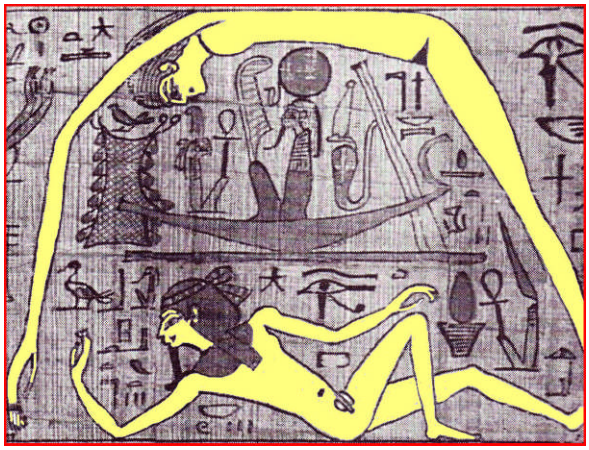
The COSMOS project

Learning about cultures of sustainability by making multi-subject organised syllabuses



Heliopolitan mindmap of the cosmos

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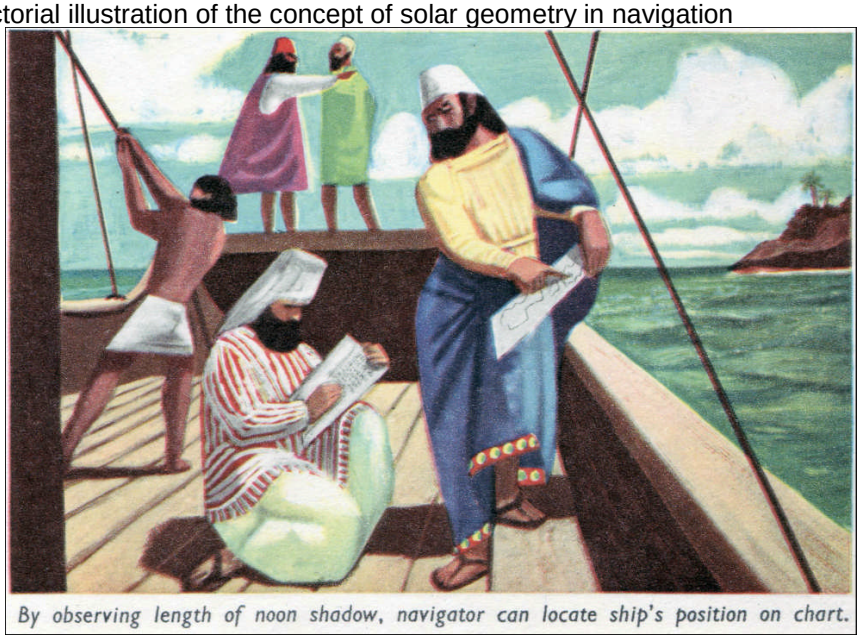
1 Subjects are arbitrary arrangements of knowledge

The mathematician Lancelot Hogben wrote the following paragraph as the beginning of his book on pure mathematics for the general reader.

> *"For MY one deer you must give me three of your spearheads". The earliest men and women like ourselves lived about twenty-five thousand years ago. They could say all this with their hands, simply by pointing one finger at the deer and three at the spearheads. The primitive way of counting with one finger for one thing and three fingers for other things, was the only kind of arithmetic they knew. For thousands of years such people thought of any quantity greater than three as a heap or pile".*

Hogben's book 'Man Must Measure', published in 1955, was the first account of mathematics to be illustrated with vibrant coloured pictures (Fig 1). In 69 pages it took an historical view of the development of the major ideas of the subject from prehistoric times to the invention of the computer. As a knowledge system about human culture it could equally well have started with the computer and worked backwards to show how our command of natural resources has depended on a succession of ideas that began with the first moon-calendar. The point is that the creation of a syllabus is an idiosyncratic affair, just as 'subjects' are arbitrary divisions of knowledge contrived by individuals or committees to facilitate learning and examination.

Fig 1 A pictorial illustration of the concept of solar geometry in navigation



Hogben's target audience was elementary *general* students of all ages. In contrast, another mathematician, Frank Castle produced a book in 1900 for the elementary *special* students who required an understanding of mathematics to solve the problems encountered in their jobs as 'artisans'. He dispensed with principles and took a purely practical approach. This objective is clear from the first paragraph of Castle's book of 194 pages, which was illustrated with dull monochrome graphs and tables.

