Moving Beyond Value Conflicts: Systemic Problem Structuring in Action

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Abstract

Value conflicts can become entrenched in a destructive pattern of mutual stigmatization, which inhibits the emergence of new understandings of the situation and actions for improvement. In extreme cases, such patterns can even lead to violence. This paper offers a new systems theory of value conflict, which suggests the possibility of three different strategies for intervention using problem structuring methods: supporting people in transcending overly narrow value judgements about what is important to them; seeking to widen people's boundaries of the issues that they consider relevant; and attempting to challenge stereotyping and stigmatization by building better mutual understanding. Each of these three strategies is illustrated with practical examples from operational research projects on natural resource management in New Zealand.

Keywords: community operational research; conflict; critical systems thinking; natural resource management; problem structuring methods.

1. Introduction

Value conflicts can be constructive when they lead to dialogue, better mutual appreciation, systemic insights and the emergence of new ways forward for action (Churchman, 1979; Mason and Mitroff, 1981; Yolles, 1999; Stacey et al., 2000; Sword, 2007; Andrade et al., 2008). However, they do not always take this constructive path: value conflicts can instead become entrenched in a destructive pattern of mutual stigmatization, which inhibits the emergence of new understandings and actions (Midgley and Pinzón, 2011, 2013). In more extreme cases, such patterns can even lead to violence (Midgley, 2016a,b).

This paper offers a new, systemic theory of value conflicts, which explains the nature of these patterns. It suggests the possibility of three different strategies for operational researchers to disrupt them and support people in finding more constructive paths for dialogue. Six examples of conflict resolution from natural resource management will be discussed, demonstrating the practical value of this theory in terms of informing intervention. These examples come from OR projects undertaken by the team I worked with in ESR Ltd (a New Zealand government research institute) from 2003 to 2010.

2.   A systems theory of value conflict

The new theory is represented by Figures 1 and 2. This draws on, and goes beyond, existing systems theories of bounded rationality and boundary critique (e.g., Churchman, 1970; Ulrich, 1983; Midgley, 1992, 1994, 1997, 2000; Midgley et al., 1998; Pinzón and Midgley, 2000; Yolles, 2001; Córdoba and Midgley, 2003, 2006; Foote et al., 2007; Midgley et al., 2007; Midgley and Pinzón, 2011, 2013; Velez-Castiblanco et al., 2016).

The two overlapping ovals in Figure 1 represent the boundaries of concern of two stakeholder groups. These boundaries signify what is seen by the two groups as happening in the situation (whose views should be listened to and the facts that matter), and by implication everything and everyone outside the boundaries is either regarded as irrelevant or is not seen or heard at all.

The overlap between the boundaries represents some aspect of the situation that is of mutual concern, but is framed very differently because of its connections with the differently bounded concerns of the two stakeholder groups. A good example is when farmers draw water from a river for irrigation while conservationists are trying to preserve endangered fish species. The common concern is with water, but the farmers frame it as a resource because it is strongly connected with their wider concern for food production, while the conservationists frame it as a fragile ecosystem because it is the habitat that the fish live in.
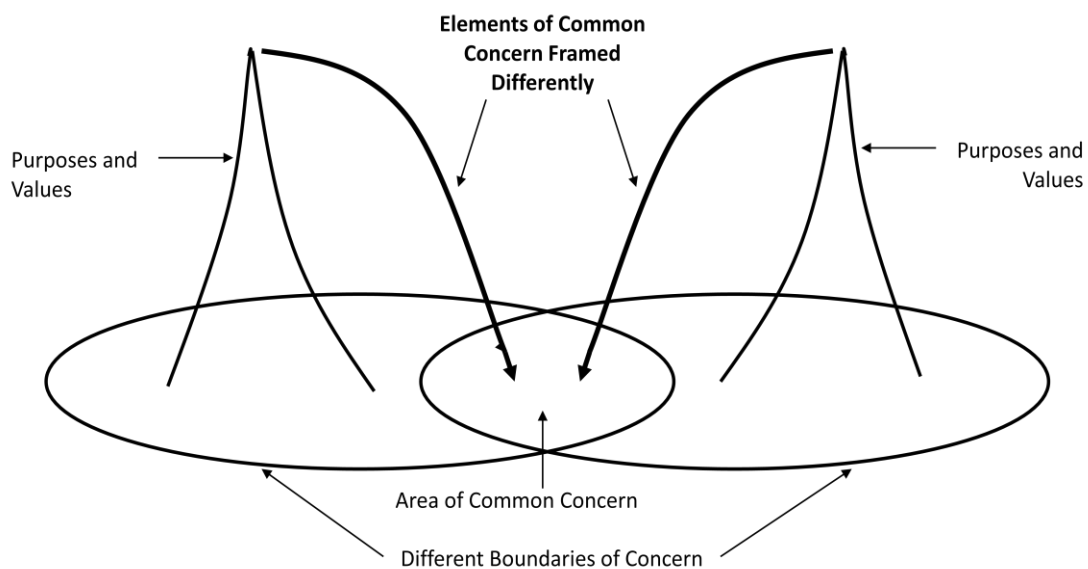

Figure 1 A systemic model of value conflicts

The peaks in Figures 1 and 2 represent the values of the two stakeholder groups. Values, in this theory, are not general principles or virtues (e.g., kindness and modesty), but are concerned with the purposes that people pursue in action (Midgley, 2000; Yolles, 2001). In this case, the farmers will value food production, and also the livelihood that comes from this.

