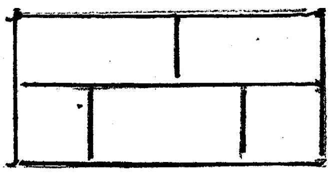
"Clear, brief and easily assimilated by all"

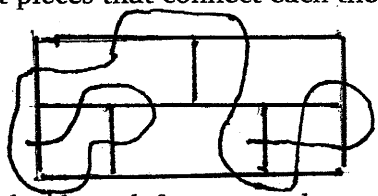
Puzzles, Proofs, Logic & Computers

Reprinted from *Newsletter* 52/2-3 and n. 119/5,6.
Note: the old Newsletters predate the *Handouts*.

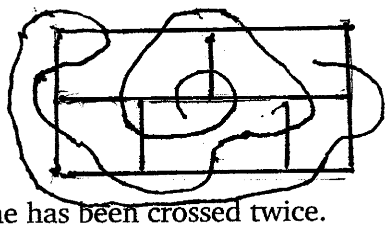
You might like to test out the family on this puzzle. I first came across it in my second year at High School [now called Year 8] **-- long, long ago!). It looks like five bricks, with two trimmed to make a neat stack:**



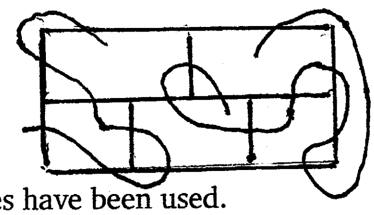
The problem is to draw a continuous line through each line of the puzzle, crossing it once and only once. For purposes of this puzzle, lines means the the short pieces that connect each the line junctions.



One line has been left uncrossed.



One line has been crossed twice.



Two lines have been used.

At this point, you might like to have a go at it yourself, and try it out on the family.

Back in 1949 when we boys first tried to solve this puzzle, the boy who introduced us to it asserted that only one man in Australia could do it. It did not occur to me at the time that such a situation was impossible: the one man who first solved it could only prove his ability by showing someone else, and then two of them would know, etc.

We worked on the puzzle for weeks. Every now and then a shout of triumph would go up: "I've got it!" but it always turned out to violate the requirements, as per above examples. Gradually we came to the the conclusion that there was no solution, that the problem was impossible. At least, we couldn't do it.

It was years later that I discovered that I could **prove** that it was impossible. This was a much more powerful assertion than 'feeling certain' it was impossible because I couldn't do it.

The years rolled on. I wanted to prove the existence of God to my High School Catholic Scripture Class. They were probably in Year 9 or so. They seemed weak on logic and reasoning, and did not trust the powers of their minds -- a singularly unscientific attitude in a supposedly scientific age. So as a prelude, I introduced The Puzzle.

It was a strange way to start a religion lesson. But "fools and children should not be shown unfinished work," as my mother loved to say.

The variety of human responses was considerable: some gave up very easily; others gave up only after repeated failure and growing frustration. Then an argument developed: some said it was impossible, and others declared it was not, and doggedly kept on trying.

When ten minutes or more had gone by, I said, "I'm going to *prove* it is impossible," and I proceeded to do so -- see below.

Their response rocked me: those who had kept on trying -- they were still trying while I talked -- rejected my proof out of hand: they didn't argue over the details, but simply asserted that "nothing was impossible."

Then one of them hit on a modern-sounding slogan, which some of the others took up: "But a computer could do it !"

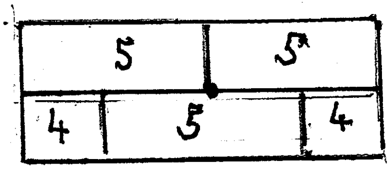
This was back in the early 1970s, when school pupils never had personal computers. It would be worth testing today's pupils with "Could a computer could do it ?"

Newsletter n. 42 noted that high schools no longer teach Euclidean geometry. Yes, there is still some geometry, but not Euclid's, with its thorough-going reasoning from which we learnt to reason accurately, to know whether a thing is proved or not.

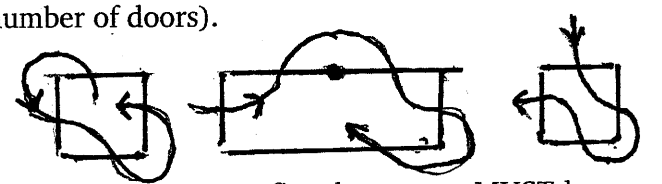
Finally, here is the proof of impossibility -- but try it on the family only after they have concluded from trial and error that the problem is impossible, so that they can contrast the power of logic over the experimental approach:

The problem to be solved can be described in another way, as entering and exiting multi-doored rooms several times over, in any order, until each door has been used once, but only once. This is equivalent to asking for a continuous line to be traced that cuts each of the short lines once.

