Making Knowledge Tangible

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Introduction

Organisations have been slowly acknowledging the significant role to be played by knowledge as an essential part of their capital assets. Knowledge management has been concerned with concepts of knowledge and communication as important for how knowledge is managed. Some specialists have focused on IT as the key to future developments. Others have critiqued this approach, not in rejecting IT as such but in it being given prominence. Some of the arguments have been based on the view that knowledge is qualitative as well as quantitative and also that we need to take into account the creation of knowledge as well as the storing of the known in data banks.

The concept of 'knowledge management' and the idea of functional classification of scientific effects and solutions are of course central tenets of the TRIZ methodology. The importance of such computer-based knowledge bases and their 'semantic web' successors cannot be under-estimated. It is our contention here, however, that they alone are not sufficient to ensure the transformation of that knowledge into tangible benefit - in terms of either problem solving or bottom-line business performance.

We do not reject computer modelling, of course, but emphasise the parallel necessity for the kind of 'soft modelling' that involves human intuition and sensory experience. We want to place this kind of soft modelling in a central position. Not only is it humanising, it provides what we will be calling in this article 'molecules of meaning' that can serve to relate qualitative knowledge - or 'feel' - to 'hard modelling' systems, amongst other features.

In general, not very much attention has been paid to the fact that the 'medium' in which knowledge is exchanged and organised deeply affects how that knowledge is ultimately deployed. If we are to use knowledge to best effect, the question of 'medium', therefore, needs to be addressed. This means that we have to think about media in their own right and be prepared to learn new ways of organising and manipulating knowledge.

We might think of our theme here in terms of the evolution of 'knowledge' from 'data':

$$\text{DATA} \rightarrow \text{INFORMATION} \rightarrow \text{KNOWLEDGE} \rightarrow \text{'WISDOM'} \quad (1)$$

…and the steps that might now be required along a road from knowledge to a contextualised, tangible, benefit-generating 'wisdom'.

In this article, we look at a new approach to organising knowledge that naturally encompasses knowledge creation and is also very close to the question of thinking and *how* we think. We propose that how we think is inextricably bound up with the medium we use to think *in*. A dilemma is that having to think about how we think is bound to be felt as an additional burden to the task of thinking itself. Applications are always specific, when our attention is focused on what we want to do rather than on how we do it, and the *how* recedes into the background. We have to spend much of this article in defining and explaining the new

medium of logovisual technology in its own right, because we believe it throws light on how we can think and organise knowledge.

Nonaka's concepts of 'ba' and 'interiorisation' form a useful background to what we have to say. 'Ba' is a 'place of meeting' in which knowledge can be created, where the implicit becomes explicit and 'basho' is a network of such 'places'. 'Interiorisation' is the way by which such knowledge becomes assimilated into us and the organisation as a whole. (2)

The new significant methodology we see emerging in recent times we name as 'logovisual technology' (LVT). It has two important features. The first is a dimension of 'tangibility' and the second a way of handling knowledge in terms of units that belong to a higher level than words, and constitute whole 'molecules' of meaning in their own right. In both features, we seek to demonstrate consistency with TRIZ predicted trends of evolution. Thus in the same way that 'wisdom' is a predictable evolution step from 'knowledge' from above, LVT may be seen as a demonstration of the TRIZ trend of evolution of dimensionality from a simple/linear to complex/multi-dimensional system.

Tangibility

In recent years, in a movement headed by Robert Horn amongst others, the concept of *visual thinking* has emerged as significant for human understanding and communication. (3) We regard this as an important step in moving from a purely linear and verbal way of representing knowledge - as in written texts - to one that engages more of the whole person. We want to add a further dimension and consider *tangibility* as equally as important as *visibility.*

These concepts impinge on what we do with knowledge in all spheres of human activity. Our own approach to what knowledge 'is' is pragmatic: knowledge is anything we *can* think about. This means that 'knowledge' is part of our human world, involving people and their relationships and is different from the pure data that may be processed in the 'black-box' of computers in ways that are not visible to us. Knowledge, for example, is what can enter conversation. This includes the much-vaunted 'tacit' knowledge that we do not usually voice but can, to some degree, when circumstances allow.

The concept of 'tangibility' refers to being able to handle and manipulate knowledge, and not simply 'see' it. This concept introduces something new from the recognition that pictorial, graphical and other means of display, aid in representing and communicating knowledge. Studies have confirmed the obvious - that 'words + pictures' fare better than words alone. As yet, there have been no academic studies of the impact of tangibility, and we are relying on experience to support our claim that tangibility should be acknowledged as equally important.

In more specific terms, tangibility refers to two main factors that are closely linked together:

- Knowledge is treated like an object
- Knowledge can be moved about in physical space

To consider knowledge as 'thing-like' may first appear strange. But it is no stranger than using words or pictures to represent knowledge. The *substantial* content of knowledge lies in the human world of minds, bodies and relationships. Somehow, we are able to use symbols to carry and transmit knowledge without entirely losing this substance. However, the substance does leak away unless it is renewed by some actual process in real time that engages the human being. That is why we are constantly having meetings and feel that documents by themselves, however sophisticated, lose something important of the substance of knowledge.

The concept of tangibility tells us that knowledge needs to be handled in a 'physical' way if it is to be 'alive'. We can store knowledge in all kinds of expert ways, but this does not make it real for the people who need it. It is common sense that, unless we actually *do something* with this knowledge, it becomes

insubstantial for us or a mere record of what is passed. To some degree, conversation brings back the vitality of our knowledge; but we want to consider the aspect of tangibility in conjunction with that of visibility. In conversation alone, what is said can be alive in the moment but lost in the flow. We may see this as a manifestation of the mono-bi-poly trend - in which the form and application of knowledge evolves to better match our range of senses.

