On the possiblility of Labour

and what it might be

Project to look at why labour provides the basis of value - body of research exists indicating that it does.

Attempt to relate labour theory of value to information theory and to thermodynamics.

One level is the use of stochastic techniques to look at the economy as a whole as pioneered by Farjoun and Machover.

Other level is to look at the nature of labour as such and the role of information in labour and in production.

We pre-suppose labour in a form which stamps it as exclusively human. A spider conducts operations that resemble those of a weaver, and a bee puts to shame many an architect in the construction of her cells. But what distinguishes the worst of architects from the best of bees is this, that the architect raises his structure in the imagination before he erects it in reality. At the end of every labour process we get a result that already existed in the imagination of the labourer at its commencement. He not only effects a change of form in the material on which he works, but he also realises a purpose of his own that gives the law to his modus operandi, and to which he must subordinate his will. (Marx, Cap I pp. 177–8)

First, are animals really lacking in purpose?

The spider may be so small, and her brain so tiny, that it seems plausible that blind instinct, rather than the conscious prospect of flies, drives her to spin. But it is doubtful that the same applies to mammals.

The horse at the plough may not envisage in advance the corn he helps to produce, but then he is a slave, bent to the purpose of the ploughman. Reduced to a source of mechanical power, overcoming the dumb resistance of the soil, he is readily replaced by a John Deere.

Does the wolf stalking its prey not intend to eat it?

It plans its approach with cunning. Who are we to say that the result—fresh caribou meat—did not “already exist in the imagination” of the wolf at its commencement?

Turn to Marx's human example, an architect, and his argument looks even shakier. For do architects ever build things themselves?

They may occasionally build their own homes, but in general what gives them the status of architects is that they don't get their hands dirty with anything worse than India Ink. Architects draw up plans. Builders build. (In eliding this distinction Marx showed an uncharacteristic blindness to class reality).

An office block, stadium or station has, it is true, some sort of prior existence, but as a plan on paper rather than in the mind of the builders.

If by collective labour civilized humans can put up structures more complex than bees, it is because they can read, write and draw.

A plan—whether on paper or, as in earlier epochs, scribed on stone—coordinates the individual efforts of many humans into a collective effort.

For building work then, Marx is partially right, the structure is raised *on paper* before it is raised in stone. But he is wrong in saying that it is built in the imagination first, and in implying that the structure is put up by the architect.

What is really unique to humans here is, first, the social division of labour between the labour of conception by the architects and the work of execution by the builders, and second, the existence of *materialized plans*: configurations of matter that can control and direct the labour of groups of humans.

While insect societies may have a division of labour between ‘castes’, for example between worker and soldier termites, they do not have a comparable division between conception and execution, between issuers and followers of orders.

Nor do insects have technologies of record and writing.

They can communicate with each other.

- Dancing bees describe to others the whereabouts of flowers.

- Walking ants leave scent trails for their companions.

These messages, like human speech, coordinate labour.

Like our tales, they vanish in the telling.

But, not restricted to telling tales, we can can make records that persist, communicated over space and time.

Architects start with the broad outlines of a design in their minds. As this is transferred to paper, they get the contexts within which the mind can work to elaborate and fill in details.

The details were not in the mind prior to starting work, they emerge through the interaction of mind, pen and paper.

Pencils and paper don't just record ideas that exist fully formed, they are part of a production process that generates ideas in the first place.

At any one time our consciousness can focus on only a limited number of items. On the basis of what it is currently conscious of, its context, it can produce responses related to this context. In reverie the context is internal to the brain and the responses are new ideas related to this context.

In an activity like drawing a plan or engineering diagram, the context has two parts

1. an internal state of mind; and

2. that part of the diagram upon which visual attention is fixated,

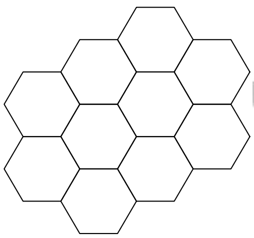
and the response is both internal—a new state of mind—and external—a movement of the pencil on the paper.

Architecture exchanges for the fallibility and limited compass of memory the durability of an effectively infinite supply of A0. One might say that complex architecture rests on paper foundations.

