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Conditions in the West (c. Nov. 1996) Gerry Martin

After your talk at the LSE Chris (I don't know his surname), sitting on your left, suggested that you had been put in the position of talking about someone - Gellner - whose explanations of the exit and the rise of modernity in the west you maybe didn't believe. You parried the question skillfully, and without confronting the correctness or otherwise of Gellner's writings, which would have been inappropriate for what was essentially a celebratory lecture you pointed out Gellner's contribution in re-stating and re-defining the question.

The problem that I have been trying to resolve in my mind is the problem of belief. Each of your five subjects names statements about behaviour aggregated over large groups of people, and at various points of time. Comparisons are drawn between the dynamics of behaviour of these large groups on different parts of the surface of the earth, and a seemingly anomalous behaviour dynamic in the population living in Europe during the past several hundred years.

None of the subjects are able to define starting points and end points of the several dynamic systems very precisely (and in this they have my sympathy) but they are all aiming to describe and then to explain, the greater degree of control over nature which has arisen in Europe compared with all other geographical areas (except N. America, which in this respect is regarded as an extension of Europe).

They all tend to see linkages between this control over nature (which often becomes control over other human beings who can themselves command lesser material control) and other cultural/institutional attributes such as democracy, liberty, capitalism etc.

The question arises, what would be grounds for belief that any particular explanation of change in human society is correct? What could Chris ___ mean when he questioned 'belief' in Gellners' explanations?

The concept of 'reliable knowledge' has proved useful in thinking about science and about relationships such as the relationships between atoms and atoms, and atoms and energy; not as absolutely reliable knowledge, which is way beyond human experience, but as knowledge which is testable, potentially refutable, universally applicable within carefully defined boundaries.

Reliable knowledge is knowledge which provides a 'fit' through experiment or by careful observation with our experience of nature. You site 'fit' between theories and the real world as the test of validity - correctly in my view (p.172).

Can anything written by any of your subjects be categorized as 'reliable knowledge'? What would reliable knowledge, in his area of inquiry look like?

If writing of the type produced by your subjects is not reliable knowledge, then, how are we to categorize it? If knowledge cannot be called 'reliable', then it may be unwise to try to build on it to produce an analytical or explanatory framework.

I think it possible that the syndrome we have examined before - generation of new knowledge > generation of new knowledge > innovation of new artifacts > quantification of new artifacts > generation of new knowledge > may encapsulate more precisely the 'condition of the West' than the pictures produced by your subjects, although Gellner, as described on pp11 and 12 seems to have been thinking along similar lines (as was Mark Elwin - China as a counterfactual, p101).

I list below some of the attributes of 'knowledge' which may themselves be considered reliable, to see if there may be some mileage in using he relationships of knowledge itself as a framework for historical analysis.

1) The enduring nature of knowledge. Knowledge, both reliable knowledge in the modern, scientific sense but also knowledge in the sense of proven technological knowledge seems to endure well over very long periods, with the proviso that the knowledge is recorded and the records are widely disseminated. This cannot be a **law** - if reliable knowledge was generated, say, in Baghdad in the 12th century, ten manuscript copies produced and distributed throughout Islam, and all quickly lost to fire, the knowledge would not endure. But in practice, much knowledge, probably most knowledge, does endure. Of course, knowledge endures more completely since the advent of printing, and particularly movable-type printing, because more copies are produced, and mechanisms for distributing them and storing them for easy access are developed.

The enduring nature is comparative - but compares very favourable with conditions such as liberty, or the nation state, or democracy, or language, or the ability or desire to manufacture artifacts.

In accounting terms, the stock of knowledge hardly depreciates. (This point is capable of considerable expansion, showing how knowledge is capable of being made increasingly reliable, and how, through examination of extant old artifacts, the knowledge embodied in the artifact has or has not endured).

2) It is agreed that knowledge has a strong tendency to endure, and new knowledge is generated at a greater rate than existing knowledge is lost, then it follows that **knowledge is cumulative**.

