

## PROBLEM STRUCTURING: THE PROCESS OF SODA MODELLING

### MARK WESTCOMBE<sup>i</sup>

Working Paper MS 02/02 (ABRIDGED<sup>ii</sup>) as submitted to ACM Hypertext 2002 Conference: Workshop on Facilitating Hypertext-Augmented Collaborative Modeling. 11-12 June, 2002, University of Maryland, MD, USA.

### AUTHOR

Mark Westcombe is a researcher in the Department of Management Science at Lancaster University, UK. Together with Mike Pidd, and in collaboration with the Computing Department, he is investigating tools and processes that can be used to support the early stages of large, systems engineering projects. He has extensive practical experience as a group facilitator using the SODA methodology in conjunction with the Decision Explorer and Group Explorer, two collaborative hypertext modelling softwares. This has focused principally on strategic decision making and risk analysis during the proposal stages of systems integration projects for the rail industry. He has worked with Colin Eden in this area for a number of companies including Bombardier, Alcatel Canada, Slattery Skanska USA, LINC and BAE SYSTEMS. These projects have included the AirTrain at JFK airport, tenders for the privatisation of the London Underground, Virgin Trains Cross Country route and Dallas Fort Worth's Airport People Mover. Most recently he has consulted with Peter Checkland and Mike Pidd using SSM and some Dialog Mapping on a redesign of the UK personal taxation system for the Inland Revenue.

### ABSTRACT

This position paper provides an overview of the process of conducting a same time, same place SODA workshop (Strategic Options Development and Analysis). This approach uses cognitive mapping as a modelling technique and is supported by the hypertext software Decision Explorer. Individual components of the workshop process are

summarised, together with the rationale behind them. The SODA methodology is also briefly placed within the UK operational research field of Problem Structuring Methods.

### PROBLEM STRUCTURING

SODA<sup>1, 2</sup> (Strategic Options Development and Analysis) is one of a number of approaches developed in the UK Operational Research (OR) community over the past 30 years to assist strategic decision-making. The aim of these different approaches is neatly captured in the title of Rosenhead's book 'Rational Analysis for a Problematic World'<sup>3</sup>, which brought together theoretical and practical chapters written on some of these Problem Structuring Methods (PSMs). Along with SODA, the PSMs discussed in the second edition of the book<sup>4</sup> include Soft Systems Methodology<sup>5, 6</sup>, Strategic Choice<sup>7</sup> and Decision Conferencing<sup>8</sup>. This field is now generally referred to, perhaps unfortunately, as 'Soft OR'. Pidd<sup>9</sup> argues that 'soft' OR modelling is distinguished by the different assumptions the approaches make regarding *problem definition*, the *nature of organisations*, the use of *models* and the emphasis placed on organisational and individual *learning*. All of these PSMs take a *process-orientated*<sup>10</sup> approach to modelling 'messy'<sup>11</sup> problems and have been developed through Mode 2<sup>12</sup> or action research<sup>13</sup>.

SODA, as a PSM, shares most in common with Hypertext approaches such as Dialog Mapping<sup>14</sup>. As compared in Westcombe et al<sup>15</sup> both these *methodologies* make use of mapping *techniques*; involve facilitators to design and conduct the workshop *process*; and make use of single or networked laptops operating specialised software projected onto a shared public screen.

### SODA OVERVIEW

The SODA methodology is a framework for "designing problem solving interventions" using cognitive mapping. Cognitive mapping<sup>16, 17, 18</sup> is a modelling technique to represent a problem space by a series of interconnected causal maps. Figure 1 shows an example of such map. The maps consist of 2-D directed graphs of nodes containing text that are linked together according to their causal relationship.