The conservationists will value the preservation of endangered species, and will have wider values concerning biodiversity. Value and boundary judgements are intimately connected: values are strongly implicated in boundary setting (deciding who to listen to and what facts matter), yet the values it is possible to espouse may actually be constrained by prior boundaries already enshrined in the formal and informal workings of our institutions and organisations (Luhmann, 1986).

These different values, associated with different boundary judgements, come into conflict when a common concern is framed differently (represented by the downwards arrows from the tops of the peaks in Figure 1) and there is competition over which framing is right. In the case of the example of water, conflict is common because when more water is taken for irrigation, this reduces water quality (pollutants become more concentrated) and freshwater ecosystems are thereby damaged. Conversely, when limits are imposed on irrigation to preserve fragile ecosystems, this imposes corresponding limits on the economic productivity of the land.
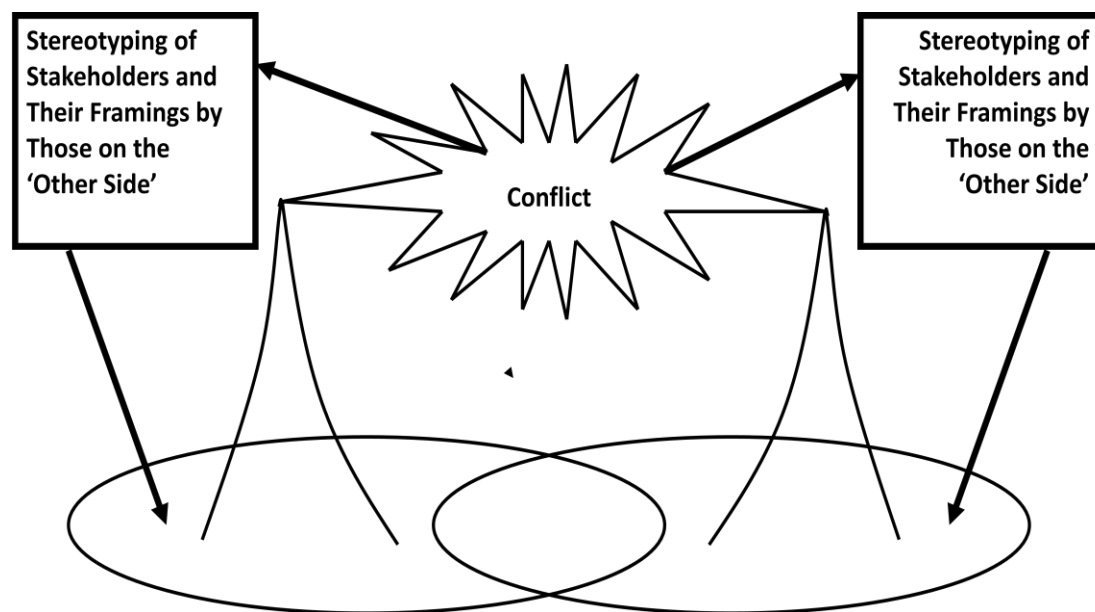

Figure 2 The addition of stereotyping to the systemic model

The final element in the theory is introduced in Figure 2: the mutual stereotyping and stigmatization of each stakeholder group by the others. Once stigmatization becomes entrenched (e.g., farmers start to call conservationists "tree huggers" and conservationists call farmers "greedy exploiters"), with anger and vitriol rising, dialogue and constructive engagement become very difficult.

3. Problem structuring methods

In the face of this kind of conflict, what can problem structuring methods (PSMs) offer? I will explain what PSMs are before answering this question.

Problem *structuring* methods can be contrasted with problem *solving* methods (Rosenhead and Mingers, 2001). The latter assume that, even if the problem is complicated, analysis can allow it to be understood objectively, and there is a correct or optimal solution to it. In contrast, PSMs start from the assumption that there may be multiple perspectives on what the problem is (Jackson, 2006). Likewise, what counts as an effective solution or an improvement depends on the framing used in an analysis and the values that inform that framing (Churchman, 1970; Midgley, 2000; Ulrich, 1983). With PSMs, it is therefore not possible to talk about 'optimal solutions' in the manner that is common in the OR problem solving literature (Checkland, 1985).

