for tall passengers?).

(xiii) 'A widespread *bottleneck* holds us back'. (Not if it is wide enough!).

(xiv) 'Delegates must make *timeous* arrangements'. OR 'The building industry has long suffered from a lack of reliable and *timeous* statistics'. (Say 'timely arrangements', 'appropriately timed statistics').

(xv) 'The Institute is *presently* working on the problem'. (Say 'now' OR 'at present').

(xvi) '*High* rates of application ...' (i.e. 'application of large quantities').

'*Ultra-high* tensile wire ropes ...' (Does this mean 'wire ropes of the greatest tensile strength'?).

'*High* dissolved salts ...' (i.e. very concentrated dissolved salts?).

'Trajectories of cosmic rays are *highly* influenced by the magnetic field they traverse'. (Say '... greatly influenced ...').

'There is excellent correlation between *high* precipitated electron flux and ionospheric disturbance'. (Author's conclusions show that here 'high' means 'dense').

In all these examples 'high' blurs the author's message because it is a lazy vogue word that has lost all meaning. But his meaning is restored when an apt word or phrase replaces 'high'.

(xvii) 'The purpose was to *optimize* the design of sand dams'. (i.e. '... to arrive at the best design for sand dams'. Here 'optimize' is a lazy vogue word, like the similar short-cuts 'maximize', 'diarize', and many others).

(c) Jargon

Jargon is sensibly defined as technical language misused. Jargon has been variously equated (as by Fowler[4]) with the specialist vocabulary of a science, art, class, trade or profession; or contemptuously (as noted by the SOED[19]), with the same – obviously (say Godfrey and Parr[20]), when such vocabularies are used to impress the layman; or (as by Weil[21]), with the short-cuts and abbreviations understood only by colleagues working in a narrow field.

King and Roland[2] believe that jargon should be distinguished from technical language. 'Every trade and profession has its technical language, intelligible only to initiates. Technical language serves a function that ordinary language cannot serve ... without excessive wordiness. But technical language is jargon if it displaces ordinary language' (in non-technical communication), or if it is used in the wrong field.

Words like 'percentage' or 'proportion', and 'average', are jargon if they are taken out of their mathematical contexts and used in everyday speech to give an impression of accuracy when all that the speaker means is 'some' or 'many', and 'ordinary'.

(xviii) 'The treatment was effective in a certain percentage/proportion of cases.' (5%, 50%, or what percentage?).

(xix) 'Our statistics are based on the *average* man'. (Do they mean the man of medium height, income, intelligence – or 'just an ordinary man'?).

(xx) 'Random selection of, say, twenty examples will usually set a reliable standard; only someone with a perfectionist syndrome would painstakingly analyse more'. (This is jargon indeed, using 'random selection' and 'syndrome' from statistical and medical fields respectively, in an article addressed to laymen).

(xxi) 'To operate such a device with an *accuracy of 0,1%* would cost about R150 000 per year'. (The engineers' 1% accuracy, or 'accuracy of 1%, 0,1%, etc. is possibly the most perversely successful piece of jargon ever invented, for a 1% accuracy is widely understood among engineers to mean 'an-*error*-of-not-more-than-1% – in other words an accuracy of 99%! But when this jargon is mixed with conventional expression in the same article, readers are left to wonder whether 'an accuracy of 57%' *is* 57% or perhaps 43%; and whether operating the device in our example would cost R150 000 – or 1 000 times as much. To avoid ambiquity, therefore, CSIR editors now change *'accuracy of 1% etc.'* to *'accurate to within 1% etc.'*.

(xxii) 'Raw sewage needs to be diluted at least *1 000 times* in sea water'. (This use of 'times' is colloquial, probably dating from our nursery days and meaningless. To be able to carry out the dilution correctly, readers must be told (e.g.) that

'Raw sewage needs to be diluted by/in at least 1 000 times its own volume of seawater'.) 'Salinity is detectable to dilutions of about *100 times*'. (Say 'Salinity is detectable at a dilution of about 1 part in 100'. OR '... at a dilution of about 1:100'.)

(d) Words commonly confused

Words commonly confused are often words that are similar in sound or appearance but have different meanings. Or they may be so familiar that no writer doubts his use of them. We list, here, some that must often be corrected in technical manuscripts and, from the host of synonyms that have to be given in dictionaries, we select the meanings which distinguish them.