<sup>i</sup> Management Science, Lancaster University, Lancaster, United Kingdom, LA1 4YX.

m.westcombe@lancaster.ac.uk

<sup>ii</sup> An unabridged version is available on request

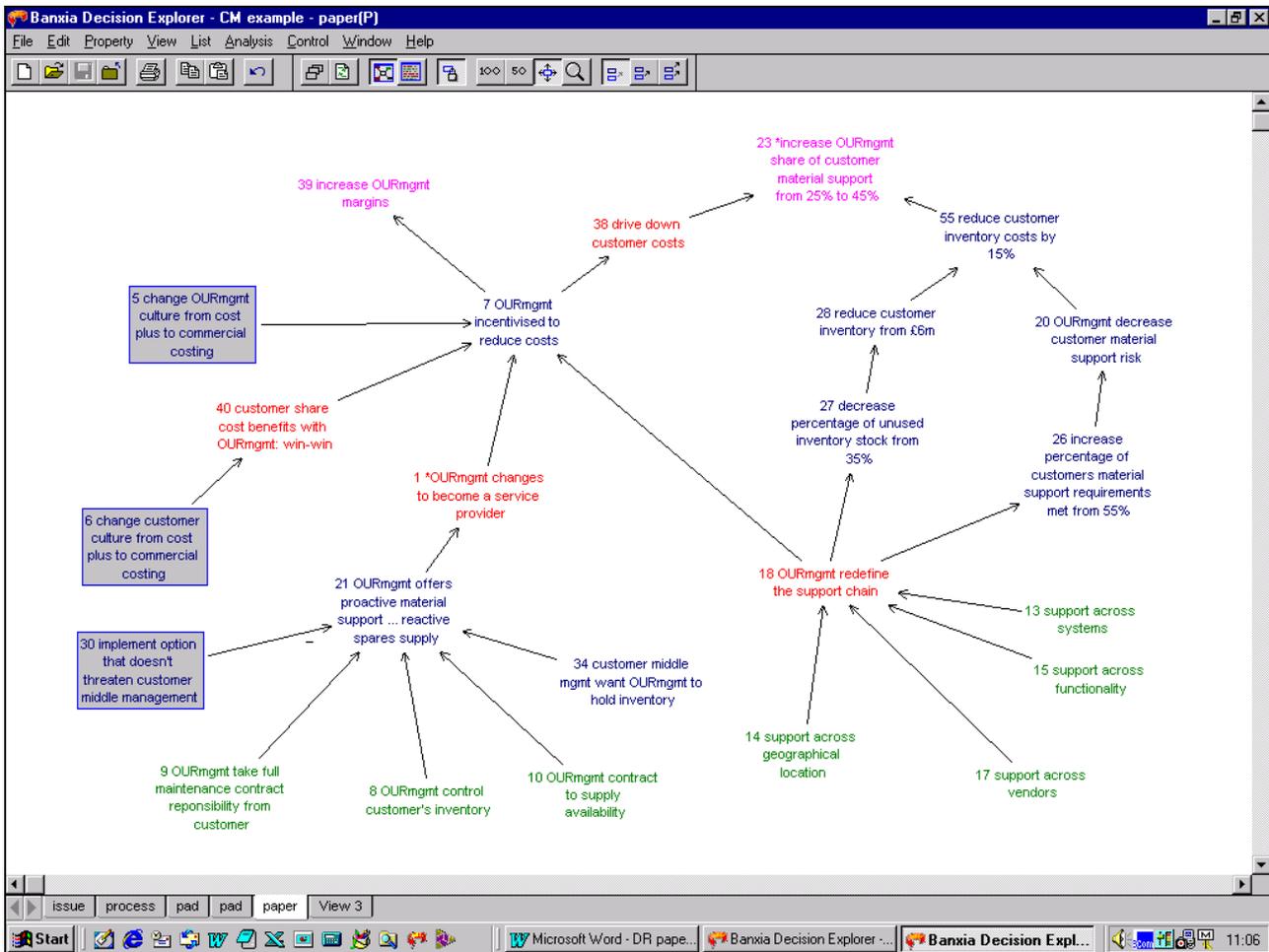


Figure 1 Example of a simple cognitive map

Cognitive mapping guidelines detail how such maps can be built and structured. Used together, the Decision Explorer<sup>19</sup> and Group Explorer<sup>20</sup> softwares support the building of cognitive maps in SODA workshops. These maps form the basis of the SODA process from the initial brainstorm-type activities; structuring of the problem; through to agreement regarding an action plan.

