

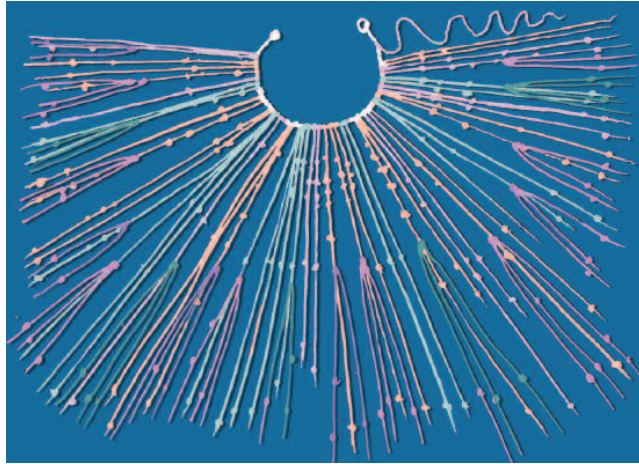
# Record-keeping with a knotted string

The quipu has long posed a puzzle to archaeologists. The device in question — its name being a Quechua word signifying a knot — was a length of cord composed of threads of various colours tied into a complex system of knots and used for record-keeping.

When European explorers first encountered the quipu they thought that the threads and knots stood for certain objects and numerical combinations, thus comprising a primitive but incredibly complicated mnemonic device by which facts could be passed from one person to another.

After the Spanish conquest of Peru in the 16th century, the conquerors, despite their reforming zeal, found it impossible to convert the native administrators from the use of the quipu to the European system because the quipu was inextricably concerned with communications at all levels of accounting and reporting. Before the conquest, all accounts concerning population levels and schemes of taxation had been accomplished with the mystery strings.

In 1956 an archaeologist working in Peru discovered a buried container that housed 21 knotted and dyed strings.



In *Science* for 12 August, experts from Harvard describe their investigations into the quipu accounting problem, and another from Lima records the discovery of the oldest known of these recording devices, comprising a series of pendant strings knotted at intervals and twisted round short sticks. It is thought to precede other known quipus by more than 3,000 years, thus indicating that the Andean system was only slightly later in arrival than cuneiform script in Sumer and hieroglyphics in Egypt.

Inca quipus so far discovered comprise a main cord from which descend up to 1,000

smaller strings with clusters of knots. The record was interpreted by running the fingers along the strings, a strange alternative to reviewing designs drawn on flat surfaces.

Multiple copies of a quipu were made so that officials of the administration could detect any deception that might be planned by tribute collectors wishing to cheat the system. The four colours of the strings also played a part in the recording of the data by the operator.

It is interesting to note that textiles were of extraordinary importance in the pre-conquest Andes. Although they have been important

in every society for providing warmth and shelter, their power to convey meaning and quantity is a characteristic of Andean cultures. It has even been speculated that in Peru weaving was invented as a conceptual art rather than primarily for making garments. From an assemblage of 12 cotton strings, some knotted and wrapped round sticks, some dyed various colours, a device for recording and calculating mathematical quantities and shapes arose.

We have much more to learn from the humble quipu to enable us to develop a closer sympathy with our ancestors.

## Biological basis of consciousness    Imagination is the master of art

There is an intriguing discussion in *Science* for 1 July concerning the true nature of consciousness, a topic that was once the exclusive concern of philosophers but is now treated scientifically and is amenable to experiment.

The leading figure in the concept was René Descartes, who believed that body and mind are different materials, since the body exists in both time and space but the mind does not occupy space. Today scientists treat body and mind as different aspects of the same thing.

Acquaintance with persons who have received neurological damage that has affected their consciousness shows that damage to some brainstem areas can rob them completely of consciousness and produce coma or a persistent vegetative state. Different brain regions probably control different aspects of overall consciousness. Moreover, conscious and unconscious knowledge may be affected without actual neurological damage.

Most enigmatic of all is the nature of the link between consciousness and the sense of individual self. Not only do we wish to understand the biological basis of awareness, we also wish to understand why it should exist at all, and what evolutionary selection pressures have shaped it. There are no good reasons to suppose that humans are unique in possessing the faculty of consciousness, however we care to define it. And we know little about how it develops from our own infancy.

Philosophers continue to maintain their vagueness regarding what consciousness is and what purpose it serves. Some are content to say that it exists but resists definition. It involves experience or awareness. They fight shy of trying to find a link between its subjective and objective sides. For some, all mental states are conscious ones.

Unfortunately, consciousness remains, both to philosophers and to down-to-earth scientists, as something irreducibly subjective. We are forced back to Descartes's famous comment: "Cogito ergo sum".

Imagination, not invention, is the supreme master of art, as in life, remarked Joseph Conrad in 1912. Wordsworth, in 'The prelude' (1850), waxed even more enthusiastic in defining imagination as "Reason in her most exalted mood".

The compilers of dictionaries remarked that imagination is the mental faculty enabling us to form images or concepts of objects not present or existent. It is therefore essentially creative. Philosophers also claimed that imagination is the power of the mind to consider things that are not present to the senses, even those that we cannot agree to exist in reality.

When we say creative, we do not imply the construction of some beautiful or practically useful object. Indeed, imagination is capable of assembling a destructive device in the mind of an evilly disposed person.

The precious faculty of imagination is linked to forethought and the ability to anticipate the outcome of an action. Many of our present troubles stem from a lack of it. If we were living in a really civilised fashion, we could avert catastrophes by recognising their imagined occurrence, but too often we either do not care what will happen to our neighbours or ourselves and disclaim all responsibility.

John Keats, in his preface to 'Endymion' (1818), offers us a striking account of how imagination develops in an individual. "The imagination of a boy is healthy, and the mature imagination of a man is healthy; but there is space of life between, in which the soul is in a ferment, the character undecided, the way of life uncertain, the ambition thick-sighted; thence proceeds mawkishness."

If we are serious about the education of the young, it might be helpful to bear Keats's observation in mind and to recognise that the cultivation and control of a responsible imagination might profitably be given a prominent place in the critical stages of human development.