(i) *Affect – Effect – Effective – Effectual – Efficient*
'Affect' means to have an effect on; 'Effect' means to bring about or achieve.
'Effective' means producing results or a striking impression.
'Effectual' (of action apart from the agent), or 'Efficient' (of persons and things) means producing a desired result.

(ii) *Aggregate – Average*
'Aggregate' means the sum or total; 'Average' is a medial estimate.

(iii) *Alternately – Alternatively* (both of not more than two)
'Alternately' means by turns; 'Alternatively' offers a choice.

(iv) *Among – Between*
'Among' is used when many are involved; 'Between' concerns only two or three at a time.

(v) *Amount – Number; Less – Fewer*
'Amount' and 'Less' denote quantity; 'Number' and 'Fewer' apply only to items that can be counted.

(vi) *Can – May*
'Can' means having the ability; 'May' means being permitted, or implies a future possibility. (See also 'Enable', (a) (ix).

(vii) *Collate; Compile – Write* (both of literary work)
'Collate' means to examine and arrange sheets in proper sequence before binding.
'Compile' means to put together out of materials from

various sources;
'Write' means to be author of original work.

(viii) *Complement – Supplement*
'Complement' means that which completes; 'Supplement' means something added.

(ix) *Comprise – Consist – Compose – Constitute*
A body 'Comprises' or 'consists of' (NEVER 'is comprised of') all the parts of which it is 'composed' or 'constituted'. Compare 'includes' OR 'incorporates', which are used when only some of the parts are mentioned.

(x) *Continual(ly) – Continuous(ly)*
'Continual' means continuing to be frequently repeated; 'Continuous' means continuing without interruption.

(xi) *Discreet – Discrete*
'Discreet', meaning prudent, has been confused in scientific descriptions with 'Discrete', meaning discontinuous or separate.

(xii) *Economic – Economical*
'Economic' means on a business footing; 'Economical' means saving or thrifty. The words are confused by economists as often as by laymen.

(xiv) *Especial(ly) – Special(ly)*
'Especial(ly)' means exceptional, to an exceptional degree; 'Special(ly)' means of a particular kind or for a particular purpose.

(xv) *Flammable – Inflammable*
'Flammable' (US) means easily catching fire; 'Inflammable' means easily set on fire. The words are almost synonymous but the more positive 'Flammable' is coming to be preferred.

(xvi) *Historic – Historical*
'Historic' means noted in history; 'Historical' means according to the facts of past events.

(xvii) *Imply – Infer*
A speaker 'Implies' or hints at a truth without stating it directly; a listener 'Infers' that truth from what has been indirectly expressed.

(xviii) *Lend – Loan*
'Lend' is the verb and (except in America) 'Loan' should be kept as a noun.

(xix) *Militate – Mitigate*
'Militate' (against) means to be in conflict with; 'Mitigate' (of punishment, etc.) means to make less severe.

(xx) *Practical – Practicable*
'Practical' (of plan, process, means, etc.) means useful or workable in practice; (of person) means realistic. Opposite: Theoretical, unpractical. 'Practicable' (of plan, process, means, etc., but never used of people) means feasible, capable of being put into practice. Opposite: impracticable.

(xxi) *Principal – Principle – Principial*
'Principal', as noun or adjective, means chief; 'Principle', as noun only, means general truth or law.
'Principial' is an Afrikanerism (q.v.), and incorrect.

(xxii) *Sewage – Sewerage*
'Sewage' means matter conveyed in sewers; 'Sewerage' means a system of drainage by sewers.

(xxiii) *Translate – Transliterate*
'Translate' means to express the sense (of word, etc.) in another language.
'Transliterate' means to represent (word, etc.) in the corresponding characters of a different alphabet. Thus Russian Природа is transliterated as *'Priroda'*, but translated as *'Nature'*.

3 ORDER OF WORDS

If it is obvious that neither a machine nor a sentence with too many parts can function properly, it is equally obvious that the parts of either must be in the correct sequence. In German, *'die auf das chemische Gleichgewicht einwirkende Kraft ...'* (the force acting upon the chemical equilibrium ...) cannot be misunderstood because nouns are identified by capital initials and qualifying phrases are tied together by gender. Similarly in the Latin *'Homo canem necavit'* (The man killed the dog), killer and killed are unmistakably identified by case endings. A language like English, however, which has lost nearly all its inflections, relies heavily on the order of words to relate them meaningfully. Words do not belong together because they are all (say) masculine or feminine or neuter, or all in the accusative case, but usually because they are near to each other in the sentence (Gowers[22], p. 122), or are

linked by prepositions or other connecting words. The meaning of a sentence thus depends both on the meanings of its parts and also on the order in which they appear. Using identical parts, we can say either 'The hunter killed the lion' or 'The lion killed the hunter' and here meaning is decided entirely by word order.

