Using Coloured Cognitive Maps to Support Design with a Positive Lens

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The premise of this paper is that there exists a duality between a positive lens, which focuses on solutions and improvements and a negative lens, which focuses on understanding what problems there are and why they are so. This paper asserts that a focus on a situation with a positive lens should be complemented by use of a negative lens to gain an understanding of undesirable aspects of a problem solution – what the nature of the problem situation is, what its causes are and what the consequences of the problem are. Alleviation of problem situations and obtaining an effective focus on what can be done to improve on problem situations are only possible with real and thorough understanding of them. Only once there is a clear understanding of the problematic situation at hand and any desirable goals of alleviation of the problem(s) and its (their) causes can effective design proceed. This paper proposes employing a new form of cognitive mapping (coloured cognitive maps) as a way to both understand a problem situation (using a negative lens) and as a way to derive proposals for solution means and make decisions about which means are most appropriate (using a positive lens). The shift from problem understanding to design expressly represents a shift in focus from the necessary negative lens to a positive lens focusing on a desirable future state in which understood problems and their causes can be resolved. The proposed technique directly supports this transition and re-focussing.

Cognitive Mapping is a form of Causal Mapping developed and popularised by Colin Eden and Fran Ackermann (Eden, 1988, Eden & Ackermann, 2001, Ackermann and Eden, 2001). Venable (2005) extended the technique into a form called Coloured Cognitive Maps. This paper will summarise the extensions to the method and notation proposed in Venable (2005) and illustrate how the technique can be used to support design with a positive lens.

The main extensions of coloured cognitive maps include …

1. The use of colour (or bolding for the colour blind) to indicate whether nodes are desirable or undesirable,
2. The conception of two forms of cognitive maps, the first of which focuses on the current, undesirable context (using a negative lens) for problem diagnosis and understanding and the second on a desired, future context and how to achieve it (using a positive lens)
3. A procedure for developing and converting between these two forms of cognitive maps

David Kroenke has defined a problem as "A *perceived* difference between *what is* and *what should be*" [emphasis added]. The above enhancements provide a straightforward way to analyse a problem, because they aid in exploring first the *what is* about the problem situation (using a negative lens) and then effectively transitioning to exploring the *what should be* in the problem situation (using a positive lens).

The notation for cognitive maps (CMs) is relatively simple. Only two primary symbols are used: nodes and arrows. See figure 1 for a summary of the notation.

Nodes are drawn with circles or ovals (or some other convenient symbol) and represent some aspect of a problem or its potential solutions. Text is placed within each node, which captures the meaning of the node. The text in the node can also be split into two parts or poles, which are separated by an ellipsis symbol ("…"). The text in these poles represents opposites and the ellipsis is read as "as opposed to". For example, the text in a node might be "Poor service … excellent service". This would be different from "Poor service … acceptable service".

Green coloured nodes represent desirable circumstances and red coloured nodes indicate undesirable circumstances. Generally, one of the poles in a node should be desirable and the other one undesirable, with the colour corresponding to the primary pole (the text that comes first). Where colour cannot be used, another indication is needed, such as bold print and darker lines for undesirable nodes (as used throughout this paper). An advantage of using coloured (or bold) nodes is that it gives a quick visual indication of the desirable vs undesirable parts of the CM without needing to read the details of the text.

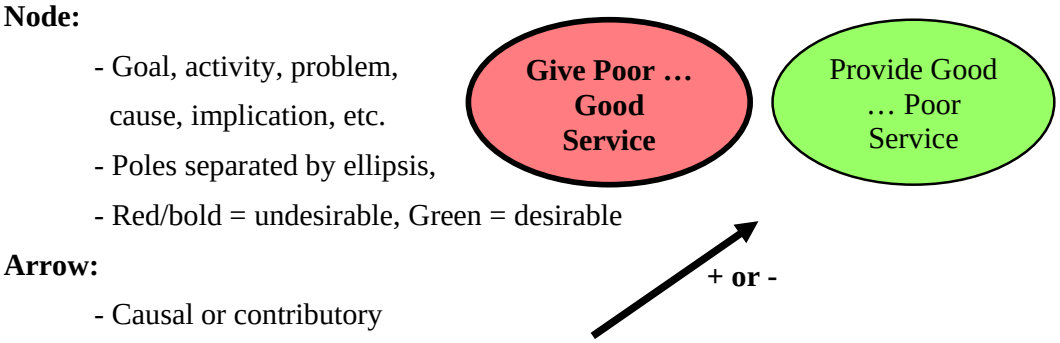

Figure 1: Coloured Cognitive Map Notation

Nodes are connected to each other with arrows. Arrows represent some degree or amount of causality between the nodes, i.e. the node at the tail of the arrow causes (to some extent) the node at the head of the arrow.

The arrows may optionally have plus or minus signs attached to them. If a minus sign is attached, it means that the causality is reversed; instead of the node at the tail of the arrow *causing* the node at the head of the arrow, the node at the tail *prevents* the node at the head or *causes its opposite pole*.

