

PLAYING AT SEMANTICS

P.C.Baayen
C.W.I., Amsterdam

Who was it that said: our playing is learning, our work is play? Certainly, among logicians, computer scientists and mathematicians there have always been many who loved to devise puzzles, make up puns and play with words and meanings. Witness the department of Scientific American, first called (in the days of Martin Gardner) *Mathematical Games*, then (run by Douglas R. Hofstadter) *Metamagical Themas*, and now contributed by A.K.Dewdney as *Computer Recreations*.

A very creative and influential contributor to the genre was the Rev. Charles Lutwidge Dodgson, lecturer in mathematics in Oxford, and to most people only known under his pen-name Lewis Carroll. His *Diversions and Digressions*, the epic *Hunting of the Snark*, and in particular the two *Adventures of Alice* have always drawn the attention of mathematicians and logicians. For both for the *Snark* and the *Alice* books Martin Gardner prepared valuable annotations, not only providing background information and literary associations, but in particular drawing attention to the logical puzzles and plays hidden behind the fanciful stories.

Naturally, ideas and characters from Lewis Carroll have been used again and again by logicians and philosophers to illustrate fine points of their argument. And if you have to prepare an introductory speech, "Alice" is a rich mine of metaphores. For instance, if you want to make the point that computer scientists in general, and those studying concurrent processes in particular, have to work extremely hard to keep abreast the rapidly changing technology, then it might be enlightening to quote the Red Queen, from the second chapter in "Through the Looking Glass". After running with the queen as fast as she could for quite a while, Alice remarks on her observation that no progress has been made. "Well, in *our* country", said Alice, still panting a little, "you'd generally get to somewhere else - if you ran very fast for a long time as we've been doing." "A slow sort of country!" said the Queen. Now, *here*, you see, it takes all the running *you* can do, to keep in the same place. If you want to get somewhere else, you must run at least twice as fast as that."

Several books dealing with logic, computability or artificial intelligence refer to Lewis Carroll's Oeuvre. For instance, Douglas Hofstadter in "Gödel, Escher, Bach" has Carrollian creatures taking part in the dialogues. And the logician Raymond Smullyan even wrote a whole book around Alice, called "Alice in Puzzle-land" (New York, 1982). A prime example of *pure* logic, if I may follow the classification of Craig Smoryński.

Maybe this needs some explaining. Smullyan - author of outstanding works on theoretical logic, such as "Theory of Formal Systems" (Princeton, 1961) and "First-Order Logic" (Berlin &c, 1968) - has enriched the literature with a number of books in which complex logical results are treated and explained through the device of logical puzzles. Apart from "Alice in Puzzle-land", there are "What is the Name of this Book" (1978), "The Lady and the Tiger" (1982), "To mock the Mocking Bird" (1985) and "Forever Undecided. A Puzzle Guide to Gödel" (and possibly others). Not only the Gödel theorems are explained and elucidated by means of puzzle sequences, but also aspects of combinatory logic and of proof theory. "Forever Undecided" was reviewed by Smoryński in the February 1989 issue of the American Mathematical Monthly; in this review, Smoryński submits that "the difference between pure and applied logic is merely one of where the application lies - in the sacred world of mathematics or the profane world of everyday affairs". Now it may seem as if Smullyan's puzzles deal with everyday affairs, like a defense lawyer jumping up and shouting "That's not true" when his client is accused that, *if* he did the terrible deed, he must have had an accomplice (thus exhibiting a defective grasp of material implication); or such as islands full of knights (who are unable to lie) and knaves (who are unable to speak the truth), or Humpty Dumpty confronting Alice with complex variations on the Barber Paradox. One is tempted to conclude, therefore, that they are applied logic. However, as far as Smullyan is concerned, Smoryński arrives at a different conclusion: "This is pure logic, not applied. It falls short of an application to epistemology because of the imaginary nature of the island and its oversimple picture of human nature".

As a true example of applied logic, Smoryński gives us an island in the Aleutes, inhabited (exclusively) by Russians and Americans, some of which are patriots and some are traitors. As it happens, patriots always and only speak the truth to their compatriots, while traitors always and only speak the truth to those of the opposite nationality. If somebody - either an American or a Russian - asks a native "Are you an American or a Russian?", he will not be able (whatever the answer) to conclude anything concerning the nationality of the native, but he will be able to reason out whether his respondent is a traitor or a patriot. The logical analysis of how Americans or Russians reason in solving this puzzle is, according to Smoryński, an instance of *applied* logic. (Amazingly, it turns out - as everyone can easily check for himself - that Russians and Americans reach different conclusions.)