In other words, there are **three rooms each with five doors** and **two rooms, each with four doors**.



A four-door room must EITHER have both ends of the line inside OR neither end inside it. This is because 'entering and exiting' go in pairs. (As a corollary, this is true of any room with an even number of doors).



By contrast, a five-door room MUST have one end of a line inside it. This is so because 'entering and exiting' go in pairs, so there is always one side not paired. (As a corollary, this is true of any room with an odd number of doors).

But there are three five-door rooms.

So if there is a solution to the problem, there would have to be three ends to the solution line, one in each of these chambers.

But our line can only have two ends.

Therefore the problem is impossible.

* * * *

Nowadays, with greater computer literacy, school pupils would not expect a computer to be able to do something that was logically impossible. Or would they ? Logic alone can't decide this, so we had best try out our proof on them... and find out.

All clear thinking (& apologetics) is hindered by the general lack of of logic. Without geometry to teach logic, it is just possible that computers might.

You must be logical to operate a computer. A computer only works with a logically constructed program and a logically minded operator.

The computer is ruthless: Yes or No, Y/N? it flashes at you. You must answer ***Yes*** OR ***No*** -- or it will *beep* relentlessly at you until you do !

Computers are little children: A child's power of reasoning leads him into humorous absurdity, because of the way he takes things so literally. There is an example of this in the first appendix at the back of the *Catholic Family Catechism*: the mother told her little girl, "God does not have a body." She laughed in her mother's face: "Then he must look funny, with His legs joined on to His head !"

Computers are similar: they are logical (even search engines using 'sloppy logic') or they can't work at all, but their logic may not be enough for a particular problem, and then they come up with weird answers due to lack of essential information that no one had yet told them.

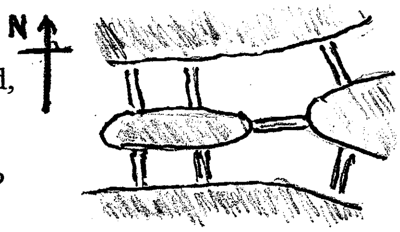
Perhaps familiarity with computers and their programming will lead to a revival of the study of logic and geometry It might be promoted also by a revival of grammar and syntax. The Kingman Committee in England, if it has its way, has just decided [before 1988] that children are once again to be *permitted to know* and use words like **noun, verb, adjective, pronoun**, and so on. They are not "prescribed", nor are they proscribed either. Commenting on this report, *The Daily Telegraph* (London) commented that a semi-literate democracy is ultimately unworkable, and that the Kingman report is only semi-satisfactory.

The Telegraph editorial praises the report for discarding the idea of any notion of correct or incorrect usage is an affront to personal liberty. But it criticises it too for the false choice between creative English and parsing a sentence. Our forebears managed both, and their creativity did not suffer.

The Konigsberg Bridges

Konigsberg, formerly in Prussia, renamed Kaliningrad, west Baltic Sea. had a puzzle-walk.

Could all seven bridges linking island, peninsula and mainland, be traversed just once ?



No one ever did it.

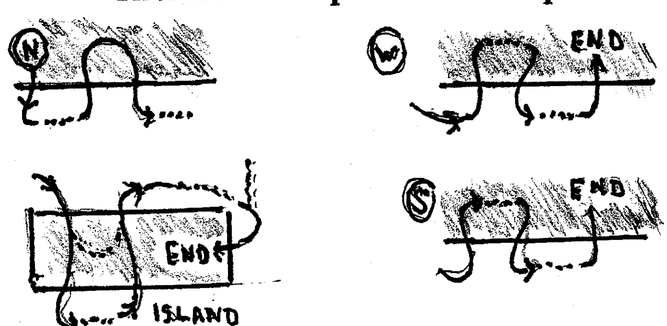
So was it possible ?

Land N has 3 northern bridgeheads; Island has 5; land S south has 3; land E between has 3. All are odd-numbers.

Starting at N by stepping onto a bridge leaves a further IN & OUT, so it can't finish there.

But after that, Island & S & E are entered from a bridge, leaving an even-number of bridges for a new OUT & INs: but *three places can't be end points.*

Therefore the problem is impossible.



Father James Tierney

P.S. The east-west bridge has now been replaced by a causeway, so the puzzle-walk has ceased to exist, except on paper.