

(16:2) THE VALUE OF LEARNING

I am here going to argue that the value of learning is out of all proportion to its amount: that if you double your knowledge of the field you increase your capacity to generate new ideas and reach sound decisions by a factor of between 4 and 64. This argument must have manifold and important consequences.

Our basic mental tactic is the *association of ideas*. Thus every new idea can potentially interact with all the other ideas previously existing in one's head. *Hence the creative potential of a new piece of information is in proportion to what one already knows*. This is a profound insight – and yet obvious once stated.

If, as usual, we use science as our exemplar, we know that breakthroughs are often made by the person who first knows two different things and puts them together: thus Oersted – seeing the connection between Electricity and Magnetism when he was studying storms at sea (3:4); or Huyghens first seeing the connection between experiment and Probability (14:4). Thus if you know N separate facts about a field your capacity to make innovative connections will rise in proportion to:

$$N(N-1)/2$$

because each of the N facts could be potentially associated with each of the other (N-1) (the factor 2 excludes double-counting i.e. AB *and* BA) thus when you know twice as many facts about a field you could make roughly 2×2, or 4 times as many potentially fruitful associations. Doubling our relevant knowledge has quadrupled our capacity to generate new hypotheses! I call it the 'Squared Knowledge Theorem' (SKT).

The truth of this revelation is more than borne out by the history of science. When one reads about the great pioneers one is immediately struck by how many of them were polymaths – curious and learned about practically everything. Two examples must suffice. Nikolaus Steno (1638 to 86) was born in Copenhagen where he studied medicine. In Paris he published a treatise on the anatomy of the brain. In Florence he originated the subject of geology by studying the rock formations of Tuscany. He identified ancient sharks teeth in sedimentary strata and was the first scholar to realise that the strata of the Earth recorded the history of the Earth and he distinguished sedimentary rocks from the igneous and

metamorphic varieties. His 'Prodromo' was the first manifesto of Geology (1639). Then he returned to Denmark to become physician to the King. He converted to Catholicism, abandoned science, and took up Theology. He quickly became a bishop and key adviser to the Pope. Alas his rabid asceticism led to an early death at only 48.

Thomas Young (1773 to 1829) –'The last man who knew everything' {6} was more remarkable still. He was a prodigy who educated himself in a formidable program of self-instruction saying "... whoever would arrive at excellence must be self-taught." His learning was so great that none of his contemporaries could properly appreciate him. His achievements were to include:

- (i) The discovery of how the eye accommodates (focuses).
- (ii) The proof that light is wave-like.
- (iii) The first description of the concept of 'Energy'.
- (iv) Classifying languages into groups – which included inventing 'Indo-European' (he knew many languages).
- (v) Breaking – with Champolion, into the Ancient Egyptian script – using the Rosetta Stone.
- (vi) The understanding that heat was radiation and energy.
- (vii) Devising the theory of three-colour vision.

He made his living by writing large portions of 'The Encyclopaedia Britannica'. He liked "a deep and difficult investigation because... it keeps one alive." {6}

Sociological study of Nobel prize-winning *scientists* [i.e. *not* Economists] showed that their most remarkable feature was a willingness to change fields and so combine their knowledge of very different kinds.