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Sustainable Practice: an ontological politics

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BACKGROUND
We have a complex and dynamic predicament. Sustainability is often offered as part of the resolution of our predicament. There is though no direct path to resolving issues to do with sustainability for the direct paths often have unintended consequences. Engineers' traditional practice of rationalisation and reduction (for example as embodied in the notion of technical efficiency at minimum cost) is a form of direct response aiming to simplify complex problems to solve them. This rationalising and reducing though has been extremely useful in solving problems of a certain type but now we are in a complex and dynamic predicament and continuing these approaches (in isolation) will exacerbate rather than help to ameliorate.
Peoples realities and conceptions are different as a result of their different genetics, histories, experiences, cultures, education, roles etc. and this applies particularly to conceptions of sustainability: there are no or few attempts at shared understanding. Further people's understandings and ways of responding are not static rather their behaviour emerges within context. Reality also includes 'things' both material and conceptual and these 'things' are both mutable and mobile. Some ideas, especially those at a 'system' level are only understood via instruments and the data that is produced – this puts these ideas at a distance – they are more remote to our senses. In the light of all the above, achieving consensus towards meaningful solutions in relation to sustainability or the resolution of our predicament is difficult and requires different practices to those normally used by engineering practitioners.
For engineers technology and the technical will be a major part of our solutions but if we are not able to engage at a level that takes into account the complexities and dynamics then we will be doomed to being part of the problem. This paper argues that ontological politics is a useful conception to aid in the navigation of the issue of sustainability. Further the notion of 'practice' is irreducible (it is a personalised and professionalised set of knowledge, skills and attributes). Sustainable practice is a potentially transforming concept. Using this practice we will engage with other disciplines, recognise the complexity and dynamics of our predicament and be empathetic with other peoples' complexities in the process of adapting with our context towards more sustainable futures.

PURPOSE
To continue the re-thinking of the nature of engineering and its' practices in adapting with the ongoing challenges of creating more sustainable futures – in this paper attention is directed to the concept of 'ontological politics.

DESIGN/METHOD
The methods used were desk research of context and philosophy, particularly Mol and Carolan's 'ontological politics', and Latour's metaphysics as described by Harman (2009) as well as, experiences using action research – a form of ontological politics, including the preparation and presentation of these a series of papers exposing these ideas at conferences like this one.

RESULTS
Further exploration of this stream of ideas and a paper that is prospective in nature.

CONCLUSIONS
This is an ongoing study and informing of practice. 'ontological politics' is a useful construct for the work of engineers in relation to adapting with emerging sustainable futures.

KEYWORDS
more sustainable futures, ontological politics, sustainable practice.

Background

In a series of papers, presented at engineering education conferences, changes in the world have been articulated (Goricanec & Young, 2011; Goricanec & Young, 2003; Hadgraft & Goricanec, 2007; Young, Goricanec, & Hadgraft, 2004): we described the world as becoming more complex and dynamic as humans have introduced science practices and technologies into all aspects of life. The book *Transforming the 21st Century: Technical Innovations and their Consequences* describes some trends that have emerged:

> "the new century's developments elevated both the magnitudes of output and the spatial distribution of mass industrial production … to new and, in many ways, virtually incomparable levels" (Cover of Smil, 2006).

The most common role of the engineer (and the way that it is taught) though, has been and, continues to be, to concentrate on the technical and technological: for evidence of this it is only necessary to read advertisements for engineering positions, the websites of Engineering Institutions such as EA and ABET and the websites of those Universities that deliver Engineering Education programs. The emphasis for many engineers is this limited role.

Another deeply embedded concept in the management of (most) human enterprises is technical efficiency at minimum cost and this 'efficiency' is applied to all ideas and work. The definitions "skilfulness in avoiding wasted time and effort" and "the efficient use of resources" (Oxford University Press, 1964) imply that in the application of this concept answers to questions are already known as it is difficult to be efficient if there is no clear answer. Yet we know that there are no clear answers in relation to becoming more sustainable, what we do know is that there are many and varied ways that we can experience this idea (Carew, 2004; Mann, 2006), there are many and varied ways forward and that the role of engineers in respect of this is not clear. This lack of clarity is not a 'problem' indeed the questioning of understanding and the exploration of this and related ideas are important to developing a shared knowledge.

When 'efficiency' is continually emphasised the effect is to rationalise, reduce and simplify. In engineering I have heard that if we resolve the 'material' issues i.e. those of water, energy and waste then we will resolve the sustainability issue. The principle of efficiency is then applied: if we use less of any or all of these to perform a function the suggestion is that we will use less overall. But these threads are deeply intertwined if we pull on any of the threads we will affect the other threads. This can be seen in the Jevons Paradox (1866) and more specifically the Khazzoom-Brookes postulate (Rubin & Tal, 2007, a modern interpretation of Jevons), which state that increased energy efficiency paradoxically tends to lead to increased energy consumption due to commoditisation. Further in agricultural practice Borlaug's paradox (2007) mirrors Jevons: through the application of fertilisers and technologies the aim is to maximise production but this does not result in global populations having enough food.

