These are preliminary, unpublished thoughts upon which discussions betweens the two authors were based. Written by Gerry Martin in c. December 1997. Figures and footnotes will be added later. Please treat as a very preliminary test.

On the foothills of modernity: Reflections upon a Japanese fan

In 1700 A.D. the population of England and Wales was 5.75 million.[1] Gregory King, the contemporary historian/demographer considered that this was about the maximum population that the domestic farming industry could support. The total land area of England and Wales is about 0.15 million ku2[2], that is, approximately 3 hectares per person. Assuming 50% of the land was, in 1700, suitable for arable agriculture, the land/food availability is 1.5 hectare/person.

In 1700 the population of Japan was 29 million. Of a total area of 0.37 million km2 0.06m km2 is suitable for arable farming. This corresponds to 0.2 hectares/person. We can reasonably speculate that, using the farming techniques available at the time, this really was the maximum population the land would support, since there was an extended dip in population during the famines of the second half of the 18th century, only recovering to 29 million around 1825.

Thus, Japan was feeding its population utilizing approximately one seventh or one eighth of land per capita. That this is a quite exceptional land yield even for a rice economy (though the majority of poorer people in Japan would eat barley and millet) may be seen from the nutritional densities quoted in Geertz, **Agricultural Involution**[3]:-

	hectors/capita
Burma	.44
Thailand	.38
Malaya	.31
Philippines	.27

In addition, we must remember that the Japanese farming industry supported a large urban population, and that the rice tax sometimes rose to 40%.

1

2

[3] p.78, note

Comparative figures of this type are bound to contain errors, sometimes substantial ones, but even if error is assumed at 50%, the Japanese land yield is still quite extraordinary.

Kauro Sugihara's land yield figures for rice show no great increase around this time, indeed, land yields do not increase substantially until Western techniques are introduced around 1870 - and so we are drawn to the conclusion that the farming output is dependent on extremely hard meticulous, skilled work carried out year after year, even century after century in a virtually unchanging manner, families handing down carefully honed techniques from generation to generation.

The production of food is homo sapiens ultimate artefact, on which all else depends.

Japan is famous for a range of other artefacts - the sword with its associated furniture, the silk kimono, the inno with its attendant netsuke and ojime, the utensils of the tea ceremony, the largely standardized house with papered sliding wall windows and fairly universal tatami mats. And, of course the meticulously constructed, carefully and artistically decorated fan.

This cluster of artifacts, which any museum curator would instantly recognize for their 'Japaneseness' all share a number of common characteristics. Firstly, they have all, including rice, barley and millet, been introduced from outside Japan, often from or through China or Korea. Secondly, they have all been greatly improved - innovated, within Japan so that they are highly satisfactory for the task required of them. Thirdly, they each require a complex series of production processes, each one highly skilled and meticulously performed, utilizing a wide variety of materials - largely but not exclusively of natural organic origin - that have themselves been prepared through complex and exacting processes.

Thus the successful manufacture of each artifact rests on a complex and precisely performed sequence of skills, sometimes calling for the sequential co-operation of skilled workers. Fourth, the complex cluster of skills in each case requires a long and hard apprenticeship, which usually takes the form of teaching within the family, so that it is common to find laquerworkers, farmers, silk weavers etc. who will state that they are, say, fourteenth generation.

Fifth, the artifacts have over this long period become virtually fixed in manufacturing method, each process being carefully reproduced through the generations in such a way that major change to any small part of the process would seriously damage the successful outcome of the whole sequence. 'Lock-in' to a complex set of manufacturing techniques and materials has been achieved. Six, while working within this set of constraints, skillfully performed variations in finish and decorative form are the norm, and are highly appreciated and valued throughout the society.

Thus swords, made in just the same manner for a thousand years, are revered for slight variations in the pattern visible in the hardening of the steel just behind the cutting edge - while maintaining identical functional usefulness from one to another. The same decorative criteria would apply, as appropriate, to the painting of a fan or to the texture, colour, or slight and non-functional change of shape in tea bowls.

All these artifacts, the treasures of traditional Japanese manufacture, share the characteristic that they were developed early - often many hundreds of years ago - to a high level of functional satisfaction, that they and their manufacturing processes have become frozen in time, but that decorative variation is encouraged and appreciated.

If we graphed function against time, we would have a representation something like this.

Fig. 1

This is a quite different shape to that which we obtain for functional artifacts in Europe.

If we consider artifacts which have been important in the rise of modernity in Europe, and graph them in the same way, function against time, we get curves which rise steeply, often with increasing steepness in recent times.

Consider:

1) Artifacts which enable man to travel more rapidly over the surface of the earth.
2) Artifacts which enable man to see and understand with increasing detail the fine structure of the world.
3) The weight of food which we can obtain from a hectare of land.
4) The speed of production of a piece of silk or cotton cloth.

On graphing these, we obtain curves like this:

Fig. 2

This, of course, is a very generalized curve, summing loosely the curves on the appended photograph. However, this cluster of curves does suggest that rates of change in the ability to perform functions which humans have considered desirable is a notable component of modernity, and we may consider that the lack of change in the Japanese curve is a fair representation of at least some features of Japanese society before the increased contact with the West in the second half of the 19th century.