(a) Words in the wrong order

Absurd examples make it easier to correct the scientific ones, by putting together those words that belong together.

(i) 'The tribesman reported a conspiracy against the chiefs being hatched in Ovamboland'. ('being hatched' should come immediately after 'conspiracy'; it was not the chiefs who were being hatched).

(ii) 'In the fighting, many soldiers were wounded on both sides'. (Left and right, back and front, or Arab and Israeli? Say, 'soldiers on both sides...').

(iii) 'The Minister unveiled a memorial to all those who had died in the two world wars on Monday'. (All those men did not die on Monday. Say, 'On Monday, the Minister unveiled ...').

(iv) 'Normal value ranges have been established for man, and the alterations in these values have been determined after the use of drugs'. (Drugs for the patient or for the investigator? Say, '... and alterations in these values after the use of drugs have been determined').

(v) 'Dr X and Dr Y have studied its effects on the composition of plasma in man, and Professor Q who is co-operating with them'. (The Professor's co-operation or his plasma? Say, 'Dr X and Dr Y, and Professor Q who is co-operating with them, have studied ...').

(vi) 'These beams are relatively light, but are of deep section by virtue of their hollow construction'. (Say, 'These beams are of deep section, but relatively light by virtue of their hollow construction'. Obviously lightness is due to hollow construction, not to deep section).

(vii) 'Only the short-period waves, as at many other Antarctic stations, are recorded successfully at Sanac'. (Say, 'As at many other Antarctic stations, only the short-period waves are recorded successfully at Sanac'. This restatement corrects the ambiguity: the short-period waves should be associated with the recording, not with the stations).

(viii) 'The report described microseismic activity during summer which is very intense when stormy weather prevails'. (Say, 'The report describes micro seismic activity, which is very intense during summer when stormy weather prevails'. The original sentence states either that 'The report describes during summer ...', or that 'the summer is very intense').

(**b**) **Misplaced or dangling qualifiers** (adjectives, nouns in apposition, participles or participial phrases).

These are also words in the wrong order, as in (a). If we study the series of statements below, we see that, in each, the words in italics qualify the noun in exactly the same way. (For those who find it helpful, the qualifying words are described in brackets):

The *blind* man did not see the hole in the ground. (Adjective)
Being blind, OR *weeping bitterly,* the man did not see ... (Present participle or the whole phrase)
Blinded by the strong light, the man did not see ... (Past participle or the whole phrase)
The police saw the man *escaping from custody.* (Present participle or whole phrase)

In each statement, the qualifying word(s) stand next to their noun, 'man'. There are extended and more complicated sentences of course, but these simple patterns will suffice to show why the following sentences may amuse, or jolt, or confuse readers because qualifying words have become detached from their nouns – as also in Example (a, i) above.

(i) 'Emerging from the western door, the fishpond lies before you'. (The fishpond emerging? What a vision!)
(ii) 'Using this technique, the commercial equipment gives satisfactory results'. (The commercial equipment isn't using this technique, *you* are. Say, 'For this technique, ...' OR 'When this technique is used, the commercial equipment ...')
(iii) 'Making use of Larson's data, the fraction of neutrons from a Radium-Beryllium source escaping over the boundaries of the tank is given by formula A (Geiger and Whyte). (There is much confusion here. To begin with, it is not 'the fraction of neutrons' that is 'making use of Larson data' but, probably, Geiger and Whyte. Further, according to the statement, it could be either 'the fraction of neutrons' or 'the source' that is 'escaping ...'.

The passage can be made unambiguous thus: 'Making use of Larson's data, Geiger and Whyte found that the fraction of neutrons escaping over the boundaries of the tank from a Radium-Beryllium Source is given by formula A.')

(c) German construction

Many writers on English style consider that the structure of German sentences has also upset the orderliness of much 'scientific English' and in 1955 Baker[23] (like others of his time), attributed this 'new fashion' to the copious writings of German immigrants in American scientific journals.

