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## PROCESS AND SYSTEMS AND WICKED PROBLEMS

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"Venture Group has a reputation for creative solutions, integrity and innovative and strategic advisory services. Our specialty is working with growth companies ... typically focus(ed) on technology or unique intellectual property and building global markets"

It seems to me that the Venture Group specialises in working with a class of people bound to have a common challenge: they are all working with "wicked problems". Not that all their clients and co-workers are more than usually evil! Rather, all face the challenges of building new businesses, enterprises and ideas - new solutions to complex, ambiguous challenges. In the words of Horst Rittel (eg Rittel, H., and M. Webber; "Dilemmas in a General Theory of Planning" 1973, available from iurd@uclink.berkeley.edu), we face "wicked", rather than "tame" situations.

What is the value of this new terminology? Why does Rittel's distinction matter? Misreading the type of problem you face, and therefore reaching for the wrong kind of toolkit, is seriously limiting when you are building something new. You need to know what you are up against. You need to know the rules of the game. If you don't, chances are you'll miss opportunities and waste resources trying to get the "right" answer from the wrong quarters, and potentially you will experience confusion and misery.

Aristotle observed this same class of problems centuries before Rittel and named it slightly differently. He spoke of a set of situations where "things *can* be other than as they are". He said that when we work in the world of conventional science and (non-quantum) physics, we work in a world "where things *cannot* be other than as they are." This is the realm of tame problems:  $\text{NaOH} + \text{HCl} \rightarrow \text{NaCl} + \text{H}_2\text{O}$ ; the dropped glass falls;  $(P_1 \times V_1) / T_1 = (P_2 \times V_2) / T_2$ ; the stubbed toenail goes black. In each of these cases the outcome follows in a predictable, linear fashion from the input. Specify the issue; analyse the requirements; formulate a solution.

But then there is another class of issues: poems; business system developments; life choices; novelty and change in resistant cultural contexts. These are issues where "things *can* be other than as they are". I could have a different partner; bought an investment property before the boom; chosen to be an art teacher instead of an artist; formed a joint venture rather than a subsidiary. Each of these situations confronts us with the questions: When is my quest "over"? When do I have a solution? Where do the roots of my decision begin? And even when I answer these questions and many like them, I know that the choices I have made mean that things *could have been* other than as they are.

I'll bet London to a brick that if you are reading this you are working with the second class of issues -- where "things can be other than as they are". And so you face solving wicked problems.

So here are the features of wicked problems as described by Horst Rittel. Allow yourself a wry grin (or a rye or gin) as you see your world described. Each of the principles is **as worded by him** (in bold). Sometimes (in brackets) I add the version as interpreted by Richard Buchanan ("Wicked Problems in Design Thinking" Design Issues 1992) if it adds further clarity. And I have drawn some illustrations from one of my experiences of a wicked problem: facilitating the community acceptance of a new mine development after they had initially vetoed it. Some of Rittel's features were immediately striking to me - others have been a "slow burn". As a whole, they have been important to me in coming to terms with being a finite human, tackling big changes.

**1. Wicked problems have no definitive formulation, but every formulation of a wicked problem corresponds to the formulation of a solution.** When you are formulating the structure of a new mining operation, you are acutely aware there are many options you did not pursue, lots of configurations not costed. There are only so many NPV models you can explore and assumptions you can test. You choose where to take your local rail line from the rail loop, and the issues of overburden relocation,

conveyor routing and haul road gradients kick in. But what if the railhead was five kilometers further north?

The understanding of a large system problem and the solution emerge in parallel. The problem you end up solving is partly of your own creation. Like a cartoon of a road-making machine that takes in raw forest and lays pavement as it proceeds, the paths you explore increasingly become conceptual and sociological conduits along which all subsequent traffic flows. So which way will you go? And how big a swathe will you clear? In such contexts, your *purpose* forms the boundary to a systemic problem. Rich, clear purpose provides “pull through” on scope. *Relevance* allows extraneous issues to fall away, key matters to come to the fore. Like a compass bearing in thick bush, I still know where I am going even if I am briefly turned aside.

**2. Wicked problems have no stopping rules.** (Buchanan: They have no end point) When do we know enough? When do we decide to stop feasibility studying and begin to take action? This question has a dilemma which lives on throughout the life of the mine: What drilling should we do to establish the unfolding identity of the mine? How close together? How far ahead of time? What level of detail do we need, versus what level of rude surprise can we tolerate?

As soon as you start, you have a new situation. This being a system, you have to draw a boundary to end the scope of your intervention. There is no “natural” boundary. But even when you draw a boundary there will be knock-on effects and unforeseen consequences. As soon as you’ve implemented your system, you’ve created a new context. Greenleaf (in “The Servant as Leader”) makes a parallel observation about the hopelessness of waiting for all the data to be in: ‘If, on a practical decision in the world of affairs, you are waiting for all of the information for a good decision, it never comes.’ There always is more information, sometimes a great deal more, that one might have if one waited longer or worked harder to get it - but the delay and the cost are not warranted. On an important decision one rarely has one hundred percent of the information needed for a good decision no matter how much one spends or how long one waits. And if one waits too long, one has a different problem and has to start all over.”