The SODA methodology has been well documented and includes a step-by-step account of how to plan a "quick and dirty" strategy workshop<sup>21</sup>. Key to the approach is the guidance provided for managing the process of group problem solving in workshops. That is both the management of the group dynamics and the decision making procedure.

**Workshop Process**

A SODA workshop usually begins with a relatively free ranging brainstorm prompted by a question such as, "What are the issues facing the organisation over

the next x years?" This is often done with a blind gather<sup>22, 23</sup> in which individuals anonymously and simultaneously contribute ideas without seeing each others' contributions. Participants input concepts via their laptops to the model on the facilitator's machine, but without any public. This generates a wide range of ideas or concepts and the gather is terminated by the facilitator, typically when up to 50 contributions have been made. The concepts are roughly clustered by the facilitator and shown back to the group. Further concepts are added as participants review one another's contributions and piggy-back<sup>22, 23</sup> of one another's ideas. This is done either via a participant's laptop or verbally through the facilitator. This two stage brainstorming helps avoid group-think<sup>24</sup> and broadens the problem space, as well as encouraging the building of ideas on the back of others.

The emerging clusters are validated with the group and are further developed. Causal links may be added between concepts, key concepts might be identified using a round robin, concepts might be colour coded according to their type, or clusters might be isolated and developed through in-depth discussion. Again the facilitator may add the concepts and links suggested by the group, or instruct the participants to do so themselves through their laptops. Typically, once the brainstorm material has been structured, the group identifies a set of key concepts and then ranks them by voting. The ranking might be used to prioritise the issues on which to spend workshop time, or used as a tool to note and share divergent opinions.

Throughout a SODA workshop, the choice of activity at any particular point depends on what the facilitator considers most appropriate to the task. SODA places great reliance on the facilitator to select and shape each step of the workshop, since there is no rigorous, step-by-step procedure. During the course of a typical SODA workshop a group might be involved in several different brainstorming activities; structuring the brainstorm material through clustering and linking; coding concepts according to their type; identifying key concepts to be further developed; voting on the priority of the key concepts; elaborating these concepts through discussion; establishing goals and options; generating actions; and finally agreeing a way forward. The facilitator is not limited to using cognitive mapping to achieve all of this. She may choose to incorporate any appropriate activity, which may or may not exploit the software. Managing this contingent approach to the workshop process is important and relies on key craft skills to exploit the array of activities available to a SODA facilitator.

#### **FUTURE DEVELOPMENTS**

SODA is a mature methodology entering its third generation of users. The techniques themselves will be customised and refined, but developments are concentrating on adapting it to new application areas. A number of areas of research which would benefit the field include:

1. Evaluating and measuring the outcomes of interventions;
2. Establishing the key craft skills used by the process facilitator and understanding how these can be transferred across practitioners;

3. Process management of distributed and asynchronous workshops (different time, different place);
4. Appreciation of the concept and dynamic of shared space;
5. Appreciation of the trade-offs between process-orientated and structure-orientated models, particularly as the approach is applied increasingly in engineering;
6. An understanding of the nature of formalisms;
7. Extracting lessons from the workshop format that are applicable for the meeting environment.
8. Understanding how PSMs can be applied to large group facilitation; and
9. Incorporation of bargaining into the methodology.

The SODA and Dialog Mapping communities share many common approaches and concerns and would benefit from an increased dialogue between the two.

#### **ACKNOWLEDGEMENTS**

This paper stems from EPSRC-supported research into Decision Support for Systems Engineering, the Wisdom Project: EPSRC ref GR/M60361. Other researchers collaborating on this project include Mike Pidd, Ian Sommerville, Adrian Mackenzie, and Ian Warren.