A picture provides a wonderful way of representing knowledge in a meaningful way, but it is static. Animation can do something towards remedying this defect, but this is to entrust the tangibility factor to an external agent, whereas what is needed (and, incidentally, predicted via the dynamisation trend) is for this to be undertaken by the people involved.

It is telling that the extraordinary concept map on the question of whether computers could simulate human intelligence produced by Horn and his workers took them years to make. (4) It is a wonderful piece of work. But the substance of the exercise was in the making of it and not so much in the viewing of it. Now that they have presented this piece of work, it is possible to consider how people can do something of the same for themselves with their own questions. *Doing it for ourselves* is making it tangible. This is because we have to handle knowledge and move it about *ourselves*, if we are to own and understand it.

We are still, however, somewhat in thrall to 'experts', looking to them to organise our knowledge for us; and the thought of doing this for ourselves can be daunting. If we want to have 'completeness' then we face considerable difficulty. What we can do is to learn how to make knowledge *our own* by handling *some* of it. Once this has been done in some domain, the capacity is enough to affect all other domains. It is, in part, a matter of confidence. Learning how to organise knowledge in a tangible way about *something* develops a capacity that carries over into *everything*. The justification for this claim rests on the following considerations.

- Thinking is based on a physical process carried out in the brain
- We can simulate this process by a corresponding physical process in the external world
- We can then 'interiorise' this process

There can be another intermediate step (between the second and the third) involving computer simulation, or any number of intermediate steps in this progressive cycle. The pattern here is ubiquitous in any sphere of human intelligence: we simulate the workings of our intelligence externally to enhance its operations internally. This is possible because 'thinking' is a cultural activity involving other minds and bodies in a real world of meaning. It is never confined to the interior of a brain.

When we first develop a new mode of simulation, this often appears to the majority as 'artificial' and 'alien' to our customary experience and therefore of marginal interest, or to the specialist few as 'superior' to our customary ways and therefore liable to replace them in the long run. We simply point out whatever new technology we use has to become *part of our own bodies* if they are to be felt as 'natural'.

Usually, 'thinking' and 'doing' are considered as two separate things, but we want to observe that we are most *intelligent* when they fuse together (we will come again to the idea of intelligence later on). Much has been made of the need to combine the operations of the two sides of the brain, the one verbal and linear and the other pictorial and holistic. We advocate introducing a (mono-bi-poly) third kind of function, which is concerned with *doing* and requires a tangible kind of operation and represents a physical kind of thinking. (5)

LVT

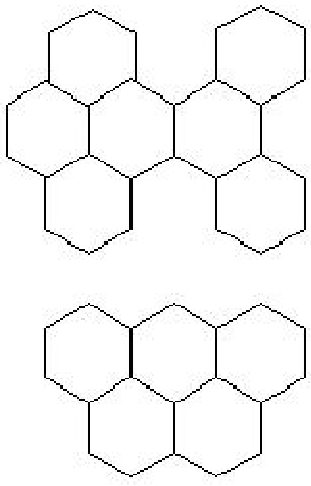
***logovisual technology*:**
making meaning visible in tangible form

We have invented a neologism, *logovisual technology* or LVT for short, to designate 'making meaning visible in tangible form'. The use of the general word 'meaning' is needed because LVT deals with knowledge that is meaningful to the people who use it; that is to say, is relevant to them personally, their relationships, the work they do and the world in which they share. LVT signifies a step beyond *visual thinking* per se because it involves the activity of the participants and the tangibility factor.

The three main characteristics of meaning in LVT are: discreteness, visibility and tangibility. The 'size' of its discrete or separate units of meaning is very important and we come to this later.

LVT has a considerable pedigree. We can trace it back to Raymond Lull's 'technology' of combining ideas, which was taken up in the seventeenth century by Leibniz, though in an abstract way. These two pioneers are often regarded as the forerunners of computer science but their work applies, we would say, more to LVT. In Renaissance times, there flowered something called the practice of the 'art of memory'. (6) This, in fact, involved considerable feats of *visualisation*. In an attempt to encompass all classical knowledge, practitioners would visualise a house or theatre in which every part was associated with a piece of knowledge. As we shall discuss later, visualisation is an underlying feature of LVT. In the twentieth century, a not widely known method was developed, called *structural communication*, decades ahead of its time, which established the basic logic of LVT. (7) This evolved into a set of simple tools which are now to be found on the market and which are slowly coming into general use. References to these can now be found in the management literature. (8) However, the significance of these tools is largely overlooked because their origin has been forgotten and there are a variety of competing products, some of which have arisen independently.

The basic premise of LVT is that meaning can be dealt with in discrete chunks. We like to call these chunks 'molecules of meaning'. Each is a whole. The tangibility factor is that such chunks are embodied in a physical object that is capable of being moved in physical space (or as a virtual object in virtual space). In a sense, such 'molecules' (MMs for short) are analogous to a *human being* who is supposed to have both 'body' and 'mind' in such a way that they are intimately connected. Nearly always, the MM is composed of a statement written onto a flat object that can be attached - but not fixed - to a working surface. We can hold MMs in our hands.



HEXAGONS

MMs are usually to be found in hexagonal shape, because this shape facilitates placing several together in a cluster. They are attached to a surface by means of adhesive or magnetism. The same shapes are found in computer applications. There are various names for these objects such as 'idons' or 'magnotes', or simply 'hexies' but we prefer the use of a more generic and non-proprietary name.