I can think of no other human attribute which is cumulative, with the possible exception of mutations in the genome. We ignore this latter exception in historical analysis, and I am not aware of any evidence which suggests we are not right to do so.

3) Knowledge is an **absolute** requirement for the innovation of artifacts. In the long post-hunter-gatherer period, the overwhelming majority of resources used by humans (including agricultural products) are artifacts, and thus require knowledge.

4) **The non-linear relationship between knowledge and artifact innovation**

The **possibility** of innovation of artifacts increases much more rapidly than the amount of knowledge or data available. I have tried to demonstrate that innovative or creative possibility increases with available knowledge at a rate steeper than a square law.

I think I can now demonstrate, in a fairly rigorous ?? that the ratio is **much** steeper. The consequent proliferation of artifacts is arguably the central feature of western civilization.

5) **Artifacts cannot be made unless they are makeable**

This may seem an absurd and self evident statement, especially in a list of the attributes of reliable knowledge; it is, in fact crucial to an understanding of the scientific revolution.

We gain knowledge of the natural world by observation or by experiment. The growth of experiment, specifically for the purpose of generating new reliable knowledge is the prime characteristic of the period of rapid increase in the rate of generation of knowledge we term the scientific revolution.

Experiment has not obsoleted observation - Mendel used experiment (plus observation), Darwin used mainly observation.

Experiments construct apparatus - artifacts - in attempts to isolate phenomena they want to

examine, and to generate around this phenomena, a number of variables. They observe the effects and try to draw firm repeatable and hence 'reliable' conclusions about these relationships.

If the apparatus cannot be constructed, then that particular experiment cannot be performed. This can be demonstrated with a few examples.

a) In the 1640s Berti in Rome, and a little later Torricelli in Florence, performed experiments which strongly suggested the existence of space empty of matter - what we would call a vacuum.

Each performed the experiment with a long vertical tube initially filled with a fluid (Berti - water; Torricelli - mercury). Berti's tube was made of lead, around 30ft tall and supported on the side of his house. On the top was cemented a flask made of glass 'rather large but very solid' (Middleton, p 11).

Torricelli, using mercury, used a much shorter tube, entirely of glass and sealed at the top end. The tube would have been around 3ft long.

In each case, when the fluid in the tube (water in the long tube, mercury in the short one) was allowed to flow out, downwards into bowls filled with water (mercury, into which the lower ends of the tubes remained immersed, the fluid partially flowed out and then remained at a stable level), leaving a space at the top. The nature of the space and the reason for a constant and fairly reproducible height of remaining fluid stimulated a huge amount of subsequent experimental work.

The prior existence of clear glass, and of quite sophisticated glass working skills, were essential to each enterprise.

If we marked on a map of the world the sites in 1640 where these experiments could be performed, we would find them to be both rather concentrated and rather limited in number - probably none at all in China, India, Japan or the America's. None in Africa except maybe in Egypt or Morocco. Several sites in the Arab countries and in Persia, maybe a dozen sites in Europe. (I must check this at the B.M. The crucial factor is the existence of glass blowing industry and, for Torricelli's experiment, the existence of long glass tubes).

Torricelli's experiment provides an interesting event to consider the selectionist, as against the deterministic or teleological aspects of innovation.

In the absence of glass, Torricelli could not, realistically, have said 'I need a material which I can see through, in the form of a tube of indeterminate length' (for to arrive at the correct length already required a number of exploratory experiments) and closed at one end. Strong enough to support itself and a heavy column of mercury. Unaffected by mercury or water (which he also used- see Middleton p 23).

Torricelli, or a would-be experimental philosopher in Japan, would have had to compress the skills, knowledge and experience embodied into three thousand years of glass making into an exercise before he could perform his experiment. This would have been physically impossible.

If we consider the next stage, and assume the existence, in Italy in the 1640s of a competent glass industry used to producing clear glass, and making blown bottles or decorative ware or blowing large bubbles of glass as a stage in the production of sheet - and all of these techniques were available in North Italy in the 17th century, then Torricelli could pay a glassworker to draw out one of his large bubbles of glass into a long tube. This would be an innovation, but one well within the capabilities of the time.

