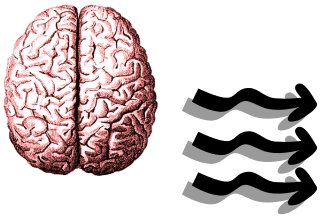

Cognitive Mapping—Theory and Practice

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Experience in the use of Decision Explorer® and cognitive mapping lead to a link with Banxia® Software Ltd. for whom Jenny now works.
See www.banxia.com

Abstract

Cognitive mapping is a method for structuring and analysing ideas and the relationships between them. It is a purely qualitative method that can be used either individually or with a group. In group use it provides a focus for debate and a vehicle through which a shared understanding of a problem, project aim or issue can be developed. This article outlines some of the history behind the development of the cognitive mapping method, provides an outline of the method itself and offers a quick look at the software developed to support it.

Introduction

Cognitive mapping, as referred to in this article, is an approach to idea structuring pioneered (primarily) by Colin Eden and Fran Ackermann (Eden and Ackermann. Sage: 1998). The research leading to the development of cognitive mapping and Decision Explorer® (the software tool developed to support it), was started in the late 1970s at the University of Bath and continued, from 1988 onwards, at the University of Strathclyde. In 1995 software development moved to Banxia Software, founded by a member of the original team (Matthew Jones). Of the original team from Bath it has been Colin Eden and Fran Ackermann on the academic side and Matthew Jones on the software development side who have continued to research and push forward the development and application of cognitive mapping and Decision Explorer®, based on action research and practical application. Since its development in an Operational Research/ Management Science context cognitive mapping has been used in many different settings. The range of applications is broad: they include, but are not limited to, strategy development, risk management, process definition, high-level project planning and (front-end) system dynamics model definition.

The arenas for these applications have been many and varied and have included projects and applications in the public, private and voluntary sectors. At the heart of all of these applications has been the need for better decision support, providing the decision makers with a sound basis for their choices, rooted in a thorough exploration of the ideas and opinions surrounding the project. Cognitive mapping is classed as a "soft OR" (soft Operational Research) technique. ("Hard OR" being various forms of quantitative analysis and mathematical modelling, "soft OR" being related to qualitative techniques).

Cognitive mapping offers a means of "structured brainstorming", which is aimed at helping groups and individuals to understand more deeply complex issues and the ideas and possibilities that surround them. With cognitive mapping a hierarchical network of ideas is developed. Through the development of the network, goals (that is possible: desired and undesirable outcomes) and supporting facts and assertions are surfaced and organised and the relationships between them are explored and made explicit. With a group the mapping process provides an opportunity to develop a shared understanding of a problem or situation. If there is disagreement or a potential dilemma, it can be made explicit and discussed.

Cognitive mapping is a causal method, that is the network of ideas is built up on a cause and effect basis, with the links between ideas being read as "may lead to", so that "idea A may lead to idea B". Cognitive (causal) mapping is a relatively straightforward and very powerful method for exploring an individual's or group's perceptions of a problem or issue. When working with a group facilitation skills become as important as knowing the method itself.

Background to cognitive mapping

In the early years at Bath the team were using mathematical modelling to address their clients' problems. For a proportion of their clients, looking for help with strategy development, the problems that they were dealing with were characterised by complex and messy data. After several projects the team realised that the key to helping these clients was not in the modelling of the problems themselves but in the structuring of the problems and dealing with the management of the softer issues surrounding strategy development.

Problem definition and problem structuring started to be seen as the keys to success rather than adopting a particular mathematical modelling or programming technique. The focus turned to methods of providing decision support for strategy formulation.

Basis in theory

In focusing on decision support, inspiration was drawn from Kelly's personal construct theory (Kelly 1955). This theory was studied and certain elements of the theory were adopted. These elements included the individuality, the sociality and the commonality corollaries, which were seen as key for working with individuals and teams in organisations. Briefly, these state that:

- people have different experiences and therefore construe events in different ways (the individuality corollary)

- to the extent that we are able construe other peoples' constructions we can communicate with them: take part in a social process (the sociality corollary)

- to the extent that we have had experiences similar to other peoples', our personal constructs tend to be similar to the constructions of those people (commonality).

Two further ideas were adopted directly. The first was that of bipolar constructs (e.g. "much needed rain rather than a torrential downpour", the contrasting pole of the idea ("a torrential downpour") gives more information about the individual's perspective on a situation). The second idea was that beliefs are structured hierarchically into a system of super-ordinate and subordinate constructs (cognitive mapping is a causally based, hierarchical structuring method). Still drawing on Kelly's work and for problem solving in particular, the construction corollary: that we anticipate future events according to our interpretations of recurrent themes, was also seen to be important. This argues that for teamwork, in attempting to create a sense of commitment and agreement to action, a common way of construing the future is needed.