Clusters of MMs can carry information by means of their shape or structure. Vertical and horizontal order can be made meaningful. Also, it is possible to depict different degrees of connection between MMs in a cluster, by placing them in touch or connected through other MMs.

Though it is easier to understand MMs if they are thought of just as written statements, it is also the case that they can carry emotional as well as conceptual information. This makes it possible for LVT to play a role in therapeutic practices, many of which rely on expression of emotional content. (9) This application is not entirely divorced from use in management work, because 'emotional overtones' can be recognised as significant information though embedded in 'rational' processes.

The next important aspect of LVT is that MMs can be combined together to make new meanings. This is nothing but a reflection of the maxim 'The whole is more than the sum of its parts'. However, in LVT this truism, or holistic assumption, is made tangible. MMs are combined together by positioning them on the working surface so that they touch each other. What such a combination *means* has to be seen and expressed. The combination of MMs becomes an MM in its own right, though on a different level to the original ones. This way of combination can continue as far we like, generating new meanings on different levels.

METAPHOR

LVT encourages and develops use of metaphor, and the term 'molecule' as in MM is an obvious example. The 'meanings on different levels' referred to can be taken as analogous to the scale of natural evolution. Thus, at a certain level, the corresponding type of MM becomes capable of self-replication and we have living systems. At the 'top' of the evolution of MMs is something equivalent to DNA. These are very powerful metaphors, not least because they connect LVT with wide-ranging insights from science and nature. We use the term 'molecule of meaning' to suggest that MMs can combine analogously to chemicals or living systems. MMMs are 'macromolecules' of extended combinations of MMs that can carry complex information. There are many different and equally useful metaphors we can use, for example that of music, where the MMs are 'notes' and the combinations 'chords' or 'phrases'. The metaphor of music is particularly useful in suggesting that there is underlying language of expression. It also exemplifies the important role of what is now being called 'emotional intelligence'. (10) It is useful to work with guiding metaphors that we can *feel.*

The 'meanings on different levels' concept is of course another important element of TRIZ thinking - where we are continually encouraged to change our perspective on a given situation by zooming in and out to, in TRIZ terminology, look at the super-system and sub-systems surrounding a defined system.

Combinations of MMs are usually referred to as 'clusters'. Clusters can be intuitive associations, in which we bring MMs together in an exploratory way that relies more on feeling than concept. They can also be highly structured, in that the *arrangement* of the MMs in relation to each other can carry significant information.

We can *experiment* with different combinations and arrangements, because the MMs are not fixed in position relative to the others. This simple facility moves us a long way forward from using flip charts. The space of the board (or computer 'window') on which MMs are displayed can be used to depict distributions of MMs according to grids and/or different axes of meaning. Clusters can themselves be clustered at several levels. The different levels can be shown on different boards or windows, linked together. Each significant cluster of MMs becomes an MM on another level.

The simplest form of LVT is by having small cards to write on that can be pinned to a board and then moved around to make different combinations. More sophisticated implementations use computer software, where the tangibility is provided through the 'mouse'. The computer format is necessary to make complete records and produce reference documentation. The more concretely tangible forms using real objects can be very effective in creative sessions. Creativity flourishes when our physical, emotional and intellectual faculties are *all* engaged.

The recent appearance of a 'spiritual intelligence' in the literature is also significant because this is based on our direct sense of meaning. (11) Creativity is relevant to knowledge, not least because of Nonaka's insistence on *knowledge creation* above *knowledge management.* These two concepts reflect the difference between *organisation* and *order*.

Order and Organisation

We use these two words in a specific way. ‘Order’ refers to any fixed arrangement and its archetype is a crystal where every atom is in its place and does not move. ‘Organisation’ refers to a pattern that embraces uncertainty and change, and its archetype is a living being or an ecology in which ‘atoms’ are in constant flux. We can note that still, to a surprisingly large extent, organisations such as companies are looked at through the lens of order and considered as being fixed, rather like a machine or thing.

In LVT we combine meanings to make new meanings. The ‘hands’ put pieces of knowledge together to make a new totality that shows something new to the ‘brains’. The emergence of new meanings is critical in organising knowledge (as opposed to putting it in order) because ‘newness’ is an essential part of meaning. The ‘eureka’ sense of discovery and insight is not some luxury but essential to having meaningful knowledge. Whenever someone works with knowledge in a meaningful way, what it ‘is’ changes. This is the substance out of which the ‘learning organisation’ may one day come to be made in reality and not just in concept.

The basic action takes place in the generation, assembly and ‘reading’ of a combination of MMs. We can put some MMs together but we then have to make sense of their combination or ‘read’ them. As we assemble a combination that we feel to be significant, we are drawing on knowledge that is *implicit.* We can feel that these MMs belong together but we cannot yet say why. When we ‘read’ them, we are becoming conscious of what was previously only implicit and the implicit transforms into the *explicit* as we give a name and description to the complex or ‘cluster’.

This follows the general case in which we can make selections and ‘choose amongst’ according to rules that are not themselves known in their own right. The phrase ‘choose amongst’ is a literal rendering of the meaning of the word *intelligence.* Intelligence involves implicit knowledge and that is why it hard to communicate it. However, through LVT we can see intelligence at work: it is rendered visible and tangible. LVT provides a means of experimenting and sharing with others in the transformation of implicit into explicit knowledge. It is a method of organisation rather than order.