In German it is correct to write 'die in einem Stahlzylinder unter Druck siedende Flüssigkeit ...' thus piling up before a noun a number of words that are not adjectives but are used adjectivally. Words and phrases are synthesized grammatically into bundles, and the resulting sentences are very clear – in German.

But, in English, one should *not* write:

(i) 'the chosen model is a one-dimensional, forward finite difference, transient heat flow simulating procedure developed by Schenk ...', OR

(ii) 'a small thin-walled, usually round, or sickle-shaped if produced by fission of the zygote, or somewhat amoeboid spore is formed ...'

As these are recent examples of what seems like German English from manuscripts, it may be that the same influence is with us today. These sentences are difficult to understand at first reading and therefore detract from the effectiveness of the reports. In both sentences a basic German construction is apparent – but an expression that is very clear in German becomes a knot of tangled thoughts in English. For the 'analytic' English language is composed mainly of uninflected word-pieces that must be correctly related in new patterns to produce new meanings.

If we examine the multi-topic sentences (i) and (ii), we become aware of their long-delayed subjects of interest ('procedure' and 'spore'), each struggling to emerge from a mind-stopping bunch of modifying phrases. But we can make them easier to read and understand if we break the passages up into short pieces, which can then be rearranged with related ideas together and in logical sequence, as in (iii) and (iv):

(iii) 'The chosen model is a one-dimensional procedure with forward finite difference, which simulated a transient heat flow. It was developed by Schenk'.

(iv) 'A small thin-walled spore is formed, which is usually round or somewhat amoeboid, or sickle-shaped if produced by fission of the zygote'.

Wild[24], does the same thing when he translates 'die in einem Stahlzylinder unter Druck siedende Flüssigkeit ...' as 'the liquid which is boiling under pressure in a steel cylinder ...' He has broken up the German construction and used English word order, with a relative clause instead of inflections to link ideas. His book contains many examples of German sentences translated into English, and therefore offers many patterns for changing German English into English English.

4 NOUNS, PRONOUNS AND MODIFIERS

In this section we deal with words that function A, as NOUNS (which, as we all know, name the things, abstractions or agents, etc. that we are talking about); or B, as PRONOUNS (which stand for nouns); or C, as MODIFIERS (which describe or modify the nouns and pronouns), or the VERBS (q.v.) discussed in the next section.

A. Nouns

Most of the troubles caused by nouns in scientific writing have something to do with Number, Agreement with verbs and with other parts of a sentence, Abstract Nouns, or New Scientific Terms.

1. Number – Singular or Plural?

Usually this question is casily answered, for most English plurals are formed quite regularly by adding -s to the singular forms; and irregular plurals are indicated in our dictionaries. In the Deskbook[26] (p. 172) there is also a classification of tricky plurals (for example, of words ending in -ex or -ix) which Scientists will find particularly useful.

2. Factors influencing Number and Agreement with verbs

Probably the commonest mistake in South African English is lack of agreement. A noun must be followed by a verb of the same

number ('John *was* at the airport'.): that is the rule. But various factors or constructions may influence its numerical status. With example (a) below as firm foundation, we go on to forms that make agreement more difficult:

(a) *and* adds items together to make a plural which takes a plural verb.
'John and Charles *were* at the airport'.

(b) *as well as* OR *with* OR *together with* holds the addition in parenthesis as it were, and so does not change the number of the subject.
'John, as well as Charles, *was* at the airport'.
'The President, (together) with members of the Council, *was* present'.

(c) *or* AND *either ... or* AND *neither ... nor* introduce alternative subjects that agree separately with the same verb.
'John or Charles *was* at the airport'.
'Neither the girls nor the boys *were* at the airport'.
But if alternative subjects are of different number, each should have its own verb.
'Either the girls were late or the plane *was*'.

(d) *There OR Here is/are* 'There are the list of chemicals' is wrong. We can show that the subject 'list' should have a singular verb by reversing the statement to 'The list of chemicals *is* there'.

(e) *Wrong identification of subject*
Since the subject (noun or pronoun) determines the form of the verb in a sentence, we must be able to identify the true subject and be sure that the verb agrees with it. The following sentences show how a mistaken subject can set an author off on the wrong track:

(i) 'Your set of dictionaries have arrived'. (Here the subject is 'set', which *has* arrived. But the plural 'dictionaries' – closer to the verb – has attracted a plural verb instead).