Structuring a map

The Figure 1 (shown overleaf) is an example of a cognitive map.

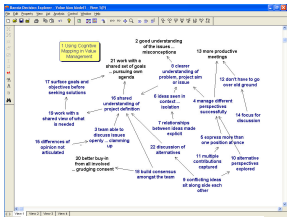

Figure 1 is shown on the next page

The concept in the top left-hand corner is not part of the map, but is the subject of the map. The individual ideas in the map are referred to as "concepts". The links are read as "may lead to". The ellipsis (…), where present, is read as "rather than". And a negative on a link changes the relationship between the poles of an idea. That is the first part of the idea (the emergent pole), in the idea at the start of a link, is associated with the contrast (the contrasting or "not" pole) of the idea at the head of the link. So, for example concepts 15 and 3 would be read as:

> "differences of opinion not articulated" may lead to "clamming up"

If we look at concepts 18 and 20, they would be read as:

> "build consensus amongst the team" may lead to "better buy-in from all involved"

The contrasting pole of "build consensus amongst the team" is "[not] build consensus amongst the team". In this case the contrast or "not pole" is not expressed in the map because it doesn't add significantly to the meaning. Emergent and contrasting poles are captured and are most valuable when they offer something new in the way of meaning. That is, when the contrast is more than a "good rather than bad",