The final state of manufacture, the closing off of one end of the tube, sometimes with a simple melted seal, sometimes with a glass bubble blown at the melted end, could have been performed either

by the skilled glassworker or by Torricelli or an assistant, if they procured a small furnace.

Thus, the process is a mixture of selection and determinism with selectionism, the selection from already existing variation playing a major, but not exclusive part.

b) A more recent example of dependence on the makeability of artifacts for the experimental generation of new knowledge is the discovery of the double helix format of DNA, showing the way in which adenine, thymine, quanine and cytosine enter a structure, the genome, which codifies the nature and physical characteristics of all higher organisms.

A crucial state in the discovery was the study of an X-ray diffraction photograph of B. form DNA taken by Rosie Franklin in 1952. (Chapter 23, and plate 13, J.D. Watson, 'The Double Helix').

The photograph demonstrated the double helix nature of DNA, and could not have been produced without the discovery of X-rays and the production of apparatus - artifacts - for the convenient generation of X-rays.

X-rays had been discovered by Rontgen in Wuryburg in 1895, while investigating electrical discharges through gases at low pressure (vacuums in glass vessels again!).

There is no possibility that anyone working on DNA in the 1950s could have decided that they needed to flood examples of the material with a radiation of around .05 Angstom wave length, and then set about trying to design artifacts to produce such a radiation. The artifacts needed to produce X-rays had to be in existence before X-rays diffraction photographs could be taken and before the double helix could be discovered.

6) **The non-lineal relationship between the generation of new knowledge and the innovation of artifacts**

This is the converse of 4) The generation of new knowledge by experiment rests on the ability to make the artifacts required for the experiment (5, above).

The **possibility** of generating new knowledge experimentally will grow non-linearly from the base of old knowledge because of the **possibility** of the non-linear growth of innovative artifacts for experimental purposes.

The six attributes listed above are all attributes of knowledge. 2, 3, 4 and 6 could possibly, I think be classified as reliable knowledge and used with confidence in historical analysis. Numbers 1 and 5 are matters of degree - pretty reliable, but their limitations in particular cases to be remembered. Still, I think, suitable for cautious use as 'reliable'.

The seventh attribute does not concern knowledge as much as artifact-as-resource.

All locations/societies which have, for whatever reasons, become sites for high rates of artifact innovation and artifact production have within a few generations become sites of much lower artifact innovation and artifact production.

As a shorthand, and in the absence of a better term (suggestions welcomed) I shall call this the **Relapsing innovation/production effect**

I class the effect as reliable knowledge simply because it has always happened. The historical record is full of instances of innovation/production clustering in societies, but there are no cases of high innovation/production being maintained in one location for long periods - more than two or three centuries.

The world taken as a whole, as viewed by a Novan anthropologist, would defy the rule. Europe taken as a whole would defy the rule. The United States viewed over the short time span of the part three hundred years may appear to defy the rule. But as we examine locations on a finer scale the rule seems to be universal, although the U.S.A. does deserve special study as being somewhat anomalous.

8) Economic historians are devoted to producing 'reliable knowledge' about quantities of production of resources and exchange of resources or specie. Their work is central to recognizing the 'quantification of artifacts' leg of our syndrome.

9) Demography, the study of the dynamics of population, produces reliable knowledge - quantitatively probably more reliable, in recent times, than any other measurements.

List of reliable knowledge

1) Recorded, disseminated knowledge endures.

2) Recorded, disseminated knowledge is cumulative..

3) Knowledge is absolute requirement for artifact innovation.

4) Non linear relationship between knowledge and possibilities of artifact innovation.

5) Artifacts cannot be made in absence of knowledge and materials to make them.

6) Non linear relationship between innovative artifacts and possibility of generating new knowledge.

7) Relapsing innovation/producing effect.

8) Economics of production and exchange.

9) Demography.