(ii) 'For the correction of variations in cosmic rays, a sliding weighted average of the counting rates of two neutron monitors were used'. (Say '... average ... *was* used'. Again plural nouns that are not the true subject have attracted a plural verb).

(iii) 'Further studies on the purification of antigens is in progress'. (Say 'studies ... *are* in progress'. Here 'studies' is the true subject, but 'purification' has attracted a singular verb).

(f) *Nouns of uncertain number and their verbs*

Not all nouns are obviously singular or obviously plural.

(i) Some nouns are always plural and followed by plural verbs, for example: annals, data (singular 'datum', an assumed fact used as basis of calculation), scissors, thanks, wages.

'The data that he used *were* not reliable'.

(ii) Other nouns, though plural in form, are followed by singular verbs: linguistics, mathematics, news, physics, series.

'A series of experiments *was* carried out'.

Some nouns in this class may also take plural verbs when they are plurals themselves, for example:

acoustics, aesthetics, economics, innings.

'Acoustics *is* the science of sound'. BUT

'The acoustics of hall and classroom *are* very different'.

(iii) Collective nouns are treated as singular or plural according to whether emphasis falls on the wholeness of the collection or on its constituent parts:

committee, contents, group, number.

'The committee *was* entitled to make recommendations'.

'The committee *were* arguing among themselves'.

'The contents of the test-tube *was* added to the mixture'.

'The contents of the box *were* scattered on the floor'.

(iv) Similarly, collective ideas, measurements, or rates take singular verbs when they are treated as units:

'Three weeks *was* spent on that project'.

'One hundred kilometres per hour *is* the equivalent of sixty miles per hour.

'Performing experiments and writing a report at the same time *is* not easy'.

3. Agreement with other parts of a sentence

Besides matching its verb in number, a subject must also match whatever it is identified with in the rest of the sentence – or the reader will be annoyed and delayed by inconsistent relationships.

(a) 'Many words which started out as the trade name of a specific company have now become generic terms for the product, e.g. Polythene'.

(Say 'Many words which started out as the trade names of specific companies have now become generic terms for their products, e.g. Polythene'.)

(b) 'References are shown by a serial number in the text.' (Say 'References are marked by serial numbers in the text.')

(c) 'Members of staff may apply for a grant to cover expenses'. (Say 'for grants', or, if this seems an invitation to extravagance, then 'a member of staff may apply ...')

4. Abstract Nouns and other Abstractions

We are often told to avoid abstract nouns and use concrete terms instead; the old injunction to call a spade a spade and not an agricultural implement still has more punch in it and illustrates the point exactly: concrete words are more precise and usually shorter.

We believe, of course, that we would never describe a spade in such abstract, highfalutin terms, except as a joke. But we are mistaken. Fowler[4] would have said that CSIR writers suffer from "Abstractitis', since we did write:

(a) 'There was a *resumption* of investigative activities' (instead of 'Investigations were resumed')

(b) 'This substance has a *growth-promoting effect*' (instead of 'This substance promotes growth').

(c) '*Separation* of acetates and iodides was effected' ('Acetates and iodides were separated')

(d) 'Marine *pollution* is the introduction by man of substances into the marine environment resulting in such *deleterious effects* as *harm* to living resources, *hazards* to human health, *impairment* in quality of sea water, and *reduction* of amenities'.
('Man pollutes the marine environment when he introduces into it substances that harm living resources, endanger human health, impair the quality of sea water and reduce amenities').

In our examples the abstract nouns may be simply 'Big words for Small', like 'agricultural implement' for 'spade' or 'investigative activities' for 'investigations'. Or they may be the names of actions or processes (as in the original sentences above) and since these abstract nouns represent actions, they are best changed into the verbs from which they were derived (as has been demonstrated in the revised sentences). Please notice all the changes: 'resumption'

to 'resumed', 'agreement' to 'agree', 'pollution' to 'pollutes', etc. Woodford[15] calls this 'releasing the hidden verb', and it is clear that the release has shortened, strengthened and clarified every sentence.

Scientists necessarily deal with and explain many abstract concepts, so that abstract words are often unavoidable and right; but this is not Abstractitis. By using verbs instead of vague abstractions when explaining, writers can do much to enliven and simplify difficult concepts – and clarify their own thinking as well. No subject can justify the pages of woolly thoughts that result from:

(e) 'Undertaking operations research type investigations';
(f) 'Inherent difficulties inducing the postulation of a working hypothesis';
(g) 'Solubilization' of this or 'conceptualization' of that; and
(h) All the other seductive words ending in -tion, -ment, -ist, -alist, -ality, etc., etc.