So how big will my problem be?

- As big as I want it to be. How big do I think I can make my solution? How big am I *expected* to make my solution! If I am acting in response to a social need, I can make a personal donation to the Red Cross. This is one level of solution. But if I am responsible for the public perception of corporate citizenship by a mine development in traditional lands a donation from my wallet will probably provoke scorn.
- As long as I want to explore it. It will require more solutions as long as I choose to solve it, or until fatigue, neglect, finitude or choice leads me to ignore the implications of my choices. There is no defined endpoint, no complete solution

Don’t obsess. Don’t attempt perfection. Embrace the 80/20 rule as a virtue, not as a compromise.

**3. Solutions to wicked problems cannot be true or false, only good or bad** This is a truth which becomes self-evident as the economics of operating the chosen mine design (and the operational problems the general managers must face) unfold. The work of the mine plan continues as the ore body is exposed. Time tells whether the original solution was good or bad, whether the ore body model was a wise interpretation or sloppy guesswork. When is the mine plan “good enough”:

- to go to the finance sources
- to go to the community
- to commence construction?

You can’t know all the consequences you didn’t intend. You can’t even know all the side effects of what you *did* intend. The functioning of a housing estate and the town planner’s choices re layout, centre, boundaries, etc unfold sociologically only after it is built. The sequel to a once hopeful medical technology casts its shadow over its “beneficiaries” with unforeseen malignancy. The ecological disaster of silent springs after mosquito control measures, or the political triumph of Solidarity are exceptional *only in scale* as events in the world. Every day the paths humans have chosen flow out into personal experience of good and bad. Don’t expect the comfort of analytic universality, or the defence of abstract certainty. The social context of *your* day and *your* place will be the context for judgement.

**4. In solving wicked problems there is no exhaustive list of admissible operations.** (Buchanan: There is no complete list of methods to solve wicked problems). The conversation space is unbounded. Surely we have to picture the IR situation in which we will be operating? Or the community attitudes to coal mining? Or the potential shifts in legislation with respect to Native Title? Or the risk that shipping will face huge tariffs due to the effects of noise pollution on marine life? There is no one toolkit that will solve such issues.

To say that a tarot card could be as useful to going forward as a design methodology is not to collapse to irrationalism, but to rise to the challenge of never knowing when a good answer will strike you. There is no best starting place. We look for guidance: Where is the book of answers from previous developments? If you can't give me the right answers, tell me the right way to proceed! Or, as a mine process engineer once said, "At least give me the book of failed answers." But reality insists:

- There is no self-evident way to divide up the issue.
- There is no "right" way to tackle the problem or to formulate the solution
- There is no complete list of component problems, so we don't know which things we have to be expert in?

Draw richly on resources; trust your own preferred modes of being. Leave room in your plans for new inputs to be integrated. No one has faced your problem, so tackle it creatively and courageously.

**5. For every wicked problem there is always more than one possible explanation, with explanations depending on the Weltanschauung of the designer.** (Buchanan "...and every explanation depends on the worldview of the designer). Is the designer a "dragline person"? What rosters do they believe in? Different rostering models have different gains and losses – they really evoke worldviews because they in fact create different worlds for those who live in them. The interminable debate in mining systems about whether to use shovels or draglines – what is the breakpoint between the one and the other technology being preferred?

Why is this circumstance the way it is? Why, for example, is this town, nation, business, country, family "so poor"? Because:

- of their forebear's choices,
- they were born here, not there,
- they lack effort and energy, or
- they lack education?

There are always multiple answers offered to complex solutions. (The media feeds off this resource - superficially exploring and provoking a variety of opinions while carefully maintaining a tepid social blancmange).

Don't look for another solution. Look for another perspective on the problem. Take heart from this potential richness of perspectives. This is actually a source of agency - a chance to change the window you look through and find one *you* can act in. The key to finding passion and energy is often to tackle the system from a perspective that intrigues you. Your own explanation provides you with advance organisers for new encounters. Good – you move from a position of strength. The weakness, if it is one, is that your explanation will work regardless! As someone said, a 3-year-old child has an effective, coherent worldview that works – more often than not she can get adults to deliver what she wants.

**6. Every wicked problem is a symptom of another, "higher level," problem.** To design our mine, to invest energy, resources and future corporate identity in a coalhole is to lay aside a bigger dilemma. We must largely beg the question of using coal in a greenhouse world (which is yet dependent on it for its power generation) and the impact of that dilemma on the market in 20 years time. Of course we wrestle with it, and attempt to mitigate our risks by mine life planning. But if we really solved the bigger problem (for example if you resolved what to do with the Kyoto protocol), thousands of work hours spent on holes in the ground would go away. If certain judgements were made and enforced, we probably wouldn't be building the mine. We are a symptom of that failure to solve the bigger problem.