PSMs can also be differentiated from other approaches to enabling discussion, such as meetings with agendas and focus groups. A distinguishing feature of PSMs is the use of models as 'transitional objects' (temporary foci) to structure engagement (Eden and Sims, 1979; Eden and Ackermann, 2006). These models may use words, pictures and/or numbers to represent, for example, people's understandings of a problematic situation; the assumptions underpinning a particular stakeholder perspective; and/or the activities that might be needed to improve the situation. Typically, models are qualitative and are constructed collectively in dialogue (Franco, 2006), but sometimes they are brought in by a facilitator based on previous inputs from participants and are used to orientate engagement: "the model... plays a key role in driving the process of negotiation towards agreement through discussion and the development of a common understanding" (Eden and Ackermann, 2006, p.766). However, a 'common understanding' does not necessarily imply consensus or agreement across the board: it may be an agreed understanding of the differences between people's perspectives and what accommodations are possible in the circumstances (Checkland and Scholes, 1990).

Rosenhead and Mingers (2004), Rosenhead (2006) and Mingers (2011) argue that PSMs are particularly useful when it is necessary to address complex issues characterised by "multiple actors, differing perspectives, partially conflicting interests, significant intangibles, [and] perplexing uncertainties" (Rosenhead, 2006, p.759). Clearly, it is different perspectives that contribute to conflict in the systemic model represented in Figures 1 and 2, and Jackson and Keys (1984), Jackson (1987) and Flood and Jackson (1991) have previously noted the utility of problem structuring methods in the context of conflict.

Returning to the systemic model of value conflicts (Figure 2 in particular), there are three aspects to it: boundaries, values and stereotyping. This suggests three different entry points for intervention using PSMs: seeking to widen people's boundaries of the issues that they consider relevant; supporting people in transcending overly narrow value judgements about what is important to them; and attempting to challenge stereotyping and stigmatization by building better mutual understanding. These entry points are represented in Figure 3.
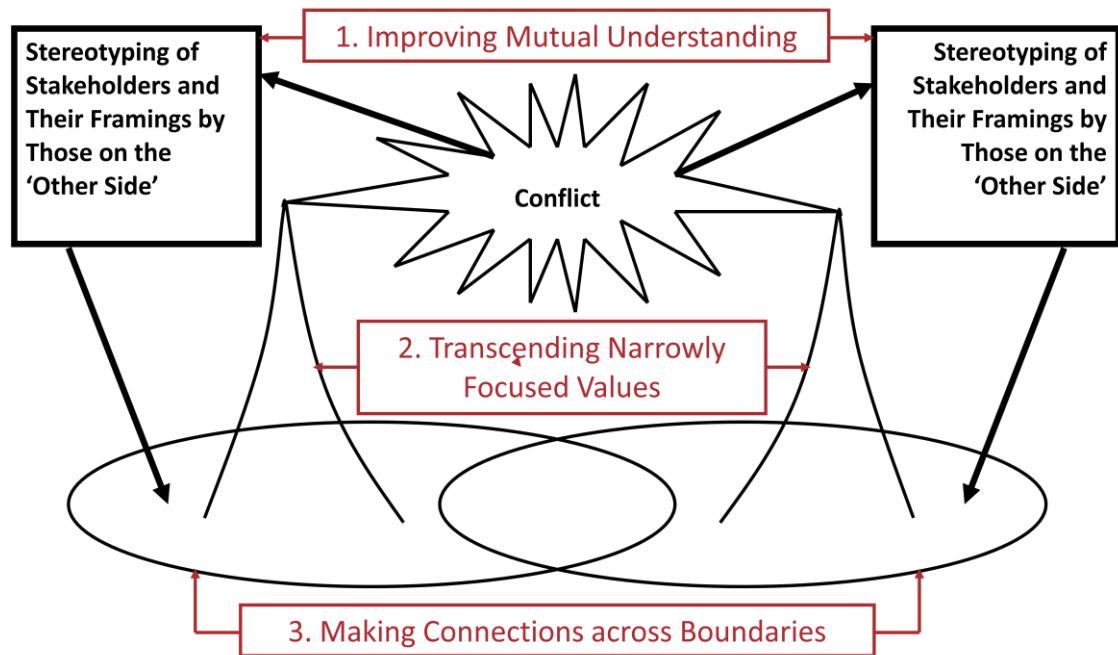
Figure 3 Alignment of strategies for intervention with the systemic model of value conflicts

Of course, because competing value and boundary judgements, plus the emergence of stereotyping, are all interlinked in the above model, OR practitioners may use two (or even all three) of these entry points simultaneously. Nevertheless, the PSMs they use can sometimes emphasise one of them more than the others. For example, Ulrich (1983) talks in depth about exploring multiple boundaries and values when he discusses Critical Systems Heuristics; Boyd et al. (2004) offer a technique for Values Mapping across stakeholder groups to transcend narrowly focused values; and Cronin et al.'s (2014) Issues Mapping is explicit about breaking down stereotypes. Thus, we can provide examples of PSMs that are particularly useful for widening boundaries, transcending narrow value judgements and improving mutual understanding. We can also provide practical examples of OR projects using a wider set of PSMs to address conflict by means of one or more of these three entry points.

4. Practical examples from natural resource management in New Zealand

Six examples from natural resource management in New Zealand will be given to illustrate this theory and show its practical utility for OR projects. The first two examples concern the improvement of mutual understanding (the first strategy in Figure 3) through the use of PSMs that emphasise sharing personal perspectives on values and thereby undermine stereotypes.