The real danger, said Fowler, 'is that once the disease gets a hold, it sets up a chain reaction. A writer uses abstract words because his thoughts are cloudy; the habit of using them clouds his thoughts still further; he may end by concealing his meaning, not only from his readers but also from himself'.

Fowler would have understood the difficulties of the space scientist who had written, but could not explain, 'Man machine requirements in this system environment impose severe visual acuity problems'. Only persistent questioning revealed that he had been trying to report, 'The pilot cannot see the instrument panel'.

But perhaps Gowers[22] has the last word when he observes that to be precise is sometimes dangerous – as indeed it may be if one risks exposing, not a secret weapon, but a secret uncertainty or a secret muddle. It seems safe to use the abstract generalization:

> 'There was only slight evidence of contamination by this insecticide in a few cases'.

But confidence could be undermined by a definite admission that:

> 'Traces of the insecticide were found in 2% of the bodies examined'.

5. New scientific terms

Man's desperate need for new words to describe new things in his

own expanding universe is responsible for many of the verbal monstrosities that he invents (like some of our Abstractions); for many of his verbal thefts from older disciplines (some of our Jargon); and perhaps even for various convoluted definitions ascribed to German construction.

A few acronyms (e.g. laser, radar) have found their way into our dictionaries as accepted words, but most, like those designating new scientific or other authorities, are meaningless shatterers of the text to all but a few readers.

New words are still formed, as in natural sciences such as Medicine and Geology, by combining Greek or Latin roots according to accepted rules. Unfortunately, this is an operation for which today's education seldom equips us and scientists have to seek other means of increasing the scientific vocabulary. That this vocabulary is already vast is proved by the great number of specialist dictionaries now available. Nevertheless these different vocabularies have features in common.

McNeill[26], analysing the engineering jargon used by space technologists in his article *Speaking of Space,* finds there 'the ingredients of most professional jargons'. He notes a few figures of speech (among them 'milkstool', to describe an arrangement of three rocket engines on the lunar spacecraft; and 'eyeballs in' and 'eyeballs out', to describe conditions of extreme acceleration and deceleration respectively). However, these joyous descriptions are the products of excited observation. Consequently they are rare and cannot be produced to order. McNeill concludes that 'space speak' makes much greater use of a familiar grammatical form, the nominal compound, which can be manufactured with ease in ordinary English.

For example, a phrase like:

> 'the system that controls altitude of the ship by ejecting gas',
> can be turned into the nominal compound:
> 'the gas ejection ship altitude control system'.

The compound consists of a string of nouns all modifying the key and always final one, and together they are treated as a single noun. Its meaning (as noted before with simpler examples[XX]), depends entirely on the order of its parts. Thus 'escape propulsion system' does not mean the same as 'propulsion system escape'.

The compounds are certainly concise. However, McNeill points out that although nominal compounds are easily formed, their

interpretations are sometimes ambiguous. Thus 'mission suitability' could mean either 'suitability *for* the mission' or 'suitability *of* the mission'.

Similarly Roland[2] (p. 12), of the American Medical Association, points to the awkwardnesses introduced into medical literature by nominal compounds. And Woodford[15] (p. 52) shows that even a 3-term compound like 'adult liver disease' could refer either to liver disease in the adult or to disease of the adult liver.

It is a pity that these nominal compounds have come to be regarded as status symbols – and the longer the better. McNeil suggests a 'pretension index' to measure their abuse. In fact Woodford advises his students to break up all such noun clusters and stacked modifiers as they usually impede communication. 'A useful rule of thumb to ensure lucidity', he says, 'is to allow the coupling of two nouns ('liver disease') but not the addition of a third ('pig liver disease') or even a modifier of the two-noun cluster ('developing liver disease')'.

Correction of the fault is achieved by restoring the verbs and prepositions that were squeezed out when the compound was formed. 'Some loss of brevity is inevitable' he admits, 'but lucidity is too important a commodity to be sacrificed on the altar of conciseness'. The origin of nominal compounds described above shows how restoration can be accomplished.