Perth has recently become the first Australian city to select desalination technology to supply its water needs. It has calculated the rate of climate change means that the rain harvest cannot keep pace with use. The use of electricity hungry technology to solve the water problem creates more greenhouse gases and becomes part of a higher-level problem. Understand your context. The philosophical paradox is that it is sometimes easier to solve the "higher" more general problem than a specific instance.

**7. No formulation and solution of a wicked problem has a definitive test.** (You cannot definitively test your solutions). Long after the mine has begun operating, or has failed, the debates will still rage about just what went wrong, and why - as long as the operation and failure flow from the mine plan. (If the failure results from something like an explosion - then there is no wicked problem, only a definitive outcome!).

Matters reminiscent of Heisenberg's Uncertainty Principle emerge:

- the situation always moves
- the moment you act, the situation is not the same

Heisenberg rattled physics because he described the endpoint at which bigger and better versions of proven machines stopped giving bigger and better answers. The old logic said that the harder a problem was, the more important to follow *the method*. Using "the method" with wicked problems confers no necessary advantage. You can't analyse, then solve. Understanding and deciding emerge together.

Where there is no clear boundary or stopping point, there is no "thing" to be tested, validated or optimised. Measure your capability by outcomes and results, not by testing and audit.

**8. Solving a wicked problem is a "one shot" operation, with no room for trial and error.** You can't build a mine to see how it works. You can't propose a development to a community and then reset their attitude to zero if they don't like your proposal. You have to get on and do it. Sooner or later someone has to say - yes, that's the option, and we are going to run with it. That's where the base of the pit will be; that's the maximum incline of the haul roads, that's the minimum spec for the trucks we use. (There is a need for courage and leadership - there is inescapably the ethics of commitment). By the time you have implemented it, you are committed. There is no "undo" button (W R Goss).

"Get physical fast". Stop theorising. Make first cut moves that help you define the problem better. Ride the wave. There is no turning back the clock. No leaving the building without being noticed, no neutral place to get off and leave no trace. Scary? Or thrilling? Life is like that. I make my decision and live with it. But in case you hadn't noticed, all of your life to date is made up of a thousand instances of that truth – and they are not all bad!

**9. Every wicked problem is unique.** There is no other mine like your mine - You can't just copy a success story. The approach to the ore body is specific to your situation. The IR situation is your problem. Access to the regional infrastructure is your problem. Even if it has surfaced in none of the other wicked problem features, here is where one key aspect of wicked contexts comes to the fore. Your problem is unique because your set of *stakeholders* is unique. The expectations that frame the problem and seek to be satisfied by the solution are different, diverse and human. And the context of stakeholder influence in the problem, involvement in the process of resolution, and ability to veto the outcome, all tangle together.

At some level, a McDonald's franchise is not a wicked problem. Wherever the discretion to vary the restaurant system is removed, taming has taken place. Franchising is making money by taking the wickedness out of the problem. But the moment you need to go outside the scope of the franchised control - for example to staff the operation you have your own wicked problem. What socio-economical system are you recruiting from?

- The region in mid- States USA with such low unemployment you can't staff the local supermarkets?
- The town in the Blue Mountains National Park where parents are anti-McDonald's, anti-globalisation, anti-fast food, and prosperous enough for their kids not to work?
- A community where it is impossible to find a kid from a home with a shower?

You are back where your solution to the problem is unique. Feel free to share your case study - but it will never be “the right answer”. Look for instances, stories, biographies, case studies – not textbooks, how-to's, rules and fixes.

**10. Every wicked problem solver has no right to be wrong - they are fully responsible for their actions.** When will your mine be safe? When will it be environmentally responsible? Under what climatic conditions will the noise impact be acceptable? There is no firm answer (look at the results of others, earlier, evaluations of what is “safe enough”). If you can't stand the heat, get out of the kitchen. This is the nature of significant engagement with the world. Mining Kakadu for uranium, re-forestation Weipa after removing its bauxite and kaolin profiles, or mining coal from verdant coastal farmlands are inextricably ethical. If you want to be the agent of doing something new, then responsibility is embedded in the task. Society is not simply economy. Do what you believe in – and be ready to be accountable for those beliefs.

Social context is integral to a wicked problem. You reach a solution when those who have a stake in the problem agree it is a solution. You have a range of problem owners – and it requires your leadership and courage to act, enact, and ensure sufficient acceptance for the fruits to be appreciated by all. Welcome to the grown-up world! The burden of responsibility is matched with the joy of authorship. “I did it!”

So there they are. Ten features of the kind of contexts that anyone who is venturing something new in the world will recognise. Ten windows on tackling systemic issues that would otherwise rapidly exhaust the useful limits of your standard set of management tools (PERT, RCA, SQC, Gantt and kin). And when those limits are found it will be you as a human person that has to re-enter the fray. Knowing that you are likely to be working with a class of problems that your education has ignored, but that are nevertheless well characterised, means you can seek the right help.

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#### *About the Author*

David Jones of Just Knowledge Australia P/L is a specialist in the process of thinking and knowledge capture in contexts where “wicked problems” are the daily fare. In these contexts he favours human and intelligent solutions over IT and engineering metaphors.

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**David Jones, March 2005**

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