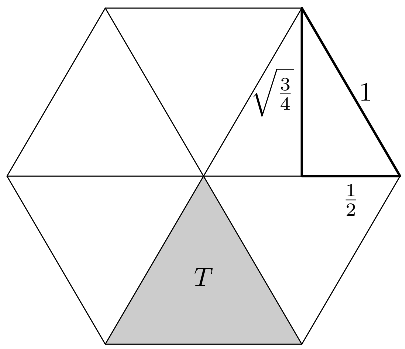
Apian efficiency

Consider the problem to which the honeycomb is the answer: to come up with a structure that is interchangeably capable of storing honey or sheltering bee larvae, is waterproof, is structurally stiff, provides a platform to walk on and which uses the minimum material. Given this design brief it is unlikely that a human engineer could come up with a better structure.

Our architects have a predilection for the rectilinear, but the hexagonal form is superior.

A tessellation of unit squares has a wall length of 2 per unit area, since a single unit square has four sides of unit length, each shared 50 percent with its neighbours. A tessellation of hexagons of unit area has a wall length of $\frac{2}{\sqrt{3}}$ per unit area, a reduction by a factor of $\sqrt{3}$. The honeycomb structure used by bees is thus more efficient in its use of wax than a rectilinear arrangement would be.



1. A hexagon of unit side is made up of 6 identical equilateral triangles, thus its area is $6T$ where T is the area of an equilateral triangle of unit side.

2. The area of an equilateral triangle of unit side is $\frac{1}{2}bh$ where b the base $= 1$ and h the height $= \sqrt{\frac{3}{4}}$. So $T = \frac{1}{2}\sqrt{\frac{3}{4}} = \frac{\sqrt{3}}{4}$.

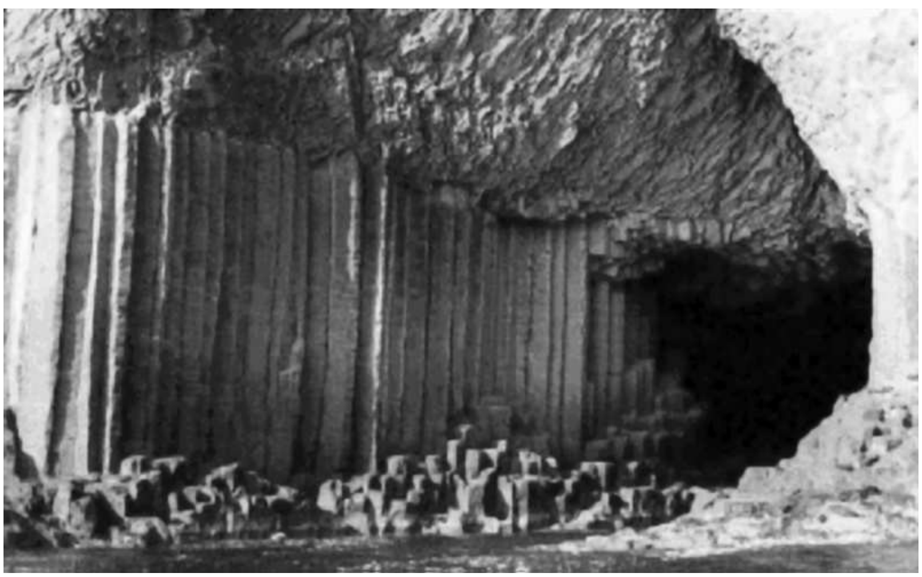
3. The area of one hexagon is then

$$6\frac{\sqrt{3}}{4} = \frac{3\sqrt{3}}{2}$$

4. The hexagon's six sides are each shared 50% with a neighbour.

5. Wall per unit area for a hexagonal tessellation is then $3/\frac{3\sqrt{3}}{2} = 2/\sqrt{3}$ which is better than the wall to area ratio for squares.

The fact that hexagonal lattices minimize boundary lengths per unit area means that they can arise spontaneously, for example in columnar basalts. Here the tension induced in rocks as they cool encourages cracking, preferentially giving rise to six sided columns.

