29. Explicit data and tacit knowledge, exploring the dimensions of archaeological knowledge

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Introduction

Throughout his career George Eogan has been concerned not only with discovering new knowledge about the past but through his teaching was intimately involved in making his knowledge available to generations of archaeologists. I was one of those students who was privileged to be taught by George Eogan, and later assist him in his research. It was through his example that I learned that Archaeology is a discipline not just concerned with generating data, but with creating, organising and diffusing knowledge about the past. I have used the opportunity presented by this *festschrift* to look at the nature of archaeological knowledge and emphasise the importance of tacit knowledge and the limitations of data.

The dimensions of archaeological knowledge

The objective of archaeology is to increase knowledge of the past through the study of material remains. As archaeologists we know things in many ways, as individuals, as groups, and both consciously and unconsciously. Knowledge can be divided into two primary types: explicit knowledge and tacit knowledge. Explicit knowledge is learning that is available to consciousness and can be expressed unambiguously in signs, words or numbers. Explicit knowledge, because it can be codified and stored (in books, computer records and archives), can be handed on without direct interpersonal communication and can be communicated and shared across space and time.

The concept of tacit knowledge was defined by Polanyi (1966) as learning that is not available to consciousness, that is experiential and difficult or impossible to communicate through language or other coded processes. Tacit knowledge is often person and context specific, consisting of insights and intuitions as well as technical abilities. It is difficult to successfully communicate across space and time. Tacit knowledge can be held by an individual, where it is manifested as complex skills. For example, an individual may be able to ride a bicycle but may have no explicit idea of how they do this; they are unable to explain the process. Most skills that require comprehension of information which is too complex to be verbalised, such as overtaking on a motorway, recognising subtle archaeological features, or the ability to see and explain patterns in raw data, rely on unconscious tacit thinking.

Many innovative theories have sprung into the conscious minds of thinkers from the subconscious fully formed, and empirical proofs added later. Frederich Kekulé is said to have apprehended the circular structure of Benzene in a dream (Cohen and Stewart 1995, 41). Edward Szilard imagined the mechanism of a nuclear chain reaction while waiting for a traffic light to change on a London street (Rhodes 1986, 28). Trigger (1980) has suggested that Gordon Childe's synthesis in *The Dawn of European Civilisation* relied heavily on intuition and "was conditioned more by his assumptions about human behaviour than by the archaeological data at his disposal". Hawkes (1982, 148) refers to Mortimer Wheeler's "famous archaeological intuition". A number of groundbreaking theories have been developed by individuals who were relatively unfamiliar with the data. For example, Alfred Wegener (1966) was a meteorologist who had never worked in the area of geology when he proposed the theory of continental drift plate in 1912. This indicates that large quantities of data may not be necessary for the development of theory.

Cook and Brown (1999) note that tacit knowledge is also held collectively by a group in what they describe as a 'genre'. An individual may know part of a language, but the whole language is only known by a group, similarly a group may hold a common view of the world based on unconscious tacit assumptions. Kuhn (1996) has described these world views as paradigms. Professional groups, like archaeologists, that hold a body of knowledge in this way are also called communities of practice. These are informal social networks with a shared repertoire of concepts, actions, tools, stories, artefacts and discourse (Wenger 1997). Cook and Brown suggest that there is a distinction between possessing knowledge and the active process of using and generating knowledge in the course of practice, which they call knowing. Taking a pluralist

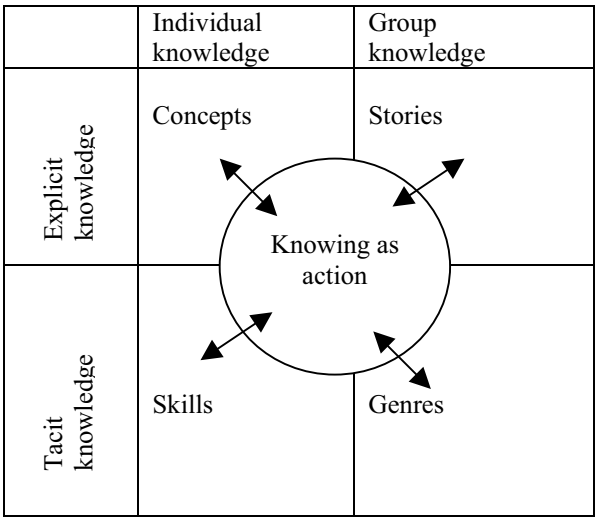

Fig 29.1: Cook and Brown's four forms of knowledge and the bridge formed by knowing as action.