4.1. *Dialogue on the use of genetically modified organisms in food production*

One of the most intense and entrenched conflicts in recent years in New Zealand was over the use of genetically modified organisms (GMOs) in food production. At the height of the

conflict, thousands of people marched in the capital city demanding a ban. Scientists working on GMOs were vilified as immoral, and conversely many scientists saw campaigners as ignorant and irrational.

In this context, the government chose to trial new dialogue methods (MoRST, 2005). One of these was a PSM, Issues Mapping (Cronin et al., 2014). Issues Mapping asks leading protagonists in the conflict to individually rank order a set of values at issue, placing the most important at the 'heart of the matter' (the centre of a set of concentric circles), with the 'less important' values in the outer rings. Aggregate maps of different stakeholder positions are then produced, and the stakeholders come together in a workshop to compare and contrast their thinking.

In Cronin et al.'s (2014) project, what was striking was the similarity in many of the value positions adopted by both scientists and campaign leaders, especially with regard to environmental integrity, which was the first ranked value for all parties. *This blew apart the stereotypes that both sides in the conflict had created of one another*, thus ending the stigmatization (at least for those in the room). A new found mutual understanding provided the basis for a much more nuanced discussion of genetic modification, with people weighing different risks and benefits. For example, there was a consensus that the risks are often worth it for medical applications, when public health benefits are possible, but if the only benefit is profit for a private enterprise, the risks born by the public and non-human ecosystems outweigh that private benefit.

4.2.   Preventing a potential conflict over plans for irrigation

Our OR team in New Zealand was asked to support a group of farmers in a dry area of New Zealand who were looking at the prospects for introducing irrigation for the first time. This would dramatically alter the potential for productivity, but would be very costly. The scheme would only be viable if all the farmers in the area pooled their resources and borrowed money to pay for a water storage dam. The implication was that everyone would have to change their land use: they would have to move from dry land farming (e.g., sheep), which was only marginally profitable, to wet land farming (e.g., dairy cattle), where both the costs and profits were much higher. Anybody continuing dry land farming would inevitably be bankrupted if they had to cover the cost of the new irrigation without changing their farming practices. The group of farmers who asked for an OR project were very well aware of the potential conflict they were heading for, as they believed that some of the farmers in the area wouldn't want to change their land use. We were asked to support the group in heading off the potential conflict and instead involve everybody in a workshop to explore each other's values to see if there was in fact a strong constituency wanting the storage, or whether the community would be irrevocably divided, in which case the group was prepared to abandon their water storage plans.

We gathered a large number of statements from interviews, the literature and the media about uses of, and values around, water. We then asked individuals to do a Q-Sort, which is a well-

established quantitative method (Dymond, 1953) that our team adapted for use as a qualitative PSM. We asked workshop participants to arrange the values on a normal distribution curve, with the majority of the statements in the middle (these were the ones people neither strongly agreed nor disagreed with) and with just a few at the tail ends (strongly agree at one end and strongly disagree at the other). Everybody then circulated, discussing their Q-sorts with one another. The dialogue focused on the placements of the value statements, *thereby building better mutual understanding*. In this case, the workshop *prevented stereotypes from being formed* by facilitating people in sharing their different, nuanced perspectives.

The Q-sort methodology, in its quantitative form, enables individuals with similar values to be clustered, and these clusters often cut across stakeholder categories (Swaffield and Fairweather, 1996), thus undermining stereotypes of those stakeholders. In our qualitative application there was no need for clustering: we judged that more could be gained in terms of increasing mutual understanding by encouraging people to learn about each individual neighbour's reasoning about values, and there was nothing to stop people reordering their value statements in response to the dialogue.

The result of this work was agreement to continue to investigate the possibilities for water storage, but keeping the whole community engaged in discussing the financial and land use implications as the investigations unfolded.

Next we have two examples of transcending narrowly focused values (the second intervention strategy in Figure 3) using PSMs:

4.3. A feasibility study for a new water storage dam

Our team was asked to do a feasibility study for a new water storage dam due to the over-allocation of water in a particular region of New Zealand. While we were initially told it had been 20% over-allocated, later research put the figure at 60%, meaning that even current levels of agricultural productivity were unsustainable. We took on the project on the understanding that we would look at the construction of a dam as just one amongst other possible options for action. This issue was causing conflict in the community, with a lot of local people saying "not on my river", and anglers, kayakers and other recreational water users had real concerns about both current levels of drought and what a future of increased irrigation (implying a new dam) would bring. We wanted to explore more options than just a dam because pre-judging the solution to drought would most likely have intensified the conflict or even made those opposed to building a dam refuse participation. Also, there had not yet been a full community consultation, so nobody really knew if there were actually better ideas than a dam out there.