> *"To perform his work intelligently, an artisan must have a knowledge of Elementary Mathematics. When he comes to appreciate for himself the workman generally finds that even the arithmetic he learnt at school has left him, and that he remembers little more than four simple rules and the multiplication table. Teachers soon discover that though anxious to learn, a student of this kind does not wish to lose contact with the practical requirements of the workshop- he is impatient of 'pure mathematics'- so the question arises how to teach him mathematics enough, by dealing with the calculations themselves which he is actually called upon to make at his work"*

Here, Castle is making an important statement about the fundamentals of effective learning, which is bound up with customisation and targeting information according to the needs of the

learner. The 'impatient' learner, in turn, selects and arranges the information according to the knowledge system appropriate to his or her needs.

Despite mathematics being a subject with boundaries that are more clear-cut than most, these two authors demonstrate that it is actually vaguely defined as a curriculum. Also, neither Hogben nor Castle was guaranteed a student reader who would be able or willing think like they did. In fact the study of students' motivation has shown that success in examinations comes from being able to assemble information in a flexible personal body of knowledge that is as arbitrary as the textbook author's particular arrangement. In this context, Hogben's book is the more useful in that it could be used as the scaffold to build a history of civilisation where each major advance depended upon the application of mathematics to solve real problems of expanding wealth and knowledge. In other words, to be successful in examinations, make your own textbook!

2 Learning by making mindmaps

All of the above is to take a view of learning as a process of making mindmaps, where a particular piece of knowledge is linked to another according to the path chosen by the compiler to build an understanding. It is often said that humans are inherent organizers, a process known as taxophily. From an early age, children exhibit taxophila in playing sorting and matching games. We cope with our ever-changing world by comparing new objects or experiences with those with which we are familiar, identifying patterns and categorizing what is new into our existing frame of reference. The emphasis on developing comprehensive systems for organising knowledge can be seen in the writings of the earliest philosophers, many of whom still continue to influence our view of the world. For example, Aristotle's effort to categorize knowledge into groups (such as physics, politics, or psychology) is reflected in our language, our education, and our science. The original classification scheme of the U.S. Library of Congress, used between 1800 and 1814, was based on the philosophical works of the 17th century British courtier Sir Francis Bacon. Bacon's view was that knowledge had to be organised primarily for the study of nature, and of man as a component of nature, so as to reduce both to controllable and 'usable' entities. Adoption of the classification systems of Aristotle and Bacon led to the creation of our traditional subject-based knowledge hierarchies set out in text books, which are all based on the 'tree of knowledge' with a trunk that branches out into concepts with subordinate elements as branches and twigs.

However, even in the mid-19th century, subject boundaries, particularly in the natural sciences were not hard and fast. A key figure in the presentation of what could be termed a multi-subject global knowledge system was Alexander Von Humboldt. He took the view that to understand nature required the linking of 'hard matter and rocks in place' with beauty and order represented in poetry, painting and gardening. This was the theme of his two-volume thesis entitled 'Cosmos'. In Volume 1 Humboldt surveys the heavens and the earth, and deals with all things from stars and nebula to the earth as a planetary body, its geography and meteorology and life forms from plants and animals to the races of man. He ends the first volume on the threshold of explaining the human mind. In Volume 2 he takes up nature subjectively as a product of mind and reaches a two fold understanding of our place in nature as a transcendental response to being engaged in the gigantic physical mechanism we call the cosmos.

Humboldt's empirical holism influenced the American naturalist and proto-conservationist Thoreau, but Humboldt did not stem the tide of subject consolidators who created the Victorian examination system. These subject divisions are now unnecessary and restricted when it comes to organising current knowledge about world development on a planetary scale. We have to return to Humboldt's insistence that, as individuals, our only view of the world is through the mindmaps we make of it by which '….*the external world blends almost unconsciously to ourselves and feelings'*. In a world of the printed-paper, the making of mindmaps requires numerous cross-references in the form of footnotes, and Humboldt's Cosmos has a bewildering array of these on every page. Nevertheless, tree structures upon which the contents of textbooks are arranged have served us well in the paper world and are now being adapted to the digital revolution through the use of mind mapping toolkits, which are user-friendly interactive personal learning tools. Digital knowledge trees, particularly where the text is reinforced by pictures, have the following advantages.

- In the paper world, a concept can hang from only one branch. In the digital world, concepts can easily be classified in dozens or even hundreds of different categories.
- In the paper world, a teacher uses only one tree. In the digital world, there can be a different tree for each person who can also participate in the making of it.
- In the paper world, the person who owns the information generally also owns and controls the tree that organizes that information. In the digital world, users can control the organization of information owned by others.