Multiple Perspectives

‘Reading’ a cluster of MMs is to be able to see it as a whole and has very strong parallels with the TRIZ ‘multi-screen’ approach. The word ‘seeing’ is used here in two senses and refers to both understanding with the mind and seeing with the eyes. We make the assumption that when we ‘see’ this is from a certain point of view, or perspective. It is not some absolute God-given access to reality. We may not know what our point of view is because it is implicit in our judgements of what makes sense. When different people are involved, they may each see a different meaning. This is nearly always the case, but it is largely obscured because of the prevailing belief that there is only one ‘good’ or ‘logical’ way of organising knowledge. A consequence of this is that most groups work unconsciously towards consensus and marginalise differences. Because, in most ways of dealing with knowledge, one can have only one way of putting it in order, this dictates consensus. As a result a great deal of meaningful knowledge is lost to view.

Having multiple perspectives does not have to mean chaos - if the differences are made explicit. We can allow several people to make different interpretations, just as long as these are looked into to derive the *organising ideas* that underlie them. In the case of a group today, working with LVT, everyone in the group uses the same set of MMs as each other, so they have a *common language.* If they see the situation differently, they will organise the MMs differently. This will be visible to all. They are then in a position to explain to each other what they mean by their choices ‘amongst’.

In contrast, in the usual discussion without LVT, what is expressed is similar to what is implied in making a cluster: it is an expression of points of view. This does not enable people *to see* what lies behind these views and how they are reflected in the given case. But, in LVT, everyone involved uses the same underlying language - the MMs - and can *show* what they mean by the selections they make.

There are many management theories, which propose that there are *four* distinct perspectives that can be adopted in relation to any given problem or aim. It is easily possible for people to map MMs according to these four types. It is equally possible for a group to evolve its own version of four perspectives, or any other number they want to work with. Such quaternaries are organising ideas. They, or some equivalent, are always in play whether they are part of a conscious theory or mere personal inclination.

STRUCTURAL COMMUNICATION

Structural communication was first devised for application to education. In the original technique, a set of questions, representing different perspectives, was applied to a given set of MMs. (The MMs were arranged in a static grid, in contrast with the present LVT use of randomly displayed hexagons.) Each question would attract a different set of MMs relevant to itself. It was assumed that these different sets would overlap. By working through the questions, we would come to view the MMs from multiple perspectives. The power in this was that the given set of MMs was the same for each of the questions and we had to decide which were relevant and which were not from the perspective of each of the questions, which would be different in each case. The formation and use of a set of questions is exactly the same as having a set of different perspectives. The sets of questions were the equivalent of, or a step towards, organising ideas.

Compiling and structuring teaching material in this form proved arduous, demanding deep understanding of the subject on the part of the author and familiarity with multiple points of view. Only later was it realised that it was far better for people to do this work for themselves. In this way, they could take part in the *organisation* of knowledge.

The Ground State of LVT

We need to emphasise the supreme importance of working from a base of MMs, or 'molecules of meaning'. These MMs need to be all on the same level and capable of being combined with any other, at least in principle. The combinations we pick out are those that come most easily to mind, or make most evident sense to us. This system always operates in terms of what is most meaningful to those that use it. It does not impose any set framework.

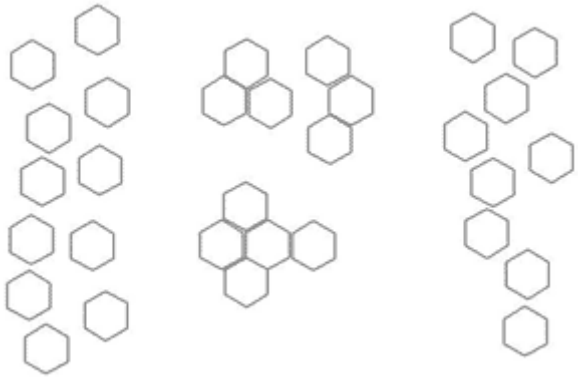
Generating and gathering the MMs is an important process. This process includes attention being paid to ensuring that everyone involved understands what each MM means and accepts it as part of the total picture. It also requires a *suspension of judgement*. For example, if there is a case study, the MMs would consist of the *facts* of the situation and not involve any interpretation. What the facts are is not cut and dried and some kind of assessment of relevance must be made. The factual MMs should at first glance be of equal status; in that we have suspended judgement on which are the most critical for the diagnosis. (12)

The assemblage of relevant MMs should not have any order. This allows for an open field of possible combinations between them, without prejudice. A great deal of knowledge can be assembled and displayed. Relative to the given task, anything between 20 and 100 MMs may be appropriate. The large number taxes attention span, but the guiding rule of thumb is that all relevant information should be displayed on the same surface. Quite automatically, people scan the field of information 'at random' as the brain searches for connections. It is, therefore, an energising process in which mental routine programming is unfrozen.

HEURISTICS

The brain 'seeking for connections' is a reference to *heuristics*. We are assuming that LVT makes use of what we have already as organic beings, which has evolved in us into search programmes for making meaning. Any suspension or interruption of routinised meaning-recognition stimulates our heuristic capabilities, which come into play pre-consciously. In LVT, we also supply significant data - the MMs.

A free space is needed on which to display combinations. With a relatively small number of MMs - around 20 - the MMs can be first placed around the periphery of the display board and afterwards moved into the centre region in clusters.



This process is a simulation of embracing a large quantity of information within a single mental embrace, which ordinarily requires a power of concentration that is exceedingly hard to reach and maintain. By having the work supported through external display, it is made much more accessible. Further, by having the space of combination in the same field as the randomly assembled MMs, but in a separate part, the thinking involved in making these combinations does not obscure the background of knowledge. Building the clusters is akin to passing through the flat display of the MMs to arrangement in depth. Each cluster constitutes an added 'dimension' in its own right.