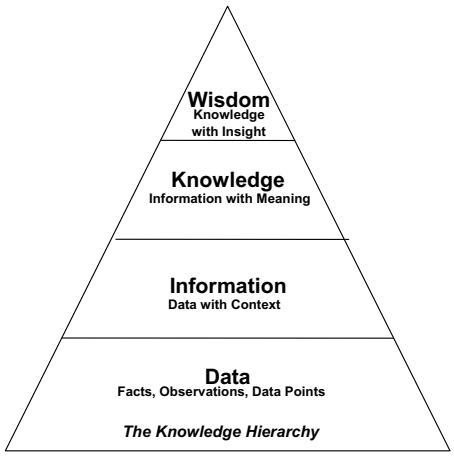

Fig 29.2: The Knowledge hierarchy.

view, they argue that the four types of knowledge (tacit individual and group and explicit individual and group) are involved in a reciprocal interplay or bridged in purposeful activity (Fig 29.1).

Types of knowledge

Taking an empirical view, archaeological knowledge is a hierarchical process commencing with raw data, which can consist of artefacts, observations or numbers, words, or even sounds and images (Fig 29.2, and Davenport and Prusak 1998). Data by itself has no inherent meaning, only when it is given meaning, by being arranged and processed into patterns, placed in context, categorised, calculated mathematically or statistically, corrected or summarised, does it become information. Ironically, too much data makes it difficult to identify and make sense of the information that matters. Only once this information is put to some use, is given meaning or is transformed through comparison with other information, its implications established, its connections to other information assessed or is discussed with others, does it become knowledge. To take another scientific example, the planet Uranus was observed on seventeen different occasions between 1690 and 1781 before Lexell realised that it was a planet (Kuhn 1996, 115). The observations (data acquisition) alone were not enough to identify it, it had to be placed in the context of contemporary astronomical discourse. We generally tend to find data in records, and information in messages, but we obtain knowledge from individuals or groups, or embedded in organisational and cultural routines (see below).

Taking a more human-centred approach, knowledge can be viewed as a typology, such as the know-that to know-why scheme that divides it into six types (Skyrme and Amidon 1997). Know-that is the basic sense of knowing, having cognitive knowledge, facts, experience and access to learning. This is characteristic of a new graduate. Know-that is most useful when joined by Know-how, which is advanced skills, and knowing how to get things done. Much Know-how is tacit knowledge and requires skill and practice gained over time, so it is characteristic of experienced workers.

Other types of knowledge include Know-who, a knowledge of the capabilities of others, which also relies on experienced judgement. For example, the ability to put together a research team with the appropriate mix of knowledge, skills and abilities. Know-when is a sense of timing, knowing when to do something like apply for a research grant. Know-where is a spatial sense, knowing where things are best done, such as the ability to identify the best location to excavate. Finally, Know-why is a strategic sense, requiring a sense of context and vision, understanding systems and how, for example, a research project will contribute to a whole system of knowledge.

The cost and value of knowledge

All knowledge, in whatever socio-economic system, has associated costs and value. The primary cost of archaeological knowledge is associated with specifying it in the form of a research proposal or project brief. Locating it, whether in an existing archive or in the field has costs, as does accessing or capturing it in some sort of a recording system. There are also costs associated with evaluating its significance, transferring it through various forms (paper to database to report), assimilating it into the body of existing knowledge and curating it in an archive.