3 Academic barriers to total understanding

Sectorialism and specialisation permeate society in general. Decision-makers tend to base their decisions on short-term benefits, and often ignore long-term environmental, social and cultural costs. In addition, well established existing organizations, institutions and structures, as well as scientific disciplines, are factors that contribute to support such narrow decision-making. Together with vested interests in politics, industry and the corporate sphere, these institutional barriers effectively block change towards more long-term, integrated decision-making favouring the environment and sustainability In particular, these barriers obscure the opportunities for joint work between social and environmental scientists in fields that go beyond their disciplinary frontiers.

4 Cultural change

Education is a key instrument for cultural change, and future decision-and-policy-makers must be provided with integrated, multidisciplinary education, training and research. But bridges are needed between disciplines at all levels of education to reinvigorate ingrained working methods and mind sets to enable future decision-makers, families and individuals to resolve the complexities of responding to change within an integrated, long-term planetary perspective.

5 Ideology of a making new subjects

The long term consequences of political, industrial and biological management and development of the environment can only be understood within a knowledge system that integrates, ecology, economics, the social sciences and technology. It should connect government and business with families and individuals. As a new subject it should be structured in order to:

- recognise the multi-disciplinary nature of economic development
- have a long-term perspective
- improve the effective balance between conserving and using resources
- emphasise informed public participation in decision-making
- promote the equitable sharing of resources and reduce the risk for conflicts
- foster respect for cultural, social and biological diversity

These are the six educational imperatives recognised by the UNESCO-Cousteau Ecotechnie Programme (UCEP) as keystones in the promotion of global education for environment and sustainable development.

5 Cultural ecology: an example of a global mindmap

Cultural ecology was developed from the subject of natural economy that was launched to support world development by the University of Cambridge Local Examinations Syndicate in the 1980s. It formed part of the Syndicate's International GCSE until a few years ago when it was replaced by 'environmental management'. The new syllabus is more technical and has lost the broad humanist sweep of the original, which was designed to put 'being environmentally friendly' at the centre of a new curriculum for living in an overcrowded world.

Cultural ecology starts from the premise that knowledge about Earth's future is preferable to blind ignorance and that there has to be a 'global syllabus' with room in it for teaching that order is better than chaos; creation better than destruction, and that gentleness is preferable to violence, and forgiveness to vendetta. This gives a powerful socio-ethical dimension to cultural ecology, which encompasses what is ethical and sacred about our ecological position on a minor planet at the edge of a vast empty cosmos. Pessimists would say that ethical constraints cannot hold against the human race as an evolved group of disputatious tribal animals hard-wired to conquer the solar system, nevertheless the British teachers who created the mindmap of cultural ecology believed that they had to try to provide a map for withdrawal.

As a concept, cultural ecology starts with the principle that human cognition differs from the cognition of all other animals primarily because it is intrinsically a cultural phenomenon. In this context, the practical focus of cultural ecology is on education about the cultural rules of behaviour for sustainable living. Culture is the patterning of our interactions with the human environment and it is not susceptible to design principles appropriate to the creation of bridges and software programs. But it is susceptible to the highly personal design principles of a gardener or an architect. Engineering models are appropriate to ordered systems in which cause-and-effect relationships can be discovered and verified, and where those relationships repeat themselves in a predictable manner. In such systems, efficiency rules – we want the most efficient system, one in which each component of the organisation is optimised in order that the system as a whole can be optimised. Examples from the social sphere are expense rules, compliance procedures, quality standards, legal structures and so on. The problem is that human behavioural systems, in respect of their culture but not necessarily of their more stable aspects of interaction, are not ordered systems and, ironically, the path to their optimisation is to allow sub-optimal behaviour in their parts. This is because society is multi-structured in terms of groups and their histories, full of individual flair in its creation. Pluralist human systems need to be effective, whereas machines are efficient; the two are not necessarily the same thing. This leads to the following two categories of systems, social ones and ideational ones; i.e.