KNOWLEDGE SOUP

A striking and convenient metaphor for the random collection of MMs is *knowledge soup.* This metaphor taps into recent trends in computing science away from electronic digital processing towards physical organic means. A 'flask' of molecules is used, in which molecules are allowed to seek out viable combinations, out of which can be selected or 'distilled' meaningful solutions to problems. This is an important metaphor for LVT since it relies on a tangible physical/chemical process

Hence the ground state of LVT, which is the random array of MMs on a flat bounded surface, represents a powerful potential. By suspending judgement, a creative step is made more possible. Creative potential is represented by the blank surface behind and between the MMs. Complexity is in the large number of MMs, while simplicity is in each MM. By simple iterative steps of movement, separation and combination, the material is open to undergoing what is now generally called *self-organisation.* In TRIZ terms again, this MM manipulation process is seen to offer direct means of recognising the different hierarchical layers of a problem or situation, and tangibly 'managing complexity'.

Networking and the Role of MMs

Handling knowledge in discrete units of meaning provides many advantages. One of these is that we can form links between different knowledge domains. Contemporary software makes it possible for every MM to be linked with associated text, databases, web sites and email addresses, as well with hard modelling and higher order models of knowledge. The importance of this is that great amounts of recorded knowledge can be made meaningful by relating it to holistic displays *through MMs*. Such displays can be enriched with metaphors, myths and images that carry emotional intelligence in a way that is now being advocated by

many consultants. Very complex fields of knowledge can be made accessible by LVT because they are centred on visual organisation and tap into our natural capacities to visualise wholes.

The simple application of LVT is restricted to a given domain of concern, or a particular *ba* (to use Nonaka's term) such as a current problem facing an organisation, and a particular group. It is early days yet to claim that this can be extended into the deliberate formation of living networks of knowledge across a whole organisation.

The localised application is modelled in an exercise by Liz Borreden of EDHEC, based in Lille, France. This was an academic exercise but it makes the principles clear. She took as her source a book on mentoring (13). From one case study in the book, she distilled a set of MMs. She then organised these into different clusters, expressing the themes of each cluster. These themes then became MMs in their own right, which were then incorporated with other MMs from other case studies. By a combination of distillation and incorporation, the process continued to arrive at a triad of factors. In all, about 70 MMs were involved. The beauty of this approach is that her final model can be traced back to its sources in particular ideas and these, in their turn can point to the actual texts from which they were derived. In the diagram (fig. 1) we show in a symbolic way the texts, MMs, clusters and model (in this case, a triad).

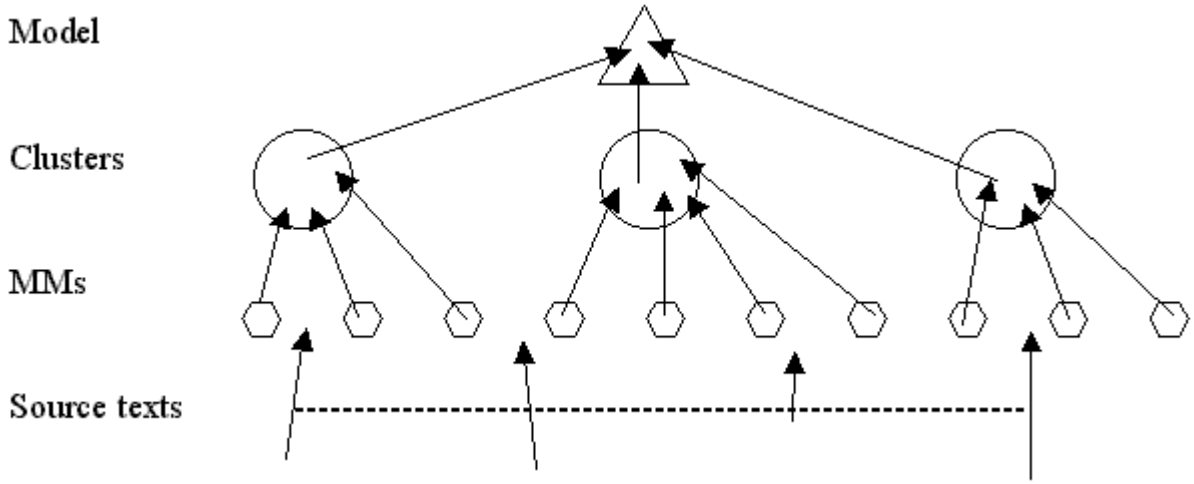


Figure 1. Hierarchy of Meaningful Knowledge

All the MMs are contained in the final model, so that the abstraction does not lose connection with its genesis. But, even more importantly, if another text was dealt with in the same way, there would be MMs that are the *same* for both texts, because they refer to the same subject. Given two such treatments, it would be possible to cross over from one to the other. Such would begin to constitute a *network.*

At present, without LVT, cross-referencing is done through references (such as those at the end of this article) and direct quotation. What links the reference - say to an article or book - and the quotation is really what we are calling an MM. Only, we never get to *see* the whole array of relevant MMs except in our own minds. We believe that what is currently just in our 'private' minds will become accessible in the future in 'public' displays.

On the Internet, there is considerable frustration over accessing relevant knowledge - even with the burden-reducing capabilities offered by new generation semantic processors - because this is done through *words* and not through the stronger meanings of MMs.

The selection of ‘chunks’ of meaning then appears as extremely important. Our argument is that doing work on generating such MMs will greatly facilitate the organisation of knowledge. In the case of Liz Borredon’s exercise, she used MMs such as “understand process to develop unfragmented person”. This can be understood as the *distillation of a whole paragraph* in a book and illustrates the level at which MMs exist.