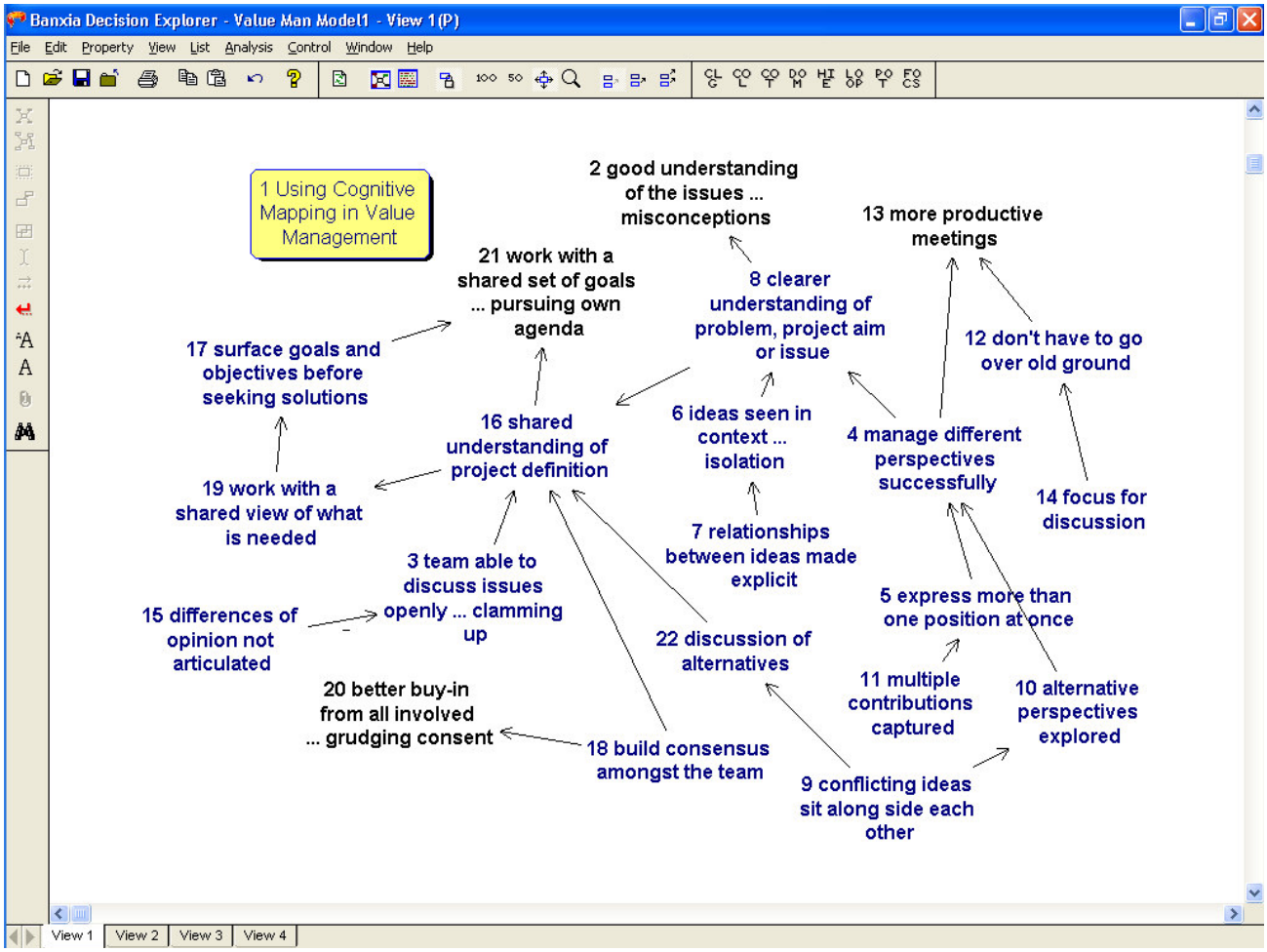

Figure 1: Example of a cognitive map exhibited in Decision Explorer®

"yes rather than no" type contrast. For concepts 18 and 20, if the "not pole" of 20 is expressed the relationship would read:

> "[not] build consensus amongst the team" may lead to "grudging consent"

The reference numbers attached to the concepts are purely for identification, generally they have no other significance. They are generated automatically by Decision Explorer® and can be turned off if desired. The only occasion when these reference numbers have any significance is when they are used to distinguish between different contributions to the map. For example, if you have carried out a series of interviews you may want to be able to track which concepts came from which interview. In this case you can use discrete numbering series for each set of contributions.

The development of a cognitive map is based on asking "how" and "why" type questions as illustrated in Figure 2.

Kelly (1955) suggested a system of "laddering" to explore systems of ideas and this is what the "how" and "why" questioning does. For each idea in the map it is possible to ask

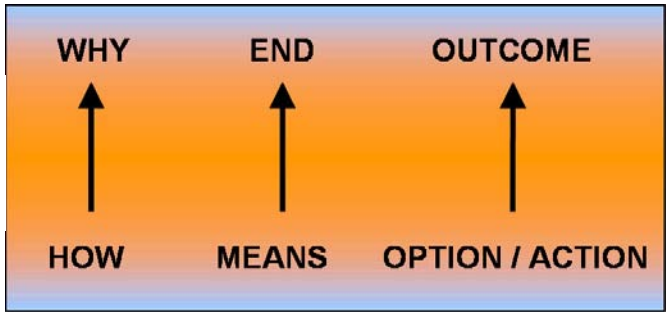

Figure 2: Cognitive Map development involves asking questions

"why is that important to us", which elicits an outcome, and "how might we achieve that?", which elicits an action. The type of structure that is developed is something like is shown in Figure 3.

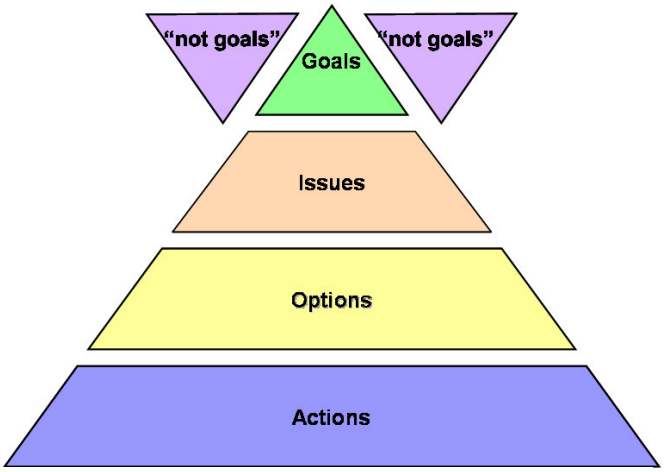

Figure 3: Structure resulting from cognitive map questioning

The labels used for the concepts at each level of the map will vary depending on the area of application. In a strategy setting the labels are "goal" (and "not goal"), "key issues", "options" and "actions". Beneath the goals and key issues there is a large body of supporting ideas which provide commentary and context and are made up of concepts that are a mixture of supporting facts, assertions, potential options for action and potential actions. In the CAFÉ application (mentioned in the next section) the labels used at each level were: so what, activity and capability (equivalent to goals), commentary and past event (equivalent to actions, in this case a previous triggering action).

Cognitive mapping in practice

In practice there is no such thing as "the right map". The sample map given in this article might well have been different, had a different person or people been involved in developing it. Small maps, such as this, can be drawn easily by hand. It is only as maps become larger that software tools, such as Decision Explorer®, come into their own, by providing a means for managing the complexity of maps with hundreds and in some cases thousands of concepts. Paper based cognitive mapping with groups can also be carried out using OvalMap Post-its® (see Bryson, J. M., (1995) and www.ovalmap.com for details). Oval mapping is a form of group based cognitive mapping.