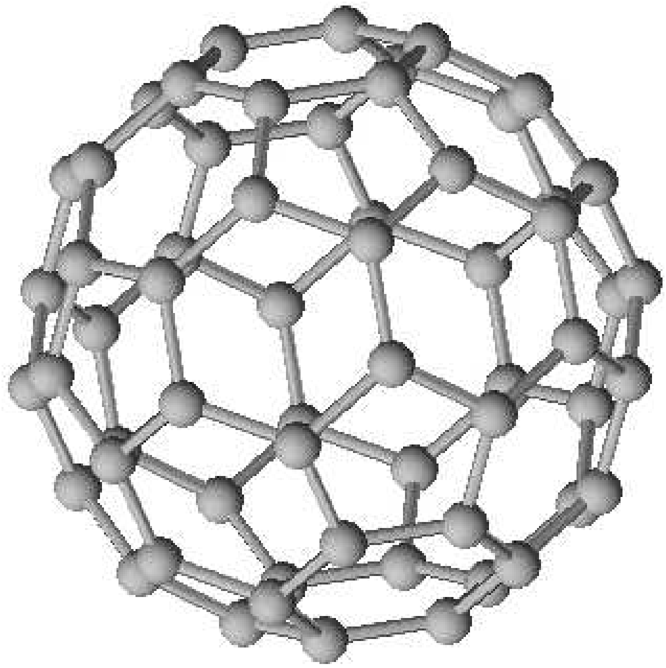


We might suspect that the beehive too, gained its structure from a process of spontaneous pattern formation . But this doesn’t tally with the way the cells are built up .

The bees build the cells up from the base, laying wax down on the upper margins of the cell walls, just as bricks are added to the upper margin of a wall by a bricklayer. The construction process takes advantage of the inherent stability of a hexagonal lattice, allowing the growing cells to form their own scaffolding.

But the process also demands that the bees can deposit wax accurately on the growing cell walls, and that they stop building when the cells have reached the right height. That is, it depends on purposeful activity on the part of the bees.

Human Hexagonal dome builders, like bees, exploit the inherent structural properties of hexagonal lattices, but they still need to cut struts to the right length and put them in the correct place. The bees likewise must select the right height for their cell walls and place wax appropriately.



Spontaneous self-assembly of hexagonal structures similar to geodesic domes does occur in nature. The Fullerene C_{60}, named after Buckminster Fuller, the inventor of the geodesic dome. has the form of a perfect icosahedron .

Condensed out of the hellish heat of a carbon arc, it depends on thermal vibrations to curve the familiar planar hexagonal lattice of graphite onto itself to form a three dimensional structure.

No architect or bee is required.

Emergent hives

A bee arriving on the construction site with a load of wax must, find an appropriate place to put it, for which they need a set of rules:

> If the cell is high enough to crawl into, put no more wax on it,
> otherwise if the cell has well formed walls add to their height,
> otherwise if it is a cell base smaller than your own body diameter, expand it,
> otherwise start building the wall up from the base. . .

No internal representation of a completed comb need be present in the bee's mind.

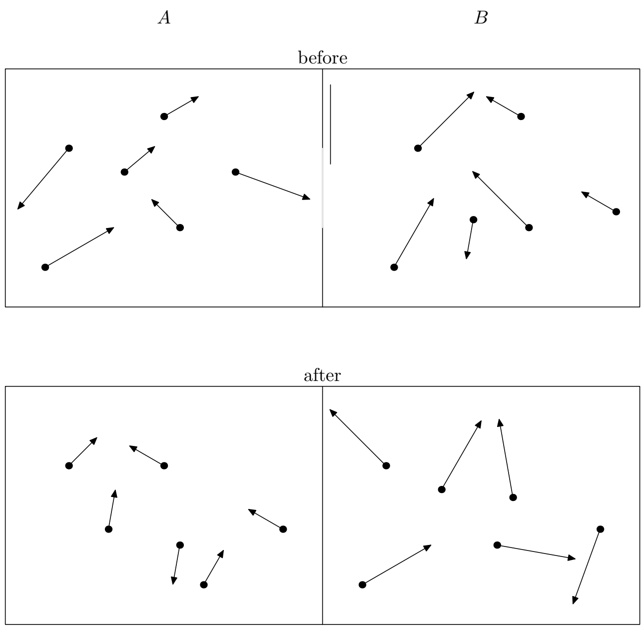
The same rules, simultaneously present in each of a hive full of identical cloned sisters, along with the structural properties of beeswax, produce the comb as an emergent complex structure.