Though the exercise we described was conducted from a written text, there is no reason why the same approach should not be applied to any source material. An organisation itself can be treated as a text, even though there would have to be considerable processing to render it into verbal material. LVT is being used in such areas as scenario planning and problem solving where there is some kind of focus of interest into a topic.

SEMANTIC ATOMS

When we work from relatively raw experience, we have to make use of semantics that we take for granted. In other words, we have to start to render our experience explicit through our vocabulary. This vocabulary concerns what we may think of as the ‘atoms’ out of which our molecules of meaning are constructed. We draw attention to this because what we call the ‘ground state’ of LVT is already a considerable achievement. However, in rendering our experience articulate, we can retain feelings and intuitions that feed into the various stages of expression and insight. What is ‘left out’ of the verbal expressions we arrive at can come into effect in how we organise the MMs into clusters and clusters of clusters.

It is necessary to emphasise that the process whereby we move from MMs to our top model is not one of generalisation, nor is it the same as the TRIZ view of abstraction. In LVT, there is no automatic mechanism for shifting between hierarchical layers, because at each transition there has to be a corresponding generation of meaning (or, in Nonaka’s terms ‘creation of knowledge’). It is recognised in science, for example, that empirical data of itself cannot result in hypotheses or theories. Hypotheses and theories require specific acts of thought. In LVT, the equivalent of ‘empirical data’ is the MMs, of hypotheses, the meaning of clusters and of theory the top model. We expand on this picture in figure 2.

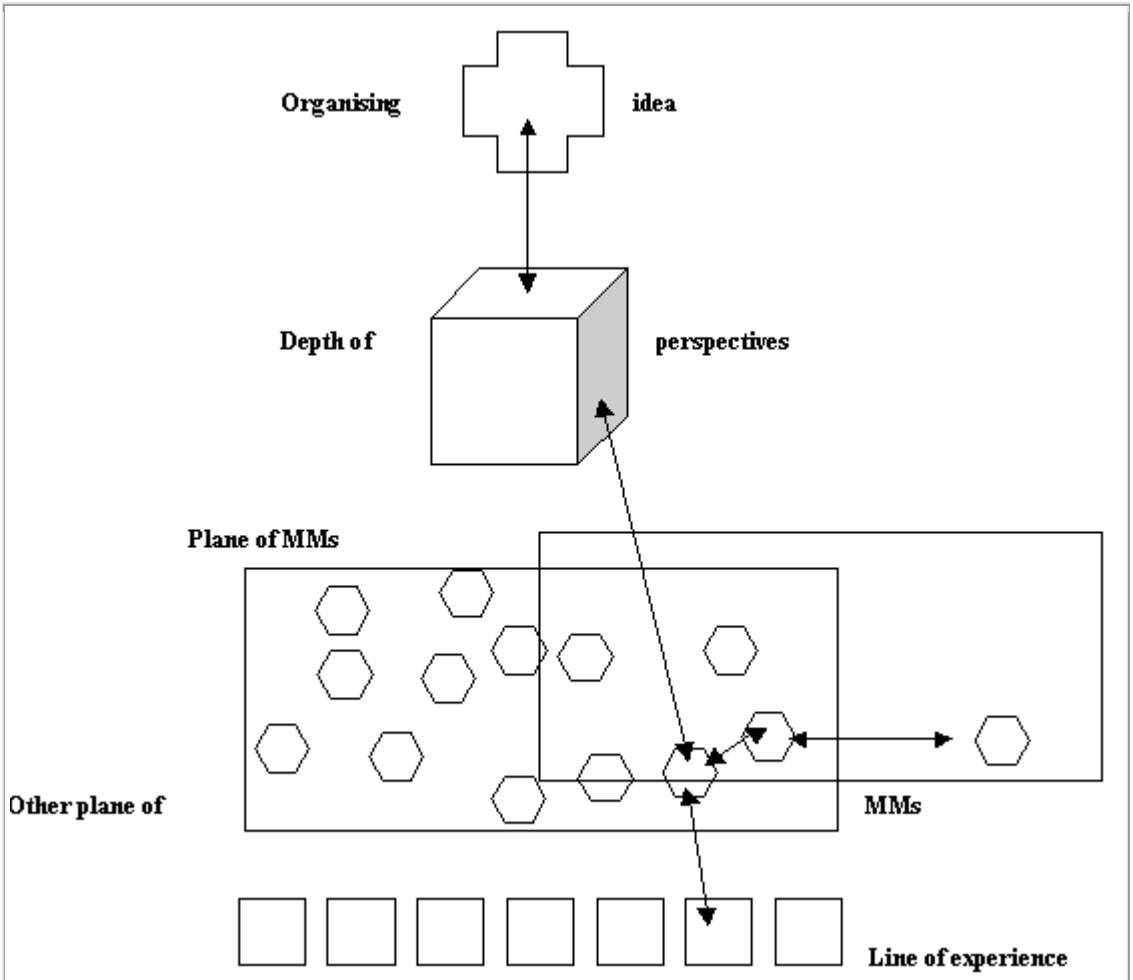


Figure 2 Organisation of Knowledge

This is a bare schemata for the organisation of knowledge. It is a useful analogy to consider the various levels from bottom to top as representing different numbers of dimensions. Hence, 'experience' is akin to a 1-dimensional line, MMs exist in 2-dimensional planes, perspectives are 3-dimensional and organising ideas, 4-dimensional. The figure shows more than one plane of MMs, to suggest cross-linkages. The cube representing perspectives is exemplified by such models as Albert Low's: Simple, Complete, Pragmatic and Communicable; or McWhinney's: Unitary, Sensory, Mythic and Social. (14) Both schemes are typical in addressing the question of the basic structure of multiple views of reality. Awareness of perspectives is an integral part of the culture of the organisation, which is a mixture of both perspectives and reflection on them in awareness. The organising idea is the theory of the organisation that gives direction to meaningful change. (15) The word is not used here to refer to general theories of organisation, though an example would be 'the learning organisation'.