In addition to some social science research (community and family surveys) (Winstanley et al., 2005a), we set up two OR workshops: one to engage with land owners, and the other to facilitate dialogue within the local community. We decided to design a new PSM for this purpose, as we were aware that we would face a significant limitation: our engagements with

the community had to be confined to two and a half hours, which is the time a public meeting usually takes to run. This is because most rural working people would be unable to set aside more time than this, and it had become a local expectation that consultations took just one evening to run. We were not prepared to go with the usual public meeting format (presenting two or three pre-defined options, with people stamping their feet and disagreeing with one another), as this was likely to exacerbate conflict. Also, we were not confident of utilising any of the most widely used PSMs (e.g., those represented in Rosenhead and Mingers, 2001) in just two and a half hours. Therefore, we designed a Community Evaluation Meeting with five stages that could, with tight facilitation (we used five facilitators in total), be enacted in the time we had available:

1) Explaining some key facts about the water systems in the region, as we couldn't presume technical knowledge about things like how the aquifers joined up the rivers underground;
2) Discussing drought and its meaning to stakeholders;
3) Identifying the full range of water-related values held by different stakeholders;
4) Identifying options for water management, including the construction of a new dam; and
5) In small groups, qualitatively evaluating each water management option in terms of all the values.

This exercise essentially pushed the participants to evaluate the water management options in terms of the full set of values, beyond just their own, *thereby transcending narrow foci*. See Winstanley et al. (2005b) for more details of this project, and Midgley et al. (2013) for the methodology and methods used to evaluate the implementation of the PSM described above.

Some significant insights came from the Community Evaluation Meetings. First, drought was a problem to everyone, not just the farmers, so both land owners and other community members were willing to consider potential solutions. Second, while many of the community participants had come into the workshop believing that water conservation measures would be enough, it became apparent in the discussion that no more than 10% savings were possible this way. Thus, some form of water storage was actually needed. So the key question was: what kind? Third, the community participants raised significant sustainability issues: they said that, if the farmers built a dam, and the extra water resulted in currently unused land being made productive, this would result in further productivity and demand for water, and the area would return to having shortages within ten years. Thus, an aspect of the solution to the drought had to be limits on the further growth of high water use agriculture to keep within the new water supply regime.

The outcome of this project was the Council putting forward three potential water storage dam solutions for further public consultation. Two of these had been extensively discussed in the workshops, and people had agreed that these were the best options. The third solution had been worked out at a later date by Council officers. Interestingly, all the objections from the public related to the third option only, showing that our Community Evaluation Meeting had successfully covered all the necessary issues relating to the preferred two options, so

community assent had been secured. The Council and land owners quickly dropped their third option in light of the community outcry, and chose one of the two more acceptable options.

4.4. *Overcoming a 30 year conflict over water conservation*

Our OR team was asked to support a local Council in evaluating its water conservation policy. Very quickly we learned that there was wide-spread community resistance to the policy, with many people simply refusing to obey the Council's edicts to save water. Upon investigation, we discovered that an entrenched conflict between the Council and its community had been going on for 30 years. In essence (although there were other complexities that will not be discussed here; see Foote et al., 2007, for details), the issue was that the community had seen the results of previous water conservation efforts, and was not prepared to repeat this experience.

The town's water supply came from three small streams, which provided sufficient water for the 500 or so permanent residents who lived there throughout the winter. However, in summer, the population grew to 5,000 because of all the second homes in the town, plus an influx of tourists, and the water supply was insufficient for this number. Several decades ago, the residents had accepted water conservation measures because of this problem, but they noticed that, whenever they reduced their water consumption to sustainable levels, the Council would agree to more land being released for house building. Thus, the water conservation had to be even more stringent the following year, and once again success would mean more houses. The community therefore accused its Council of undermining its own water conservation policy. From the point of view of the Council, however, expanding the housing stock was essential because they needed more rates income (local housing tax) to invest in sewage and other infrastructure that was no longer fit for purpose due to previous town expansions. Significantly, water management and housing were dealt with by entirely separate divisions in the Council, making it almost impossible for either division to accept that the two issues should be linked. This is a good example of how the boundaries assumed in the construction of organisations can result in the emergence of narrowly focused purposes and values, with other values (in this case concerning development) being disallowed for discussion by the water management officers.

After some initial exploratory research based on individual interviews, our team offered to facilitate a problem structuring workshop to address the above issue. The Council were initially resistant to the idea, as they said it went beyond our brief to support the evaluation of their water conservation measures (which, as explained, they viewed as entirely separate from community concerns about development). However, they did accept the logic of participatory practice (e.g., Bradbury, 2015; Winstanley et al., 2016), in that they realised that the evaluation and the future of water conservation would have no legitimacy if the community failed to 'buy into' them. They therefore agreed to a workshop on condition that it would be focused on the effectiveness of their technical water conservation measures alone. We accepted this boundary judgement in the knowledge that, in the context of a participatory workshop, there would be no possibility of keeping development off the agenda, whether the

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Council wanted it to be raised or not. The task we faced was to design a PSM process in a way that would allow *the transcendence of overly narrow values* concerned with water conservation without the Council shutting down the discussion and refusing to listen, as they had done in previous years.