Many South African scientists also produce and admire nominal compounds for their seeming efficiency. No doubt many writers are influenced by computer or chemical terminology. But compounded nouns do impede communication simply because they are clumsy. For example:

> 'A 20 inch diameter mirror' (instead of 'A mirror of 20-inch diameter')
> 'Good quality spring water is found'. ('Spring water of good quality is found')
> 'A brick veneer timber frame construction house'. (Here we must clear our minds to recognize simply 'a house constructed from a timber frame with brick veneer'.

B. Pronouns

Incorrect or uncertain reference of pronouns creates many problems in scientific writing. Pronouns stand for nouns and must be so used in the text that the reader will know immediately which nouns they

do stand for – that is, which nouns are their antecedents.

In legal documents, the nouns themselves are often repeated in order to avoid ambiguities, but in non-legal writing pronouns are more freely used to avoid clumsy repetition. Where exact meanings must nevertheless be conveyed, as in scientific reports, all pronoun references must be very carefully checked by authors and editors before publication.

Examples of careless writing quoted here show that uncertainties may arise:

(a) where there is more than one possible antecedent, as for the pronouns underlined in (i) and (ii);

(i) 'Franz studied under the famous radiographer, Dr Pilsen, when *he* was in Oslo'.
(When Franz or Dr Pilsen was in Oslo?)

(ii) 'The strain-gauge was attached to the rock-face but *it* was found to be unreliable'. (The rock-face, or the strain-gauge?)

(b) when the pronoun, as in (iii) and (iv), is used to represent an antecedent that has not been properly stated but must be inferred;

(iii) 'Column A gives square roots; *this* is an operation which can be handled by a slide-rule'. (Here the statement should have been completely written out. Say, 'Column A gives square roots; *extracting square roots* is an operation which can be handled by a slide-rule'. Example from Weil[21]).

(iv) 'Pressure was applied to each of ten samples for exactly two seconds; *this* is important if significant differences are to be detected'. (Here the writer intended to say, '... *precise timing* is important if ...').

(c) when indefinite or impersonal pronouns are used – especially such pronouns as *this,* as in (iii) and (iv) above; *these, that, those, one,* as in (v) below; and *it,* as in examples (vi) to (xii);

(v) '*One* must judge by *his* own observations'. The pronoun *one* (with its possessive *one's*), must be used throughout a sentence or passage, and not changed to *he* (with *his*), or *you* (with *your*).

(vi) For *It ... it ... it* troubles, a CSIR writer has provided this superb example: 'Although this system was drawn up after the economic survey had started, it was preferred

to the system suggested for their official manual because it was felt that it was tied up too intimately with the needs of the situation as it had developed in South Africa'.

(The first *it* refers to this new preferred system; the second *it* is impersonal; the third *it* refers, rather doubtfully, to the official system; and the fourth *it* to 'the situation'. Maddening, isn't IT?)

(vii) 'He put his feet up on the stove as *it* was very cold'. (Meaning the weather, not the stove. The *impersonal it* is often misapplied, as in this example from Partridge[18]).

(viii) 'Further payment for speed tests was suspended because *it* was too dangerous'. (The writer means *the testing*, but says *the payment* was too dangerous. Here again the *impersonal it* is misapplied).

(ix) Certain idioms incorporating the *impersonal it* are in fact literal translations of impersonal, passive, Latin constructions which have become accepted as English usage; for example, *constat inter omnes*, that is, *'It is agreed among all'* may become *'It is generally agreed [that]* ...'. Many English sentences in scientific reports begin with such *it* ... *that* statements and these sentences can be shortened and improved if the *it* ... *that* sections (underlined in the examples below) are omitted altogether or perhaps replaced by one word. No meaning is lost, and some obvious padding is removed, as shown:

(x) *'It is unnecessary to add that* further tests will have to be made'. ('Obviously ...')

(xi) *'It can sometimes happen that* excessive rain renders plants more susceptible to infection' ('Sometimes, excessive rain ...')

(xii) *'It is quite usual that* specimens in equilibrium with the controlled laboratory atmosphere are simply described as dry'. ('Usually, specimens ...')

(xiii) *'It is now perfectly clear that* ...' ('Clearly, ...')

Why not 'I' and 'We'? The question is well put by Roland[2], because the traditionally approved style for objective scientific writing was always in the third person – and much of it also in the passive voice (p. 27). Unhappily, the resulting publications usually made heavy

reading, wordy but not necessarily clear.