Visualisation

Nonaka advocates a 'middle-top-down' process for knowledge creation/management. This is very much paralleled by the approach embodied in LVT. The 'middle' in this case is ascribed to MMs, which are already considerable distillations of meaning in their own right, representing critical ideas or factors in a complex and changing situation as much as they can represent such factors in a static text. The 'top' is ascribed to the ultimate models (such as the triad in Liz Borredon's exercise), which represent basic organising ideas, including the idea of 'theory' as put forward by commentators introducing complexity theory. (15) The bottom is ascribed to the source material, which usually comes in a rough and ready way,

because it is being distilled out of the raw experience of organisational actions. At every level and in every step, there is an opportunity for creativity in step with *order.* Order comes into play - as Kurt Lewin might have said - whenever the system of knowledge is frozen in a specific state. Creativity comes in when this order is unfrozen allowing for movement and learning. This would include allowing people to handle the knowledge, which means that they would have to have the tools for doing so.

If we had to rely on setting up an explicit system of knowledge to apply to all aspects of an organisation, we would be facing an impossible challenge. Even if we had the resources, by the time it was near complete, it would already be outmoded. The resolution of this dilemma relies on accepting the relativity of knowledge and the process of interiorisation.

The relativity of knowledge stems from the basic complementarity of the implicit and the explicit. It is impossible, in principle, to make all implicit knowledge explicit. There will always be something left out of the explicit that will prove important at some time. We just do what we can to make ourselves alert to surprises in the future.

This alertness stems from interiorisation. The use of a medium of thinking *changes what thinking is.* There is not a 'set of tools' on the one hand and 'users' on the other. As is surely obvious from the last century, technology changes us as much as we make it what it is. We mentioned from time to time the power of *visualisation.* This power is still almost entirely neglected in current educational practice so that people entering into professional life do not have it much developed. It is all important in being to see the wood for the trees and to create good designs. We propose that the power of visualisation can be enhanced and developed by LVT and results from an interiorisation of what we do with knowledge in a tangible way .

We have moved from consideration of a technology to consideration of a human power. This is because we believe that the quest for the organisation of knowledge *must* base itself on human capacity because knowledge needs to be organised for people and not in spite of them. It is of little value if knowledge is organised (or ordered, rather) in such a way that people cannot *feel* that it is theirs. They need to be able to *see* the organisation for themselves. This seeing, or visualisation, must be rooted in *tangibility*. This is how we are made.

If we are able to foster the organisation of knowledge in *some* areas, then this can influence a great many areas. The approach of organisation does not aim at mechanical completeness but bases itself on having starting points from which networks can build. Such networks can be built on MMs instead of words. This means that every level is intelligible in its own right and pathways of meaning can be discovered connecting every local space of knowledge with every other.

Current developments in LVT software are focused on groupware, making it possible for several people to operate in the same space. With this development, computerisation will provide a complete simulation of the physical-social interaction of using solid objects, allied with facility for networking in real time.

SMALL WORLD THEORY

The way in which networking works has been described in the 'small world' theory. This addresses the question of how a complex set of elements (e.g. people) can be effectively connected together when it is in practice, due to the limitations of space-time, impossible for every single element to be linked with every other element. It is proposed that elements cluster together in distinguishable groups but, in each group, there are a few elements which are also directly linked with elements in other groups. Such apparently few connections can actually serve to connect the totality of clusters as a whole system. (16)

The Haptic Factor

It is therefore more than interesting that some developments in computer technology concern the amplified use of tangibility. For example, research is being done on 'handling molecules' (that is, chemical ones) by

means of virtual reality gloves into which can be introduced sensations of resistance, attraction, etc. (17) Other developments are looking into making the 'objects' on the screen auditory. It is being seen that the more physical and sensation based the operations, the more they engage our sense of reality and the greater our effectiveness. This we refer to as the *haptic* factor, 'haptics' being the branch of psychology that deals with sensory data through the skin and the sense of touch.

> **HAPTIC**
> Haptic derives from the Greek *haptesthai*, which means to touch. In the broader sense it also includes the sense of one's body in 'internal touch' or the proprietoceptive sense that Bohm refers to. (5) The internal dynamic of our skeleton, muscles, tendons, etc. connects into the external world of solid objects and forces. In its most strongly relevant sense to our theme it refers to the sense by which we 'gasp' what something is. We use this word 'grasp' to indicate not only clasping something but also *understanding* it.

Though such developments take far longer to come into general use than their enthusiasts tend to assume, the trend is there. Such concrete and qualitative aspects of handling knowledge are usually neglected in management circles because they smack too much of 'play' - after all this is what our kids like doing so it can't be serious - and also because of the historical inertia of treating knowledge in purely conceptual terms, without emotion or sensation.

Though we have presented MMs in terms of written statements on objects, we can look forward to them being genuine objects in their right (i.e. their dimensionality will evolve). All that is now treated in terms of 'environmental design' will come to be considered as an aspect of LVT. LVT is simply the movement and arrangement of meaningful objects. And it does not matter *what* kind of object this is, just so long as we can 'handle' it. In this sense, it is not wildly irrelevant to mention such things as Megalithic architecture as an LVT device.