We designed a hybrid PSM, drawing on methods from Scenario Planning (e.g., Bradfield et al., 2005) and Soft Systems Methodology (e.g., Checkland and Scholes, 1990). Essentially, people drew giant 'rich pictures' of the potential best and worst case outcomes from the water conservation measures, and then the participants collectively reflected on the values that mattered. For the first time in 30 years, the Council officers had to accept that their value set (and corresponding boundaries of analysis) should be expanded. We believe we made this breakthrough because we were careful to ensure that the Council felt in control of the framing, and the values around development were discussed within this framing. Nevertheless, the transcendence of the initially narrow set of values was obvious.

As soon as the Council showed that they could really listen to the community's concerns, and transcend their initial values, the residents stopped resisting some of the water conservation measures that the Council had been trying to introduce for years, without success. Principal among these was water metering, and the workshop participants collectively designed a charging regime that they could accept as fair (penalising only excessive use).

In the longer term, this work had other major, unforeseen consequences: once the Council had accepted that they would not be able to invest in the sewage infrastructure by expanding the housing stock and consequently their rating base, they came to the realisation that they had to look for investment from elsewhere. All the elected politicians collectively resigned and asked the nearby city to allow them to become a ward within their jurisdiction. The city was able to provide the money that was needed, and the investment went ahead without further, unsustainable house building.

The final two examples of dealing with conflict concern widening the boundaries of analysis (the third intervention strategy in Figure 3):

4.5. *Ending a blame game over food poisoning*

A major argument had erupted over a scientific study (Savill et al., 2003; Pulford et al., 2004) that had become a national news headline in New Zealand, with the media blaming farmers for allowing their cows to defecate in rivers, thereby passing food poisoning bacteria from animals to humans via the water. New Zealand has one of the highest levels of campylobacter food poisoning in the developed world (Gilpin et al., 2008), and milk products are a major export earner for the country. The fear amongst dairy farmers was that, if they were blamed for the food poisoning, this would dirty the 'clean green' image of New Zealand and impact on the profitability of dairy farming. The argument was extremely heated, and there was a fundamental disagreement on the nature of the problem. Some said cows were the issue, others blamed chickens or human sewage, and even wild ducks were in the frame. Actually,

the science suggests that all of these things can be reservoirs of campylobacter, and therefore potential sources for infection (Nicol and Wright, 2000; Savill et al., 2003).

The team I was part of supported separate stakeholder groups in building causal loop diagrams, the qualitative starting point for System Dynamics modelling (e.g., Maani and Cavana, 2007), focusing on the issues they felt were most important. Some looked at dairy cattle, some at human sewage, some at chickens, etc. We then brought the groups together in a large workshop and asked them to examine each other's models. The idea was for everybody to look for elements in other people's models that have causal connections with elements in their own models. The result was a dawning realisation that they were dealing with one large system, with campylobacter flowing through it all: nobody could deal with their part of the system without taking account of other people's parts (Ball et al., 2005).

By the end of the day, protagonists who had previously been in emotionally charged battles *were all working within a wider boundary* and were talking with each other quite reasonably. Although significant tensions between the stakeholders remained, our workshop at least started a more productive conversation around the causes of the high levels of campylobacter food poisoning in New Zealand.

4.6.   Breaking through a 25 year conflict over competing priorities for water management

The Canterbury region of New Zealand is a major agricultural production hub. At the time of our intervention, a large number of farms had converted to dairy, which was one of the most profitable sectors of the economy. Dairy requires a significant amount of water, yet Canterbury is a relatively dry region, and Environment Canterbury (the Regional Council) was enforcing restrictions on irrigation to protect local ecosystems. A major conflict had grown over several decades, with many farmers taking the Council to court to challenge the restrictions on water use. The Council was spending unsustainable amounts of money on legal battles, which was diverting resources from their core business of environmental protection. Local communities had become polarised, with some people championing environmental values and others commercial ones. Likewise, the elected politicians on the Council were split down the middle, causing decision paralysis. In this context, the CEO of Environment Canterbury launched a strategic water management initiative to break the deadlock.

Following a massive community consultation over how people valued water, I was asked to recommend an OR approach that could take 20 community leaders through a process of identifying strategic alternatives for action. I suggested Strategic Choice (Friend and Hickling, 2004), and we brought John Friend to New Zealand to work with our team on an intervention. *Strategic Choice broadened the boundaries of stakeholders' thinking* by looking at all the decision areas that needed to be accounted for, not just water quantity for irrigation and water quality protection. Various strategic options for each decision area were defined, and then people identified incompatibilities between options in different decision areas (e.g., taking more water for irrigation is incompatible with preserving water quality, unless new

water sources are brought on stream). This made it clear what the feasible strategies covering all the decision areas actually were.