In order to make effective use of cognitive maps for problem analysis, a procedure is needed to guide the user(s) of cognitive maps as to what specific actions to perform and how. The procedure for problem analysis in this paper is divided into three stages (see figure 2).

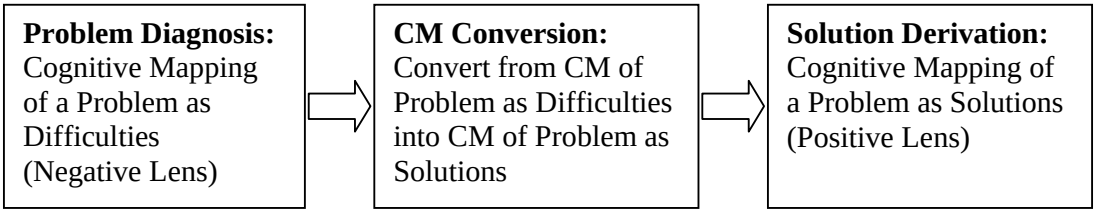

Figure 2: Procedure for Problem Analysis with Cognitive Maps

The first stage is problem diagnosis, in which a cognitive map is developed of the problem as difficulties. The second stage is to convert the cognitive map of the problem as difficulties into a cognitive map of the problem as solutions. The resulting cognitive map is incomplete, but a basis for progressing in the third stage. The third and final stage is solution derivation, in which the cognitive map of the problem as solutions is expanded with various candidate or potential solutions.

Once a problem is fully analysed and diagnosed, then we can begin thinking about solutions. However, in order to do that, we need to change our mode of thinking from what is undesirable to what is desirable (i.e., shift from a negative to a positive lens). We can support that with a simple transformation of our CM of the problem as difficulties into a CM of the problem as solutions. The conversion procedure is simple and straightforward. Each node that is undesirable is edited so that it is desirable and vice versa, with its colour changed and its poles reversed. The text is usually changed to be *elimination or reduction* of causes, *solving or alleviation* of problems, or *improvement* of symptoms or implications. Figure 3 gives an example of a conversion. The specific choice of words in the new cognitive map of course is significant in determining how positive and strong the positive lens is. For example, in figure three, one might have said "dramatically increase", "dramatically improve", and "do work extremely well" rather than the more modest text shown.

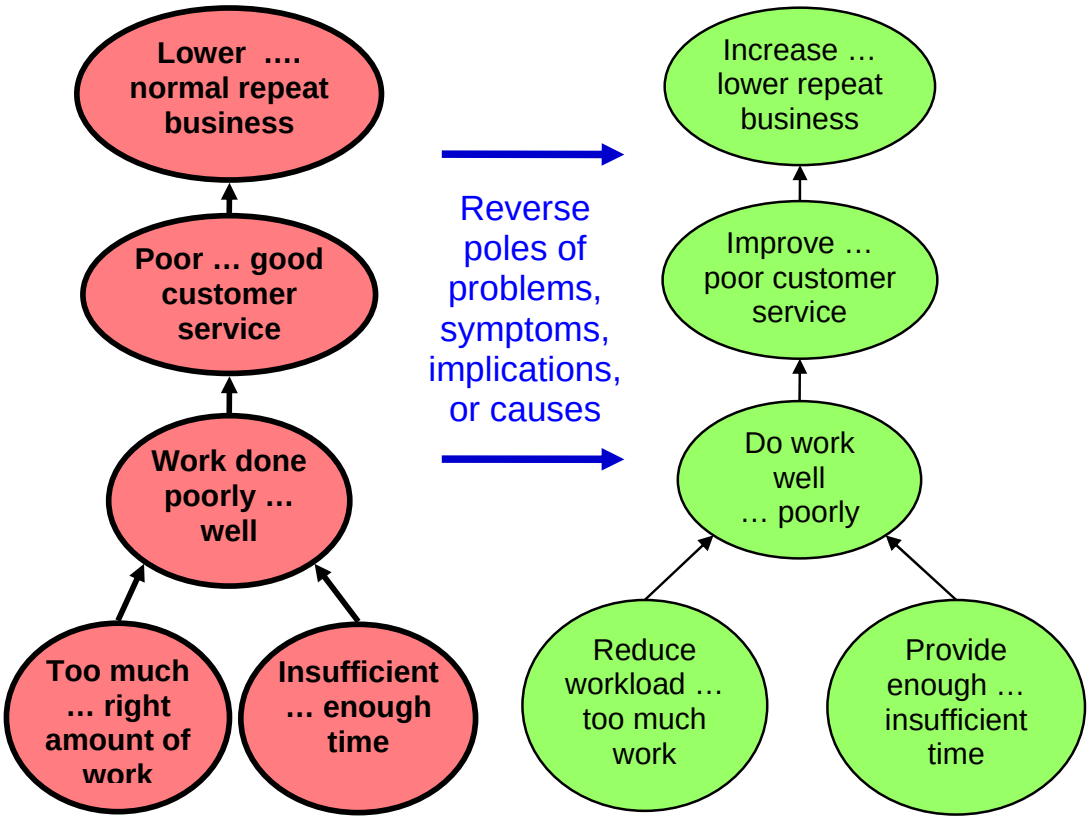

Figure 3: Example Conversion to an Initial Cognitive Map of a Problem as Solutions