If we examine the curves in the photograph in more detail, we find that, while they may be roughly correct, they do not represent the whole picture.

Consider two of the curves, the speed of travel and the yield of wheat per hectare.

Fig.3

1)Running
2)Horseback
3)Steam train
4)Automobile/internal combustion engine
5)Aeroplane
6)Rocket/chemical reaction.

In a period of 200 years, the possible speed of travel has changed from approximately 23 mph, the maximum sustainable speed of a horse, to some 23,000 mph, the speed of exit from the earth's orbit for a flight to the moon - a factor of 1000 to 1.

The artifacts which have been innovated to enable this change to come about are **not** part of a continuum - it is the **function** which is the measure on the curve. Each class of artifact would produce a curve more like this:

Fig.4

That is, we do not proceed up the curve by steady improvement of the same artifact, although some further improvement is always possible, for any given principle of artifact operation we run into a law of diminishing returns, and a new principle embodied in new artifacts is required to pursue further the **same function**.

Often, early artifacts of the new generation incorporated features of previous generations of artifacts - early trains and cars sometimes looked like horse carriages - but the long rise of function has come from changes in principle based on new knowledge. If we consider the shape of the curve for any one of these classes of artifact, it would look like the Japanese curve - it would run into stasis, with variation increasingly decorative rather than functional, just like cars in the 90s.

We find a very similar pattern with yield of wheat per hectare.

Fig.5

The yield in England, already a 'high yield' country in 1800, increased about 7 times by 1950. Around 60% of the increase between A and B is ascribed to the application of Mendelian genetic principles to plant breeding, principles unknown before 1865, and unapplied before 1900. The rise from A to C represents a mixture of plant breeding, artificial fertilizer (particularly nitrogen fixation from atmospheric nitrogen) and herbicidal chemical weed control together with mechanical matter moving techniques.

The new principles of artifact innovation which have been the foundation of the exponential rise of function have not come from refinement of old principles - they have come about from quite disconnected lines of intellectual and tacit knowledge inquiry and development, that have been brought to service to further an existing functional aim.

They have had most disparate origins - the steam engine can be traced back **at least** to Torricelli's investigations of the space above a column of water or mercury in a vertical tube closed at the top, the internal combustion engine to attempts to derive useful power from the explosion of gunpowder - introduced into Europe ultimately from China - in an enclosed space.

Mendel, an Austrian monk, pursued his studies into the mathematics of genetics in his monastry garden, Priestly, Lavoisier and others laid the foundations of a chemistry which, quite unknown and unsought, would within two centuries, multiply agricultural productivity many times.

Our modernity of the west rests firmly on the knowledge embodied in the artifacts of the west, knowledge which derives from a multiplicity of sources, frequently sought in a disinterested way without any vision of its application, and always arising in a cultural climate which, at least transiently, was congenial to such knowledge generation.

Chamberlain, in his **Things Japanese** mentions frequently, sometimes directly and sometimes quoting the writing of others, the lack of originality of the Japanese.[4] If we consider the **requirements** for originality in the west, we may develop a better understanding of, and sympathy for, the Japanese situation.

To be 'original' in the west, an individual undertakes an exercise in creativity. That is, he becomes acquainted, deliberately or fortuitously with data which he considers desirable, and if he is attempting a product for commercial application, which he hopes others will consider desirable. The date must exist, or he cannot use it in a creative or original act.

The vast majority of data used in creating new artifacts is derived from knowledge generation activity quite separate and apart from the immediate innovation of a particular artifact (quite contrary to Adam Smith's model of innovation), and so our would-be-innovator is highly dependent on the pool of data - knowledge - which surrounds him, and to which he can make access.

This is, of course, a major aspect of the 'bounded by leaky' situation which has

[4]For instance, p.256, quoting Munginger and Lowell

existed through Europe for many centuries, allowing knowledge to be generated in a diversity of cultures as they moved into and out of their various traps, while the knowledge gained would leak away to become part of a universal pool.

Japan was not a part of such a system.

China, its prime sharing-culture, had moved into its own high level equilibrium trap long before, and was not a source of new knowledge of techniques.

The Japanese artifacts which we have considered had been developed to sophisticated, high level stasis, with only decorative form left as a channel for creativity - and, in this heavily circumscribed area, creativity flourished in abundance.

The Japanese utilization of the materials available to them, constrained by the prevailing amount of knowledge and in the absence of the bounded but leaky conditions which existed in Europe, led to a quite extraordinary collection of artifacts manufactured with extremely high skill, but each of course running into stasis - the absence of completely new approaches to advance the same function (no amount of improvement to the Japanese fan will lead to the electric fan or to the air-conditioning system).

As soon as Japan was exposed to the full thrust of the western world this long tradition of the meticulous manipulation of materials, through long sequences of complex operations was utilized, firstly to make, by copying, western goods and just as quickly to innovate for local needs and for improvement.

Immediately the most fundamental artifact, food, was produced more effectively using western knowledge (see enclosed graph prepared by Koaru Sugihara).

The textile industry was revolutionized, the use of fossil fuels to generate power mastered.

Japan had been standing on the foothills of modernity.