Three strategic options for the future of water management were identified, and these were taken out for community consultation. A large amount of feedback was gathered, demonstrating overwhelming support for a modified version of the 'middle ground' option, with the other two options (environmental protection before all else, or economic development at any cost) being roundly rejected by a large majority of the population. The consensus spanned all the identified stakeholders. Indeed, the final strategy was so robust that it survived the abolition of the elected Council (this happened because the national government didn't appreciate the balance that was struck between production and environmental sustainability, wanting a greater emphasis on economic growth). The government imposed their own non-elected authority, who quickly realised that the strategy coming out of our OR process was actually the only feasible option to pursue. Prior to our intervention, breaking the deadlock between the advocates of conflicting economic and environmental priorities had been valued at a potential $1.7bn of sustainable economic growth, which is now in the process of being realised.

5. Conclusions

In this paper, I have presented a new systemic model of value conflicts, and this indicates that there are three strategies for the use of PSMs to turn an unproductive, entrenched and stigmatizing conflict into a useful creative tension, so constructive ways forward can be generated. I have given examples from natural resource management in New Zealand, focusing on the use of Issues Mapping, Qualitative Q-Sort, Community Evaluation Meetings, Scenario Planning, Soft Systems Methodology, Causal Loop Diagramming (from System Dynamics) and Strategic Choice. Further research is needed to look at how other PSMs can be used to support intervention in line with the systemic model of value conflicts. Also, reflection on this model might inform the design of entirely new PSMs.

6. Acknowledgements

References

Andrade L, Plowman D A and Duchon D (2008). Getting past conflict resolution: A complexity view of conflict. Emergence: Complexity and Organization 10: 23–38.

Ball A, Foote J, Gregory W, Midgley G, Pulford D, Savill M, Scholes P and Wood D (2005). Systems of zoonoses on dairy farms. Proceedings of the Public Health Association Conference, Wellington, New Zealand, 6-8 July 2005.

Boyd A, Brown M and Midgley G (2004). Systemic Intervention for community OR: Developing services with young people (under 16) living on the streets. In: Midgley G and Ochoa-Arias A E (eds.). Community Operational Research: OR and Systems Thinking for Community Development. Kluwer: New York.

Bradbury H (ed.) (2015). The Sage Handbook of Action Research. 3rd ed. Sage: London.

Bradfield R, Wright G, Burt G, Cairns G and Van der Heijden K (2005). The origins and evolution of scenario techniques in long range business planning. Futures 37: 795-812.

Checkland P (1985). From optimizing to learning: A development of systems thinking for the 1990s. Journal of the Operational Research Society 36: 757–767.

Checkland P and Scholes J (1990). Soft Systems Methodology in Action. Wiley: Chichester.

Churchman C W (1970). Operations research as a profession. Management Science 17: B37-53.

Churchman C W (1979). The Systems Approach and its Enemies. Basic Books: New York.

Córdoba J-R and Midgley G (2003). Addressing organisational and societal concerns: An application of critical systems thinking to information systems planning in Colombia. In: Cano J (ed.). Critical Reflections on Information Systems: A Systemic Approach. Idea Group: Hershey.

Córdoba J-R and Midgley G (2006). Broadening the boundaries: An application of critical systems thinking to is planning in Colombia. Journal of the Operational Research Society 57: 1064-1080.

Cronin K, Midgley G and Skuba Jackson L (2014). Issues mapping: A problem structuring method for addressing science and technology conflicts. European Journal of Operational Research 233: 145-158.

Dymond R F (1953). An adjustment score for Q sorts. Journal of Consulting Psychology 17(5): 339-342.

Eden C and Ackermann F (2006). Where next for problem structuring methods. Journal of the Operational Research Society 57: 766–768.

Eden C and Sims D (1979). On the nature of problems in consulting practice. Omega 7: 119–127.

Flood R L and Jackson M C (1991). Creative Problem Solving: Total Systems Intervention. Wiley: Chichester.

Foote J, Baker V, Gregor J, Hepi M, Houston D and Midgley G (2007). Systems thinking for community involvement in water conservation. Journal of the Operational Research Society 58: 645-654.

Franco L A (2006). Forms of conversation and problem structuring methods: A conceptual development. Journal of the Operational Research Society 57(7): 813-821.

Friend J and Hickling A (2004). Planning under Pressure: The Strategic Choice Approach. 3rd ed. Routledge: London.

Gilpin B, Scholes P, Robson B and Savill M G (2008). The transmission of thermotolerant campylobacter spp. to people living and working on dairy farms in New Zealand. Zoonoses and Public Health 55(7): 352-360.

Jackson M C (1987). New directions in management science. In: Jackson M C and Keys P (eds). New Directions in Management Science. Gower: Aldershot.

Jackson M C (2006). Beyond problem structuring methods: Reinventing the future of OR/MS. Journal of the Operational Research Society 57: 868–878.

Jackson M C and Keys P (1984). Towards a system of systems methodologies. Journal of the Operational Research Society 35: 473-486.

Luhmann N (1986). Ecological Communication. 1989 translation. University of Chicago Press: Chicago.

Maani K E and Cavana R Y (2007). Systems Thinking, System Dynamics: Managing Change and Complexity. 2nd ed. Pearson: Auckland.

Mason R O and Mitroff I I (1981). Challenging Strategic Planning Assumptions. Wiley: New York.