Data may have great cost but is not knowledge and has little value without further work. The value of knowledge is not always self-evident or universal, its value varies between individuals or groups (see Carver 1986 for an extended discussion of archaeological value). However, the value of knowledge is not diminished by copying and is usually enhanced by sharing. Knowledge is a collective good and can still be used by the originator after it has

been communicated to others. Presenting a paper at a conference, for example, encourages reciprocity and feedback that can increase the value of the knowledge. Increasing the amount of similar data does not make knowledge more valuable (although it does drive up the costs of knowledge), the value of knowledge is increased by adding different data. Too much data or information can swamp the ability of the recipient to assimilate and use it and may divert attention from what is important (Simon 1978). Information is only useful if the recipient can understand and apply it, and this requires an existing level of knowledge to allow the assimilation of the new information. Other costs include classifying the nature of the information and relating it to the knowledge base. This can be made difficult (and more costly) if it is disorganised, lacks a summary, a list of contents, categories, *etc*.

Knowledge capture

Another issue is how knowledge is captured and stored. In general it can be embrained, embodied, encultured, embedded and encoded (Blackler 1995). Individual knowledge can be embrained in the form of conceptual skills and cognitive abilities (this is similar to know-that). It can also be embodied, acquired by doing and problem-solving and rooted in a particular context. Collective knowledge can be encultured in a group or community. This is achieved through shared understandings, socialisation and shared language. Knowledge can also be embedded in systemic routines, technology and structures. Material culture embeds knowledge (much of the information obtained from an excavation will be embedded in the artefacts), as do organisational and social structures. Finally, knowledge can be encoded, it can be externalised and conveyed by signs and symbols and made available to anyone who understands the code.

Discussion

In the search for objectivity and the focus on data collection the importance of tacit knowledge can be overlooked. Tacit knowledge or know-how can never be truly expressed in a book, report or a database, yet it provides the ability to accomplish all archaeological activities. Because it has such a large tacit component Know-how can only be passed from the experienced to the inexperienced in an interactive process in the course of practice. This emphasises the importance of experienced archaeologists who possess know-how, and the processes by which this knowledge is passed to others.

The concept of the knowledge hierarchy is an important reminder that data is not the same as knowledge. Data may have been produced at great cost but it must still be developed through a series of stages before it becomes knowledge. Today more archaeological data is being collected than ever before, in the form of artefacts, bones,

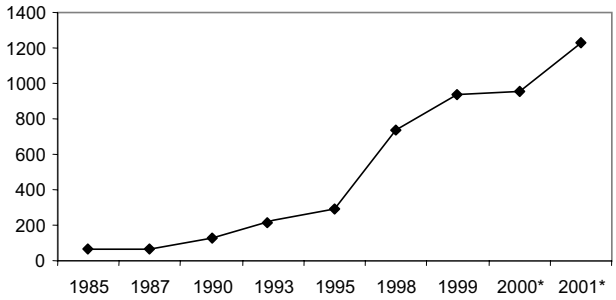

Fig 29.3: Excavations in Ireland 1985–2001.

descriptions, measurements, *etc*. This data acquisition is being driven in an attempt to preserve monuments by record that would otherwise be removed in the course of development (DAHGI 1999, 25). However, most of this is remaining as data (Fig 29.3, Mount 2002). The data is situated within and has value related to the community of practice that created it. It may have little or no relevance or value in other contexts. We have noted that the value of data does not relate to its quantity (indeed too much data can reduce its value) but to its perceived relevance to individuals and groups. It is by no means certain that raw data collected today, even if carefully archived, will continue to have meaning or value to archaeological communities of practice in the future. Also, without careful checking, the validity of the data may come into question (see Lambrick and Doyle 2000, 22–5, for questions which have already arisen regarding the reliability of archaeological data). Therefore two questions arise, is it wise to collect more data than can be successfully assimilated without incurring overload? Is it worthwhile archiving excessive data quantities that may have no relevance in the future?

A final issue is the opportunity costs of investing scarce resources in data that may have no future relevance. Could the resources be more usefully invested in some other activity that would have a more tangible or immediate benefit? The risk that data collected today might have limited relevance in the future suggests that investment in other activities might be wiser. The alternative is to collect data, not in an attempt to preserve archaeology by record for some future community of practice, but to answer questions related to a matrix of theoretical frameworks which develop questions about periods and themes of relevance to Irish archaeology in the present. This approach would aim to make the creation of knowledge the primary aim of archaeology rather than the collection of data.

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