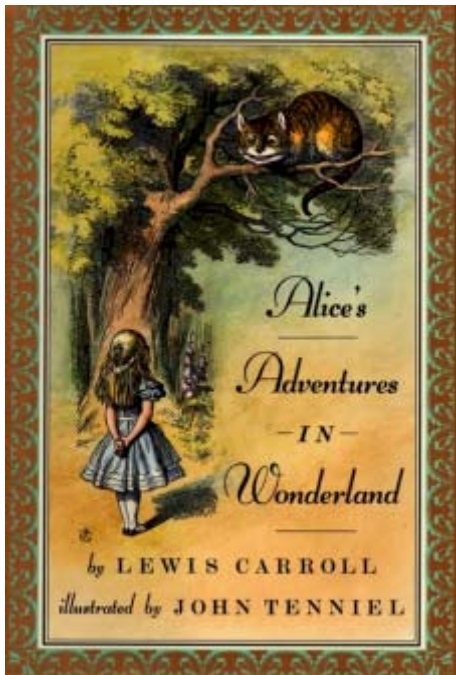

Maths and Language

David Jefferies

INTRODUCTION

Publisher Jack Stone suggested an article extolling the benefits of the language of Maths as an aid to clear thinking, and as a bridge between folk who do not share fluent use of a common language.



Your Author thinks that this is a subject that has been very well visited in the past by all kinds of erudite people from all kinds of disciplines. Thinking about who might be taken as a role model, Lewis Carroll came to mind – the world’s most accessible mathematician, possibly. He was also a very careful, precise, original, and creative user of the English language. A visit to the well-stocked library at home unearthed the following gem by Lewis Carroll.

Puzzles from Wonderland, VII

When the King found that his money was nearly all gone, and that he really *must* live more economically, he decided on sending away his Wise Men. There were some hundreds of them – very fine old men, and magnificently dressed in green velvet gowns with gold buttons: if they *had* a fault, it was that they always contradicted one another when asked for their advice – and they certainly ate and drank enormously. So, on the whole, he was rather glad to get rid of them. But there was an old law, which he did not dare to disobey, which said that there must always be

“Seven blind of both eyes:
Two blind of one eye:
Four that see with both eyes:
Nine that see with one eye”

Query: How many did he keep?

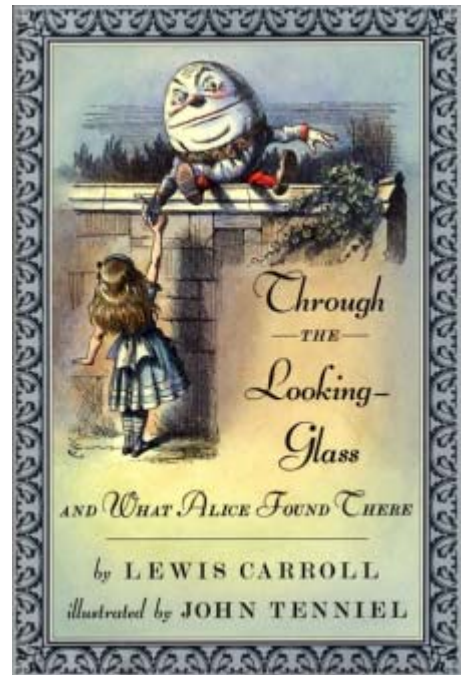
And the answer provided by Lewis Carroll is

Five seeing and seven blind
Give us twelve, in all, we find;
But all of these, 'tis very plain
Come into account again.
For take notice, it may be true,
That those blind of one eye are blind for two;
And consider contrariwise,
That to see with your eye you may have your eyes;
So setting one against the other—
For a mathematician no great bother –
And working the sum, you will understand
That sixteen wise men still trouble the land.

(Well, having read the poems I started to beat my brains out trying to figure out what Lewis Carroll meant by his words. After an hour of getting nowhere, I thought to myself that perhaps there was a mistake somewhere in the wording in my book, and that others had had this problem. And sure enough, a Google search turned up the following--

“Seven blind of both eyes:
Ten blind of one eye:
Five that see with both eyes:
Nine that see with one eye”

So it looks as if someone else has been having trouble interpreting Carroll's logic and has amended the numbers to make the answer of 16 seem more plausible.)