Midgley G (1992). The sacred and profane in critical systems thinking. Systems Practice, 5: 5-16.

Midgley G (1994). Ecology and the poverty of humanism: A critical systems perspective. Systems Research 11: 67-76.

Midgley G (1997). Dealing with coercion: Critical systems heuristics and beyond. Systems Practice 10: 37-57.

Midgley G (2000). Systemic Intervention: Philosophy, Methodology, and Practice. Kluwer/Plenum: New York.

Midgley G (2016a). How can co-creation produce better outcomes for people and communities? Paper presented at a SESYNC Workshop on Co-Creation, April 2016, doi: 10.13140/RG.2.1.2373.3360

Midgley G (2016b). Co-creation without systems thinking can be dangerous. https://i2insights.org/2016/07/07/co-creation-and-systems-thinking/ Accessed 9.7.16.

Midgley G, Ahuriri-Driscoll A, Baker V, Foote J, Hepi M, Taimona H, Rogers-Koroheke M, Gregor J, Gregory W, Lange M, Veth J, Winstanley A and Wood D (2007). Practitioner identity in systemic intervention: Reflections on the promotion of environmental health through Māori community development. Systems Research and Behavioral Science 24: 233-247.

Midgley G, Cavana RY, Brocklesby J, Foote J, Ahuriri-Driscoll, A and Wood D (2013). Towards a new framework for evaluating systemic problem structuring methods. European Journal of Operational Research 229: 143-154.

Midgley G, Munlo I and Brown M (1998). The theory and practice of boundary critique: Developing housing services for older people. Journal of the Operational Research Society 49: 467-478.

Midgley G and Pinzón L (2011). The implications of boundary critique for conflict prevention. Journal of the Operational Research Society 62: 1543-1554.

Midgley G and Pinzón L (2013). Systemic mediation: Moral reasoning and boundaries of concern. Systems Research and Behavioral Science 30: 607–632.

Mingers J (2011). Soft OR comes of age – But not everywhere! Omega 39: 729–741.

MoRST (2005). http://www.morst.govt.nz/current-work/science-in-society/dialogue/ Accessed 28.10.11.

Nicol C M and Wright J (2000). Studies of campylobacter isolates in New Zealand, 1995-1997. Australian Journal of Medical Science 21(2): 77.

Pinzón L and Midgley G (2000). Developing a systemic model for the evaluation of conflicts. Systems Research and Behavioral Science 17: 493-512.

Pulford D, Ball A, Foote J, Gregory W, Michie H, Midgley G and Savill M (2004). Associations Between Livestock Farming in New Zealand and the Presence of Environmental Zoonotic Pathogens Linked with Human Gastroenteritis. ESR Client Report FW0524. ESR: Christchurch.

Rosenhead J (2006). Past, present and future of problem structuring methods. Journal of the Operational Research Society 57: 759–765.

Rosenhead J and Mingers J (2001). Rational analysis for a problematic world revisited. Chichester: Wiley.

Rosenhead J and Mingers J (2004). Problem structuring methods in action. European Journal of Operational Research 152: 530–554.

Savill M, Hudson A, Devane M, Garrett N, Gilpin B and Ball A (2003). Elucidation of potential transmission routes of campylobacter in New Zealand. Water Science and Technology 47(3): 33-38.

Stacey R D, Griffin D and Shaw P (2000). Complexity and Management: Fad or Radical Challenge to Systems Thinking? Routledge: London.

Swaffield S R and Fairweather J R (1996). Investigation of attitudes towards the effects of land use change using image editing and Q sort method. Landscape and Urban Planning 35: 213-330.

Sword L D (2007). Complexity science conflict analysis of power and protest. Emergence: Complexity and Organization 9(3): 47–61.

Ulrich W (1983). Critical Heuristics of Social Planning: A New Approach to Practical Philosophy. Haupt: Berne.

Velez-Castiblanco J, Brocklesby J and Midgley G (2016). Boundary games: How teams of OR practitioners explore the boundaries of intervention. European Journal of Operational Research 249: 968-982.

Winstanley A, Ahuriri-Driscoll A, Hepi M, Baker V and Foote J (2016). Understanding the impact of democratic logics on participatory resource decision-making in New Zealand. Local Environment 21, doi: 10.1080/13549839.2015.1127218

Winstanley A, Baker V, Foote J, Gregor J, Gregory W, Hepi M and Midgley G (2005b). Water in the Waimea Basin: Community Values and Water Management Options. ESR Client Report for the Waimea Water Augmentation Committee and the Tasman District Council. ESR: Christchurch.

Winstanley A, Thomas J, Baker V, Foote J, Gregor J, Gregory W, Hepi M and Midgley G (2005a). Water Augmentation for the Waimea Plains: Community Values and Water Management Options. Proceedings of the New Zealand Hydrological Society Annual Conference, Auckland, New Zealand, 28 November to 2 December 2005.

Yolles M (1999). Management Systems: A Viable Approach. Pitman: London.

Yolles M (2001). Viable boundary critique. Journal of the Operational Research Society 52: 35–47.