Remnants of this search for anonymity remain with us today, as in the following:

(xiv) 'Many reports on the recycling of waste water have already been published, but here the authors investigate another aspect of the problem'. (Were 'the authors' responsible for the 'many reports' as well as for the new investigation? Bibliographical references for the reports and 'we' instead of 'the authors' – or 'present authors' – would make this clear.

(xv) 'This paper argues the case for local control of pollution and stresses the need for regional planning'.
(Personification of a 'paper', a 'report' or a 'publication' is common but embarrassing. A paper or a report cannot argue or stress. Say, 'In this paper "*we*" argue ... and stress ...').

Clearly, there are roles for pronouns of all persons in scientific literature, and we trust that objectivity will be evident without third-person reporting.

C. Modifiers

The term 'Modifiers' has been used to refer to both adjectives and adverbs.

An ADJECTIVE modifies a Noun by limiting, qualifying or describing it more fully (as in 'a *loud* noise').

An ADVERB modifies a Verb ('speak *loudly*'), an Adjective ('*partly* loud'), or another Adverb ('*consistently* loudly').

(a) Confusion of adjectival and adverbial forms

Confusion occurs more often in spoken than in written English, but is occasionally found even in scientific writing.

Slow is an adjective; *slowly* is an adverb. Thus it is wrong to say 'Salts dissolve slower at low temperatures' *OR* 'Workers decided to go slow'.

(b) Unwanted adjectives

Certain adjectives and nouns are too often used in pairs, like: active (or careful) consideration; serious crisis; definite decision; final conclusion; integral part; essential condition; grave danger; actual (or true) facts.

In all these pairs, the meaning of the adjective is contained in the meaning of the noun. It is unnecessary adjectives like these that have caused the adjective to be called the enemy of the noun (Fowler[4] and Gowers[22]), threatening to deprive the noun of all strength if it stands alone. Indeed, what meaning is left in *consideration* if it is not active, a *crisis* that is not serious, or a *conclusion* that is not final? To quote Gowers, 'If a part is always an *integral part* there is nothing left for a mere part except to be a spare part'.

Many nouns are strong in their own right, like *crisis, danger, accident.* Gower's advice is to reserve adjectives to denote kind rather than degree; thus we could say *economic crisis* or *traffic accident,* but *not* an *acute crisis* or a *bad accident.*

(c) Unwanted adverbs

Similarly, some adverbs are habitually used to modify or intensify certain adjectives, especially adjectives of quantity or measure, like *many* and *few, short* and *long, heavy* and *light.*

Some unwanted adverbs commonly associated with these adjectives are: relatively, comparatively, appreciably, unduly, considerably, substantially, and, note especially, *very* and *rather.*

All these are vague intensifiers, which add nothing to the meaning. It means little to say, 'Many specimens were submitted to the museum during the year but comparatively few were mounted'. Far better is the definite statement, 'Nine hundred specimens were submitted during the year but only 27 were mounted'.

Moreover, as with adjectives and nouns above, some adverbs are habitually used with strong adjectives that do not need them, as in *absolutely essential, definitely decided.*

(d) Respective, respectively – unnecessarily or incorrectly used

Until a child told me in a letter, 'We went in three buses that drove one behind the other respectively', I had not realized how deeply this word has eaten its way into the vocabulary of the whole population.

The letter showed that a very young person had grasped the distributive sense of the word but not its whole meaning. Yet he did just as well as the Departmental Head who wrote, 'Three new machines of 10, 20 and 40-ton capacities respectively have been

installed in our Department'; and just as well as the learned Ph.D., who wrote that 'These Beta rhythms were similar in the normal and abnormal groups respectively'.

In all these examples, the word *respectively* should have been omitted. Gowers regards it as 'a fairly safe bet that *respective* (or *respectively*) is used unnecessarily or wrongly in legal and official writing more often than any other word in the language'. The word is useful for distributing correctly a certain number of items among an *equal* number of recipients when one verb serves them all. For the 3 machines mentioned above, *respectively* is not necessary unless 3 recipients are also named. Then, if it is stated that the machines were installed in (say) Pretoria, Durban and Cape Town, *respectively* would show that the 10-ton machine went to Pretoria, the 20-ton machine to Durban and the 40-ton one to Cape Town.

If only two places are named, then which got the biggest machine, and if four places are named, which went without?

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