The example is enlightening. It is surely to be hoped that Smoryński will fulfill his promise and indeed write a monograph on "Beyond Detente; A Puzzle Guide to Geo-Political Realities". But of greater importance is the application of Smoryński's classification to the scientific work of Jaco de Bakker and his school. Indeed, isn't it obvious that the semantics of programming languages, particularly so if dealing with parallel object-oriented approaches, is so far removed from "the profane world of everyday affairs" that evidently it is to be classified as *pure* logic! It is not clear to me whether this conclusion will please Jaco; after all, he has been singularly successful in convincing pragmatic, application-oriented people to pay for his research. But in any case this explains the great attraction to logicians of Jaco de Bakker and his department.

The Carrollian universe has not only been a source of ideas to logicians and their ilk: it has also inspired authors with more literary aspirations. One of those, Gilbert Adair, has given us a third Alice adventure: "Alice through the Needle's Eye" (Macmillan, London &c, 1984). It is a pleasant book to read, almost as full of puns and playings on words and meanings as the real Adventures. Where it falls short, is in the logic tricks and puzzles.

Alice, falling through the eye of the needle she is vainly trying to thread, drops down to a country full of Carrollian creatures. Enjoying her birds-eye view, she considers herself to be the first orni-theologist. After a safe landing in an A-stack (inhibited by a Cockney mouse who is convinced she is 'Alley's comet'), Alice meets many interesting creatures: camels of course (after all she seems to remember that it is in the nature of camels to go through the eye of a needle), an anony-mouse who wrote all those poems in anthologies signed Anon., and the otter and hamster who together built a dam and then could not agree whether to call it *Otterdam* or *Hamsterdam*. At one stage Alice finds herself in a restaurant, with the waiter a nicely dressed Frog (the illustrations by Jenny Thorne, by the way, do convincingly look like they might have been drawn by Tenniel). Alice asks him what dish he recommends. "We-ll", replied the Frog in a slow drawl, "what I *can't* recommend is the Frog's Legs, you know. Order those - and you'll see as how the service slows down something dreadful".

One happening is an Election, with an Emu running for office. This is one of the episodes where a chance for a logical joke is missed. Alice asks his Emu-nence what election promises he makes. "The Emu gave her such a piercing stare, that any other little girl of her age would have been quite put out by it. "Ahem - what promises do I make? Why, I promise - I promise - I promise *not* to break my promise - and that's a promise! Next question!". "

Certainly, Lewis Carroll would have handled this scene differently. Why, the Emu's answer is logically speaking without content (and that probably is the sole intention of the author); but Alice (and we) would have had more food for thought if the Emu had said something like "you annoy me so much - I promise you I'll break this very promise". Or wouldn't it be more fun to have a politician say: "I promise this is the last promise I'll ever break"? It might be nice if Jaco, or some of the people around him that are well-versed in temporal logic, would sit down and make up really clever promises; if somebody does, please tell me what comes out of it!

One of the denizens of the country behind the needle's eye deserves special mention: the Grampus. He is an impressive character; one just can't get around him or ignore his presence. From his appearance and behaviour (he even has the ability to read and use *italics*) it is immediately clear that he must be a learned scientist; this also appears from some of his idiosyncrasies (he regularly lectures to Alice, and he is so absent-minded that he sometimes even forgets that he is absent-minded, and remembers everything). In fact, he is Headmaster in the School of Whales. Although he is (on first sight) a ferocious man-eater, he turns out to be quite amiable and friendly, once you learn to know him better. And on top of that, he is a specialist on semantics. Allow me to quote from the Grampus lecturing to Alice.

"Meaning, my dear, is a rare and precious substance", the Grampus gravely replied: "so precious that, if my opinion were asked about it, it should

be preserved under a bell jar in the Museum - on view to the Public, Tuesdays and Fridays, at sixpence a time".

"But dictionaries are full of meanings", objected Alice, who remembered consulting one not so long ago.

"Full of *meanings*, perhaps, but empty of *meaning*", said the Grampus. "As I ought to know, for I tried reading a dictionary once - just as a change from my Auto-biography, you understand - but the story in it was the dullest and most meaningless I ever read. And the reason for that is, that the best meanings can't ever be written down, that's how precious they are."

The Grampus, to me, somehow, however imperfectly, combines several features which I admire in Jaco de Bakker. For that reason, I would have liked to reproduce here one of his portraits by Jenny Thorne. Alas, it was too late to obtain permission from artist and publisher. Therefore I decided to go one better, and I asked Tobias Baanders to give me his artistic impression of a "Headmaster of the School of Whales". As always, Tobias came up with a beautiful drawing. I am pleased to dedicate it here to

Jaco de Bakker.