It must be a truism to state that at present management and technical language has become so abstracted from concrete experience that it is proving a barrier to the active participation of human beings in what they are managing. LVT is emerging as an almost instinctive corrective.

Summary

The human criterion. We emphasise the reflection of the whole person in the combination of the conceptual, the visible and the tangible embodied in LVT. This naturally includes emotional and spiritual intelligence, but intelligence in general we see as rooted in the fusion of hands and brains. LVT is an appropriate tool for the organisation of knowledge. It is strongly based on the humanisation of systems of thought, which must allow for creativity and change.

Development of meaning. Powerful as some of the TRIZ knowledge bases are becoming, they offer little by way of meaning or context to some users. For example, it is one thing to know that there are 44 ways to achieve the function 'move a liquid', another to know which is the most appropriate to a particular application, and another again to transfer whichever scientific effect the researcher has chosen into a proven solution. Having the knowledge is a massive leap forward in capability, but it is someway away from 'the answer.' LVT recognises and tries to bridge the gap between 'knowledge' and organisation and use of that knowledge. LVT however recognises that it can never lead to a 'complete' system of knowledge, because substantial knowledge must always be in process of renewal and creation. Practice of it develops the power of visualisation, or seeing wholes; and it also sets in motion the formation of networks of meaning, which can link with 'hard modelling'. The facility that LVT offers stems from it being rooted in 'molecules' of meaning rather than in words or documents per se.

Middle-top-down. The Nonaka prescription for involvement of management levels is paralleled by the basing of LVT on MMs (representing the 'middle'). Movement towards the top is done by clustering or combining MMs into meaningful new wholes. These wholes are then sides or dimensions of the governing

set of perspectives, which need to relate to a top organising idea. It is from the realm of ideas and perspectives that organisation flows down to the processes of generating MMs in the first place.

Logotechnology. In general, technologies based on meaning are not fixed to any set of tools or systems. LVT can operate with pencil and paper as well as with computer software and laptops. It is the involvement of people in using this new medium of thinking that can make all the difference in the way that knowledge is organised. The opportunity that non-computer forms of LVT give for people to walk around, move objects and talk, grounds knowledge organisation in the human world.

The haptic factor: LVT is based on tangibility, and as people move away from keyboard and mouse as their interface, the physical aspect of knowledge will come to the fore in an even more powerful way.

LVT. 'Logovisual technology' is our name for any process that embodies the three factors that can be summarised in our 'top model', the triad: Meaning-Seeing-Moving

The road to 'wisdom'. TRIZ allows users unprecedented access to the world's knowledge. The road to benefit producing 'wisdom' means learning how to place knowledge in a context and make it tangible.

A future article will describe ways of using LVT to support and re-enforce the application of TRIZ methods.

Notes

1. DeBono, E., *Serious Creativity,* 1994
2. Nonaka and Takeuchi *The Knowledge Creating Company*, 1995
3. Robert Horn *Visual Thinking: communication in the 21st century,* 1999
4. See the article 'Beyond Words' by Bob Holmes in *New Scientist 10th July 1999.*
5. David Bohm, for instance, draws attention to the remarkable power we have of 'proprietoception' - the capacity to be aware of our physical bodies - and its importance in thinking. See his book *On Dialogue*, edited by Lee Nichol, 1996. There are signs of an emergent appreciation of tangibility, as in *An Unusual Intelligence: physical thinking for the 21st century*, 1996, by Anoly Bryner, Dowana Mahona and Peter Senge
6. See *Doctor Illuminatus: a Raymon Lull reader* edited and translated by Anthony Bonner and *The Art of Memory* by Francis Yates, 1974 for background reading.
7. Results of this research and development were published in a journal *Systematics* in the 1960s. In an era before the existence of PCs, the best technology of the time was applied to devise a teaching machine in collaboration with the then General Electric Company. Structural Communication began as an educational method but was then developed into a management tool. Real change is slow!
8. For example, see Arie de Geus *The Living Company: growth, learning and longevity in business*, 1997, p. 90, where he discusses the combining of 'soft modelling' and computer systems modelling and the article 'Organic Knowledge Management (part three)' by David Snowden in *Knowledge Management* Vol. 3. issue 10, July/August 2000, page 18.
9. A case study 'Jenna's dilemma' by Liz Borredeon of EDHEC School of Management, France to be presented at European Mentoring Conference, Cambridge November 2000.
10. See for example *Emotional Intelligence at Work*, 2000, by Hendrie Weisinger
11. See *Iq: connecting with our spiritual Intelligence*, 2000, by Danah Zohar and Ian Marshall
12. This was first shown by Anthony Hodgson in a series of articles under the title 'The Case of the Misfiled Missive' published in the *Harvard Business Review* in the late 60s, based on structural communication.

13. See Liz Borredon, of EDHEC School of Management, France, 'Capturing Essential Meaning' in *Career Development International Vol. 5, no. 4/5, 2000.*
14. See Albert Low's *Zen and Creative Management* and William McWhinney's *Paths of Change: strategic choices for organizations and society.*
15. See Michael D. McMaster *The Intelligence Advantage: organising for complexity*
16. See the article 'Small World' in *New Scientist, 4 December 1999*
17. Information about such developments can be found at www.cs.unc.edu/Research/graphics/GRIP <http://www.cs.unc.edu/Research/graphics/GRIP>

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The International Centre for Management Creativity, founded in the UK in 1989 by John Varney, specialises in providing diagnostics and creative solutions for optimising business performance in organisations around the world.

Information on CMC International and the LVT products and services it offers is available at www.cmcsite.com <http://www.cmcsite.com>