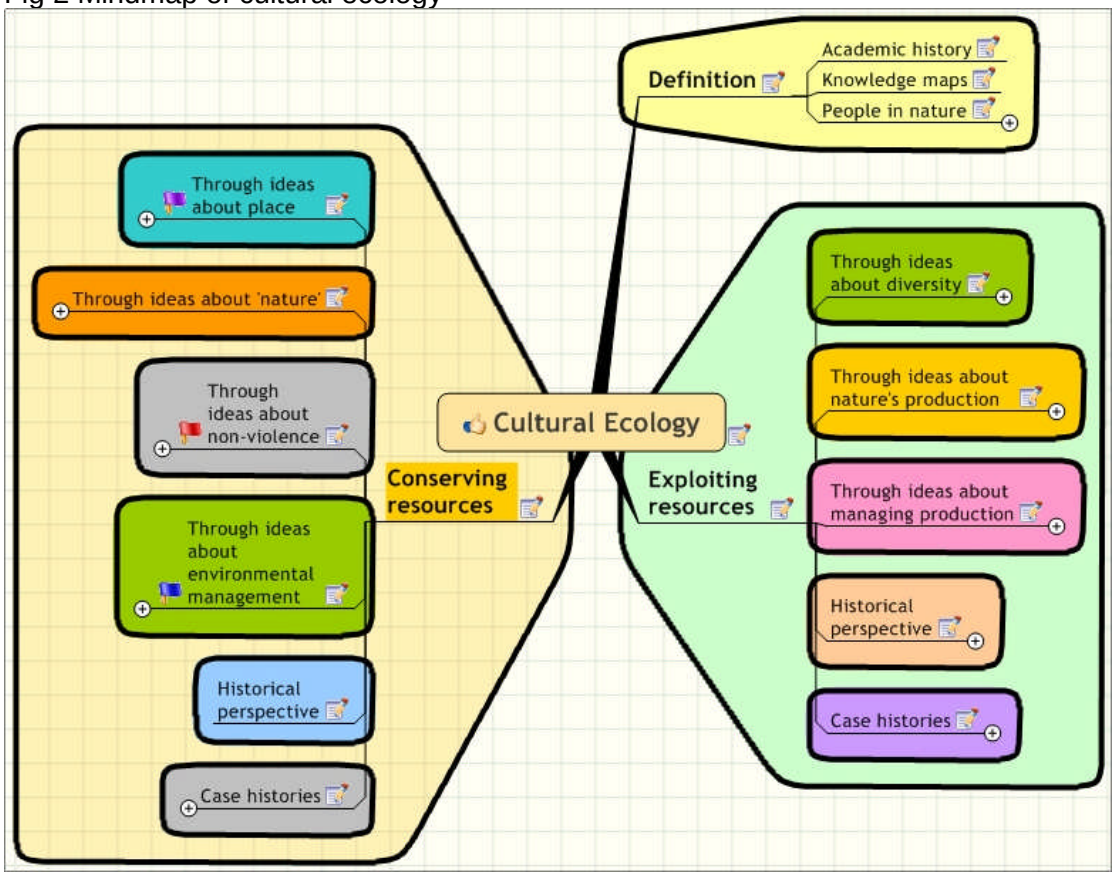
- Culture as a social system is about what people do or make. This is the pattern of residence and resource exploitation that can be observed directly, documented and measured in a fairly straightforward manner.
- Culture as an ideational system comprises shared ideas, systems of concepts and rules and meanings that underlie and are expressed in the varied ways that humans chose to live. Culture, so defined, refers to what humans learn, not what they do and make. Ideation is the way in which humans provide standards and structures for deciding what is... for deciding what can be... for deciding how one feels about it... for deciding what to do about it… and for deciding how to go about doing it.

The emphasis within cultural ecology was to provide an ideational scaffold. The aim was to present ideas about living a sustainable life, not to provide prescriptions for living it (i.e. it was to be biased towards the second of the above categories, not the first).

The big ideas behind sustainability through conserving resources, its educational pillars as it were, are categorised as being about 'people and place', 'nature', 'non-violence', and 'environmental management'. These ideas about conserving resources are placed alongside ideas about exploiting resources

connected with biodiversity, nature's production and managing natural resources for human production (Fig 2). Both of these major divisions are placed within the historical context of the origins of the ideas, with case histories to exemplify how the ideas are expressed in the real world.

Fig 2 Mindmap of cultural ecology



The other principle behind the creation of the cultural ecology mindmap was to demonstrate how to build such maps for crossing subject boundaries and establish relationships to assemble a personal body of knowledge for living sustainably. Technically, this is a straightforward task of demonstrating mind mapping with commercial software such as 'Mindmanager' and 'Inspiration'.

In summary, when producing the mindmap the organisers of cultural ecology were trying to answer the question how should people learn in order to be educated citizens and to find and do interesting and important work in the 21st century? This is really about a lifelong learning perspective for action, beginning with the proposition:

If the world of working and living relies on collaboration, creativity, definition and framing of problems and if it requires dealing with uncertainty, change, and intelligence that is distributed across cultures, disciplines, and tools—then community education programs should foster transdisciplinary competencies that prepare people for having meaningful, productive and sustainable lives in such a world.

To deliver cultural ecology as an information package for living in the 21st century, the following additional questions need answering. How do people go about knowing what they know? What is the contribution of the environments in which the knowing is accomplished? What are the limiting factors to be removed?