This was clearly a job for mathematics. I labelled each line of Carroll's original poem with a letter – A; B; C; D; and I labelled a seeing eye with O and a blind eye with X and I put the total numbers given by Carroll into this table.

A	7	XX
B	2	X
C	4	OO
D	9	O

And then consulting the answer-poem we are told some more numbers

5 seeing
7 blind

Well, the 7 blind people are all in category A.

Category D (9 members) that see with at least one eye include the 4 members of category C that see with more than one eye, and this leaves us with $(9-4) = 5$ people who see with just one eye and are sightless in the other.

So Carroll's answer of 16 consists of 4 people sighted in both eyes (OO) plus 7 people blind in both eyes (XX) plus the five people with sight in just one eye (OX or XO).

The moral of this little story is that the mathematics helps us to interpret the language in which the problem is stated, in a way that lets us determine for ourselves what we think the author meant by writing those particular words, or what he thought he meant if the meaning is still ambiguous.

There are many other problems, often to be found in newspapers or puzzle books, which can be stated in words but are much simpler to fathom out if translated into mathematics. The example from Lewis Carroll given in the poems above can be translated into the branch of mathematics known as "symbolic logic". Carroll gives another example to conjure with – I think you will find difficulty with thinking about this deceptively simple problem on the basis of verbal language alone.

- (1) All humming birds are richly coloured
- (2) No large birds live on honey
- (3) Birds that do not live on honey are dull in colour

Well, this isn't too bad; we deduce that *all humming birds are small*.

But then consider this one

- (1) The only animals in this house are cats
- (2) Every animal is suitable for a pet, that loves to gaze at the moon
- (3) When I detest an animal, I avoid it
- (4) No animals are carnivorous, unless they prowl at night
- (5) No cat fails to kill mice
- (6) No animals fail to take to me, except what are in this house
- (7) Kangaroos are not suitable for pets
- (8) None but carnivora kill mice
- (9) I detest animals that do not take to me
- (0) Animals, that prowl at night, always love to gaze at the moon.

And the application of mathematical symbolic logic leads us to the inescapable conclusion that

I always avoid a kangaroo

And as a guide for the student, Lewis Carroll provides the following algebraic symbols for the logic

Universal = “animals”
A avoided by me
B carnivora
C cats
D detested by me
E in this house
H kangaroos
K killing mice
L loving to gaze at the moon
M prowling at night
N suitable for pets
R taking to me

In the introduction to this set of 60 problems, Carroll states

“If possible, find some genial friend, who will read the book along with you, and will talk over the difficulties with you. *Talking* is a wonderful smoother-over of difficulties. When *I* come upon anything – in Logic or in any other hard subject – that entirely puzzles me, I find it a capital plan to talk it over, *aloud*, even when I am all alone. One can explain things so *clearly* to one’s self! And then, you know, one is so *patient* with one’s self; one *never* gets irritated at one’s own stupidity!”

Of course, in electronic logic we have “truth tables” and “De Morgan’s Laws” and other aids to thought, which otherwise can become quite tricky. Much science teaching involves training people in the simple, accessible ways of thinking about problems, and often (usually) this involves some kind of maths. It is very sad that many people rote-learn maths rather than using it as a tool. Maths is only useful if the interpretation, modelling, or translation into symbols is done carefully and correctly. Wrongly interpreted but otherwise correct mathematics can lead to a lot of wasted time, effort, and money.

IN CONCLUSION

To close, I make no apology for extensively quoting from Carroll, whose writings in 1896 have lots of useful advice for us over 100 years later, and I leave you with his woodwork puzzle illustrating the difference between maths and modelling.

A stick I found which weighed two pound;
I sawed it up one day
In pieces eight of equal weight
How much did each piece weigh?
(Everybody says “a quarter of a pound”, which is wrong.)

In Shylock’s bargain for the flesh was found
No mention of the blood that flowed around;
So when the stick was sawed in eight
The sawdust lost diminished from the weight.

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