The key here is the interaction between behavioral rules and an immediate environment that is changed as the result of the behaviour.

What an architect does is not so different. Architects produce drawings, not buildings or hives, but producing a drawing is an interactive process in which the architect's internal state of mind, his knowledge of the rules and stylistic conventions of the epoch, produces behaviour that modifies the immediate environment—the paper.

The change to the paper creates a new environment, modifying his state of mind and calling into action other learned rules and skills.

Information producing power: Maxwells demon



Gas initially in equilibrium. Demon opens door only for fast molecules to go from A to B, or slow ones from B to A. Result Slow molecules in A, fast in B. Thus B hotter than A, and can be used to power a machine.

It seems that the second law of thermodynamics expresses the coarseness of our senses rather than the intractability of nature.

Information in industrial production - example of the printing industry

In my notes I look at digital paper as a gedanken experiment. I showed that if you wrote text on it, although this text represented information, it contained much less information than the paper potentially could. If we transfer what we have learned from this example to ordinary paper and the process of producing a book we see that the production process encompasses two opposite phases.

1. The production of the paper. This is an entropy *reducing* process. The blank sheets of paper oviously have low information content with respect to human language, but they also constitute a low entropy state with respect to the raw material. In a sheet of paper the cellulose fibres are constrained in:

   (a) Orientation, since they must lie in a plane rather than being free to take up any angle. This implies a reduction in the volume of state space that the fibres occupy, and thus from Boltzman, a corresponding reduction in entropy.

   (b) Position, the fibres are constrained to exist within a small volume a few hundredths of a millimeter thick. This restriction in physical space obviously entails a smaller entropy, as shown in our discussions of Maxwell's daemon.

2. The writing of the text, whether by hand, as in the distant past, or by a printing press. This is an entropy *increasing* process. We can see this in two ways:

   (a) Consider the text to be printed as binary data, encoded using ASCII[*] or UNICODE[†]. Clearly the book contains this information, since by sending the book in the post to someone we can enable them to recreate the relevant binary file. Thus by the equivalence of information and entropy, we have increased the entropy of the book relative to the blank sheets of paper.

[*] American Standard Code for Information Interchange, a code which uses 7 bits to represent each letter or symbol, it is restricted to the characters appearing on US typewriters

[†] A newer 16bit code that can represent every letter or glyph used in any of the world's languages, including ideographic scripts like those of China and Japan.

(b) Consider the fact that whilst all blank sheets are alike, printed sheets can be different. The number of possible different pages that can be printed is so huge as to dwarf the concept of astronomically large ‡. Since entropy is logarithimcally related to the number of possible states, the increase in the number of possible states implies a rise in entropy.

It may be objected that whilst there are a vast number of possible pages that could be printed, we are only interested in printing a particular page. This is true, but it is the particularity of the page that constitutes the added information and thus the added entropy.

‡If we allow 40 lines of 60 characters, with these characters drawn from a lexicon of all of the worlds languages we have of the order of some 10^{10000} possible printed pages, , the volume of the universe in terms of the Plank dimension 10^{-35}m the quantum of space, is of the order of 10^{210}

First a low entropy material is created, following on from that its entropy is increased in a controlled way. Initially *natural* information is removed. Subsequently *anthropic* or human created information is added. The natural information removed is irrelevant to our concerns, that added, is dictated by them. The first processs, pulping wood, bleaching it, forming it into sheets, drying it, has to use energy to produce the reduction in entropy— thermodynamics gives any local reduction in entropy, its energy price.

The second process, increasing entropy, could in principle be done at no energy cost*. In practice our technologies are not that efficient. Still, the power consumption of a printworks remains lower than that of a paper mill.

*The controled not gate proposed for quantum computing is in principle a mechanism by which a process analogous to the printing of information onto blank paper can take place in a reversible and thus non energy consuming way.[DiVincenso95].