Cognitive mapping has been described to me as "powerful but deceptively simple". The qualifier "deceptively" was used because at first glance structuring a map of ideas based on "A leads to B" might appear quite straightforward. However, it is not always clear whether or not "A" really does lead to "B", and there may be disagreement around this. The skill is often in the negotiation and reaching an agreement as to what the most likely relationship between the ideas is. And it is the discussion and negotiation generated in building a map that is part of the power of the method.

If you have not used ideas mapping methods before or you only have a passing acquaintance with them, then you may not see cognitive mapping as particularly different from Mind Mapping or Concept Mapping and you may not see the value in it. However, it is a powerful process in that it forces individuals to question the relationships between ideas and in so doing to explore other possibilities. It is structured brainstorming, with the aim of eliciting a goal structure. Unlike Mind Mapping, where the relationship between ideas is purely associative, cognitive mapping asks for a causal relationship between ideas, what leads to what. Unlike Concept Mapping, where any form of relationship can be expressed between ideas, cognitive mapping uses only one form of relationship. This means that the maps are amenable to analysis. The ends of the lines of argument (known as "heads" – as in the idea at the head of the arrow, with nothing further beyond) should be representative

References:

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Eden, C., Ackermann, F., (1998) "*Making Strategy: the journey of strategic management*". London: Sage Publications Ltd.

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Eden, C., Jones, S. and Sims, D. (1983). "*Messing about in problems*". Pergamon Press Ltd.

For Oval Mapping:

Bryson, J. M., (1995), "Strategic Planning for Public and Nonprofit Organizations". *Revised Edition, Jossey-Bass Inc. Publishers*

Eden, C., Ackermann, F., (1998) "*Making Strategy: the journey of strategic management*". London: Sage Publications Ltd.. .

of goals (or outcomes). The start of the lines of argument (known as "tails" – as in the idea at the tail of the arrow, with nothing "underneath") should be representative of triggering events or drivers. With cognitive mapping people must question what they really want to achieve, what the possible outcomes are and of those possible outcomes which are goals for them and which are "not goals" – undesirable outcomes. Going through the process of building a cognitive map (even if you don't use the map in any other way) helps you to understand more deeply the issues that you are facing. In many (but not all) pairs of concepts an argument can be made for reversing their order. For example, looking at the sample map above, you might argue that building consensus amongst the team may lead to (developing) a shared understanding of the project definition OR that a shared understanding of the project definition may lead to building consensus amongst the team. The final order of concepts in the map depends on the content and purpose of the map and is negotiated within the group. The map building process helps to surface the different views which are held by members of the group, it shows diversity, and by acting as a focus for debate, the map helps to keep discussions on track. Given "The Magical Number Seven, Plus or Minus Two" (Miller, G. 1956) as a limit for immediate memory, a tool or method which helps you to captures ideas, to structure the ideas and to refer back to them, will help to keep discussions focused. The negotiation process which takes place when building a map helps to build a shared understanding and to bring out new ideas about the problem, project aim or issue.

Summary

How might cognitive mapping be relevant to Value Management? At a basic level (something akin to "private use") cognitive mapping can be used individually or with a group within a single organisation as a tool to help in general discussions, and its use may go no further than that. Many individuals use cognitive mapping to organise and explore their own thinking about problems or issues – it provides a quick way of jotting down information and using the laddering technique helps to expand on the initial ideas. Even small, "doodled" maps can be quite effective in helping to organise thinking. Alternatively, cognitive mapping can be used with client or stakeholder groups, to explore their needs and goals. In this arena maps can grow quickly and become more complex. A fairly high level of skill with mapping is needed in this sort of setting, and it helps to have two facilitators in a meeting, especially if using computer supported cognitive mapping. The lead facilitator choreographs the discussions, while the second facilitator records the ideas. Cognitive maps have been used (and adapted) in a number of different ways, for example as in the CAFÉ: Construction Alternative Futures Explorer project (manual available as a free download from http://www.banxia.com/dexplore/cafe.html) and the Scenarios for Scotland project (information available from http://www.st-andrews.ac.uk/academic/management/s4s/).

The method itself is not restricted to use in a single discipline or industry sector, from that perspective it is a "neutral" method. It is, however, goal orientated and focussed on cause and effect, rather than any other form of relationship.

Value management encompasses a focus on teamwork, identifying and communicating goals and targets to team members and reconciling and managing stakeholder expectations. With this in mind the focus of Value Management sits well with the cognitive mapping method.