A scientific paper claims a success of some kind. If it claims a discovery, however small, what greater kind of success can there be? It is a wonderful feeling to believe one has discovered something that no one else knows, and then to divulge (to Nature or Perception) this secret of nature or perception.

But what of our, presumably far more frequent, failures? There must be many kinds of failures. Perhaps indeed failures could be studied for revealing processes of discovery—much as illusions are studied for finding processes of perception. In any case, failures of concepts or experiments cannot mean simple falsity; for many and perhaps even all the greatest discoveries of science turn out less than completely true. Similarly, if veridical perception meant completely true there would hardly be any candidates in our experience.

One class of failure is simple, though perhaps not very interesting: failure to continue the search. Here I propose to confess two of my failures of this kind—ideas that never saw the light for even a tachistoscopic flash of visibility. So they could neither shed light, nor be switched off through recognition that they were nonstarters. As they were never tested it remains possible that these ideas have some interest, so it may be worth discussing them here even though they came to nothing.

**Failure one: The fish in a moiré random world**

This started from a question: “Why is learning slow?” Why—with but a few exceptions, such as Alexander Luria’s Mr S (Luria 1968)—can’t we remember names or numbers from a single exposure? Computers can store isolated facts and relations accurately—why can’t we? Rival kinds of answers present themselves: (a) that our memory ‘hardware’ is inadequate; (b) that there is a ‘software’ or strategy reason for slow learning. The fact that very rapid, even one-trial learning of associations does occur in special situations, such as for imprinting, suggests that alternative (b) is correct; that the brain is capable of rapid learning, but ‘chooses’ against it.

A clear advantage of slow learning is that transitory irrelevances will generally be lost. Consider Pavlovian conditioning: If the dog is to associate bell with food, to set up a predictive relationship he must not associate other events that may happen to occur when the bell sounds. There may be another sound, or the movement of a technician, or a tickle in his toe; but as these are unrelated they will not be predictive. To establish predictive power for otherwise unrelated events several instances are needed. This is partly because the world, and the nervous system, are ‘noisy’. As Francis Bacon (1620) and J S Mill (1843) very clearly pointed out, repetitions of observations make it possible to sort out what is predictively important from random or unrelated events, which are best ignored. Where learning is for establishing predictive relations the same considerations apply; so, much of learning ‘should’ be slow to be useful.

So far this seems to me correct. The next step was to ask: Is the strategy of slow learning itself learned, or is it innate? It was this question that suggested (in about 1958) this failed experiment.

The notion was to bring up animals in an environment of controlled randomness, and see whether the general rate of learning was affected. In the limit, in a totally random environment prediction would be impossible. Would an animal, or baby, in such a world learn that learning is fruitless? But, in practice, how would it live to find out? In a
largely random world, slow learning should reveal useful predictive associations. At the other extreme, in a simple nonrandom world, one-trial learning should be the rule. So the obvious thing to do for the experiment was to control the randomness of a miniworld, and see whether learning is faster the less the variations. If so, organisms must set their own optimal rate for learning, by discovering what is usefully predictive in their world.

It is unfortunate that we can't switch on to one-trial learning for telephone numbers, or for names at a party; but this would only be useful for a few numbers and a few names, for most have only transitory importance. But in some situations it could be useful to switch into a one-trial learning mode. This would save time for children learning the alphabet, and their tables, and it could save the social embarrassment of forgotten names and faces. Can we, indeed, learn when to learn and when not to learn? Can spies switch on retention for secrets, with forgetting to avoid giving secrets away? Should it be possible to learn learning strategies, for various situations or environments, then there might be special rooms in schools where no errors or uncertainties are allowed for learning undoubted facts, just as for a computer, in a single trial. But this would be dangerous, for each generation could lock its knowledge and prejudices into the memory-stores of its children. This would negate the social significance of death, and of new life.

But how, for an experiment to find out whether learning is slower when prediction is harder, could ambient randomness be controlled? And what would be a suitable organism to test? I chose an active fish—a Guppy. Controlled randomness was provided by surrounding the tank with moiré patterns, which moved in various directions as the fish swam around the tank. The temperature, and so on, were held constant. The moiré patterns were produced by double sheets of metal with finely spaced holes, the sheets being not quite parallel. As the fish swam, the moiré patterns in which he lived sometimes moved with him, sometimes against him, and sometimes up or down with random directions and velocities. The randomness could be controlled by having the sheets more or less straight and parallel, and bending them occasionally to change the complex patterns. It was not very clear (or rather I never worked it out properly) what associations should be set up for testing the fish's learning.

Was this a silly idea? Unfortunately I don't know, for the fish died and I never tried it again.

Failure two: Switching children on with lights
Mark and Caroline were small, and we lived in a 16th century thatched cottage, near Cambridge, which had several rooms of curious shapes. There was an ancient bread oven in a wall of the sitting room, and the beams were so low I had to walk around the house like a Chess Man. There were many oddly placed light switches, and the children would turn the switches on and off with irritating frequency. As the lights were partly hidden behind corners, and by beams and so on, it was not always obvious which switch worked which light. It seemed to me that they (especially Mark who was the older, aged 3) played with the switches more in the dusk of evening, when it was not very clear which light if any had come on. Were they learning to associate the switches with the lights? If so, would more uncertainty or randomness increase their switching experiments, or perhaps reduce them?

The experiment was set up informally, in the house, with a rectangular wooden box, having a lockable lid, which had three spring-loaded switches and a light. The first switch made the light come on every time. The second switch was not connected to the light. The third switch only sometimes turned the light on: it turned the light on randomly, half the times it was moved. (This was done with a random sequence wired on a telephone exchange 50-step unisellector. This was activated by any of the switches,
so the clunk noise it made was the same for each switch, and as the sequence started at a different point following a step from the first or third switch its randomness was increased.) There was a counter for each switch, to record how many times each had been operated.

The box was left all day on the floor, and when the children went to bed I would note the counter readings. The result was that the no light switch was the least used, and the 50% random switch by far the most used.

But this experiment was never completed, or reported. For at that point my wife Margaret was taken away to Papworth hospital with TB. Then the children had other concerns than switches and lights, and so did I. So although this was by far the least of its effects, this momentous event ended a promising little experiment.

In these cases failure resulted from some unpredictable event throwing up an obstacle that was not overcome. I was like the children with the switches, or the fish lost in the randomness of the moiré tank. But, really, these events only postponed potential success, which was lost through failure to push on against the odds.

These are examples of one kind of failure. More interesting failures are ideas that 'should' have worked though despite every endeavour they did not. Any offers?

Richard L Gregory

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