Once the cognitive map has been reversed so that the preponderance of the nodes are desirable (green), the view is through a positive lens. Stage three of the process (solution derivation) augments the cognitive map with proposals (statements describing candidate designs) that address *how* the causes of the problematic situation may be eliminated or resolved and thereby the problem alleviated (at least partially) or solved altogether. Nodes are

added as necessary to provide more detail about proposed solutions. While the desirable impacts of proposed solutions are shown as they address the problematic situation at hand, other anticipated impacts, whether desirable or undesirable should also be explored and considered. Figure 4 gives an example of a CM of the problem as solutions.

Once there is sufficient detail in the CM, the technique supports comparison of candidate designs by scrutinising the anticipated impact(s) of choosing and implementing the different candidate solutions (whether singly or in combinations). Figure 4 (next page) provides an example showing alternative strategies (designs) and their anticipated impacts.

References

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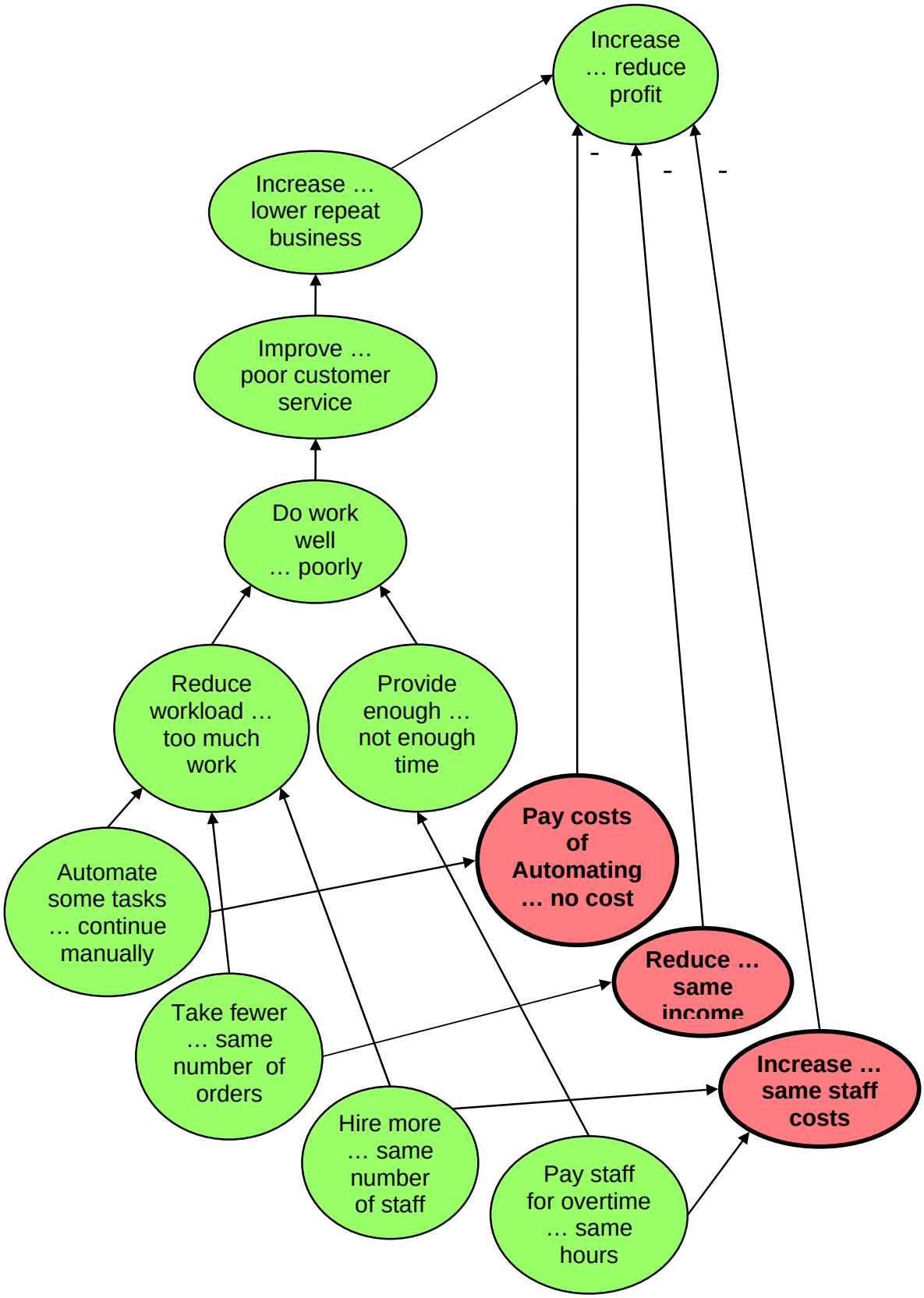

Figure 4: Example Augmented Cognitive Map of a Problem as Solutions