#### **REFERENCES**

- <sup>1</sup> Eden C (1989). Using Cognitive Mapping for Strategic Options Development and Analysis. In: Rosenhead J (ed). *Rational Analysis for a Problematic World*. Wiley: Chichester
- <sup>2</sup> Eden C and Ackermann F (2001). SODA – The Principles. In: Rosenhead J and Mingers J (eds). *Rational Analysis for a Problematic World Revisited 2001*. Wiley: Chichester
- <sup>3</sup> Rosenhead J (ed) (1989) *Rational Analysis for a Problematic World*. Wiley: Chichester
- <sup>4</sup> Rosenhead J and Mingers J (eds) (2001). *Rational Analysis for a Problematic World Revisited*. Wiley: Chichester
- <sup>5</sup> Checkland P and Scholes J (1990) *Soft Systems Methodology in Action*. Chichester: John Wiley & Sons
- <sup>6</sup> Checkland P (2000) *Soft Systems Methodology: A Thirty Year Retrospective*. Systems Research and Behavioural Science Special Issue 17 pp S11 – S58
- <sup>7</sup> Friend JK and Hickling A (1997). *Planning Under Pressure: the Strategic Choice Approach* (2<sup>nd</sup> edition): Butterworth-Heinemann: Oxford.

- 
- <sup>8</sup> Phillips L and Phillips MC (1993) Facilitated Work Groups: Theory and Practice. *Journal of the Operational Research Society* **44**: 533-549
- <sup>9</sup> Pidd M (1996). *Tools for Thinking: Modelling in Management Science*. John Wiley & Sons: Chichester
- <sup>10</sup> Conklin J & Burgess Yakemovic KC (1991) Human-Computer Interaction Vol 6, pp 357-391
- <sup>11</sup> Ackoff RL (1979). The future of operational research is past. *J Opl Res Soc* **30**: 93-104
- <sup>12</sup> M. Gibbons, C. Limoges, H. Nowotny, S. Schwartzman, P.Scott and M. Trow (1994) *The new production of knowledge: the dynamics of science and research in contemporary societies*. Sage, London.
- <sup>13</sup> Checkland P and Holwell S (1998) Action Research: Its Nature and Validity. *Systems Practice and Action Research* **11**: 1 9-21
- <sup>14</sup> Conklin J (*forthcoming*). Dialog Mapping. Quoted on: <http://cognexus.org/index.htm>
- <sup>15</sup> Westcombe M, Pidd M, Mackenzie A, Warren I and Sommerville S (2002). Problem Solving Dialogue: Cognitive Mapping and IBIS. Working paper MS01/02. Management School, Lancaster University, UK. Also available from <http://www.comp.lancs.ac.uk/computing/research/cseg/projects/wisdom/>
- <sup>16</sup> Eden C (1988). Cognitive Mapping: a review. *Eur J Oper Res* **36**: 1-13
- <sup>17</sup> Eden C (1992) On the Nature of Cognitive Maps. *Journal of Management Studies*. **29** (3): 261-265
- <sup>18</sup> Ackermann F, Cropper S and Eden C (1992) Getting Started with cognitive Mapping in 7<sup>th</sup> Young OR Conference Tutorial Papers. Birmingham: O.R. society. Also available at <http://www.banxia.com/depaper.html>
- <sup>19</sup> The Decision Explorer software is available from Banxia Software Ltd. <http://www.banxia.com>
- <sup>20</sup> The Group Explorer software is available from Phrontis Ltd. <http://www.phrontis.com/>
- <sup>21</sup> Eden CL and Ackermann F (1998). *Making Strategy: The Journey of Strategic Management*. London, Sage Publications
- <sup>22</sup> Shaw D (2001). Exploring what happens in a JOURNEY Making gathering – Using group communication software to support brainstorm-type activities. PhD thesis, University of Strathclyde
- <sup>23</sup> Shaw D, Ackermann F and Eden E (2001). *Sharing Ideas in Groups - A Research Report On Electronic Group Brainstorming For Real-World Workshops*. Working Paper: RP01113 Aston Business School, UK. Available at <http://research.abs.aston.ac.uk/wpaper/0113.pdf>
- 
- <sup>24</sup> Janis IL (1982). *Groupthink*. Houghton Mifflin Company, Boston.