James (2012) so clearly describes the effect of this ontology of 'efficiency' using just one example,

> "we improve efficiency in one thing say the fridge, its reduced costs make it accessible to more of us, And we don't just go on to use bigger fridges and more of them (developing ideas like bar fridges, meat fridges, etc.), we create and expand related spin-off cooling technologies, industries and activities. Air conditioning has become a 'must', we expect access to food from all over the world any time of year, and see refrigerated spaces in supermarkets take up increasing amounts of space as our demand for chilled goods increases. All that also conveys the sense that the food we buy will last longer than it does, resulting in increasingly excessive food consumption, and food waste (4 million tons a year in Australia alone). Of course, not

only is the food wasted, so too is the energy used to produce, transport, buy, store, and dispose of it."

This emphasis on technology and efficiency continues despite engineering Institutions (Engineers Australia (EA) and the Accreditation Board for Engineering and Technology (ABET), for example) expanding requirements for accreditation of undergraduate engineering programs and for graduates of these programs to have more expansive knowledge, skills and attributes. Further, it continues as the bulk of practising engineers are not new graduates and they practice in ways consistent with these foundational ideas. Also most employers of engineers want most of those that they employ to 'fit in' to an existing organisation and paradigm. Note that even these words 'foundational' and 'fitting in', are problematic. Foundations are very much built to be 'fixed' in place, they purposefully don't move around much, fitting into an existing organisation also suggests that this human context is not shifting and changing. Ideas though need to be both mutable and mobile if we are going to understand the complexity and hold on to *all* this complexity when moving towards becoming more sustainable. Further thinkers from different field have recognised that to lift ourselves out of current paradigms we need a different way of thinking and being (Bateson, 1972; Smullyan, 1992, Einstein has also been cited in this regard).

Our technological systems, networks and institutions have become globally interconnected, over-efficient and therefore fragile (Taleb, 2010) and a turbulent field has emerged (as described by Emery p.38-56 in Emery & Trist, 1973). As the interconnectedness increases, the use of efficiency expands and as improbable events (Taleb, 2010) occur the effects reverberate around the world. It has become a dynamic and complex world as human intervention has increased in intensity – without *simple* answers (Appleyard, 2011). There is now even a call for clumsy solutions to this complex world (Verweij & Thompson, 2009).

An early paper in the series identified above proposed that sustainability be embedded in the things that engineering produces, in the way engineering is practiced and in the way that engineers learn (Goricanec & Young, 2003). In another about generative metaphors for engineering (Young, et al., 2004) we suggested that engineers having been a party to creating the labyrinthine predicament in which we are enmeshed now need to find new and novel ways to escape from it: this is reminiscent of the tale of Daedalus. It was emphasized in a further paper (Goricanec & Young, 2011) that practitioners need to develop enhanced practices; the paper showed responses to sustainability issues through integrative practices in organisational settings. Further it was seen in another paper (Hadgraft & Goricanec, 2007) to be necessary to embed these practices in education (including engineering) to respond effectively; the paper describes how these ideas have been implemented in engineering education and in postgraduate sustainability education (for professionals including engineers).

Further, in this series of papers we proposed new practices that are integrative and potentially transformative to respond to these changes. Integration and transformation are both important: integration both across different disciplines and epistemologies (Somerville & Rapport, 2000) but also the integration of ideas into practice (Denning & Dunham, 2010). Transformation (Gunderson & Holling, 2002) like being more sustainable, rather than a direct end, is an emergent property of concentrated efforts. These concerns have been a source of intense interest over more than a decade.

Becoming more sustainable through practices

In this AAEE 2012 paper sustainability is again the subject, with the emphasis on becoming *more* sustainable, as we will never reach an end of sustainability, we will continue to be on the path, as we learn about some aspects we will understand that there is more to do. The link to practice is continued here as we need to move from knowing (epistemology), towards doing and being (ontology) that ensures that a greater goal is achieved. I suggest that having a focus on the meta-concept of *practice* ensures this link continues to be made. I will

use the example of climate change as well as a range of concerns from other contexts to highlight the issues involved.

It is important though to be reminded that we need to develop an understanding of what *more sustainable* might mean, what are the desirable and feasible futures that we would aspire to. While consistent with Moriarty's (2000) call for engineers to know what, know how and know why, this is not the role of engineers independently, so rather than pursue this line of argument I am choosing to consider some practices that engineers do undertake that can be informed by this concept of 'ontological politics'. The outputs and outcomes of these practices though should always be considered within the context of the greater good.

'Ontological Politics' circumscribed

It should be noted here that I purposefully use the term 'circumscription' rather than the more common 'definition', as definition suggests that any term can be separated out and understood in isolation of its context. This idea of separating out and reducing a concept to its minimum is in fact part of the problem that we have. Instead there are many ways to understand this term 'ontological politics' and it is this fluidity that is powerful here: it is its mutability and mobility (Boudourides, 2001) that allows us to follow the complexity of the situations being explored. 'Sustainability' is similar: it too has many different conceptions – it is understood by people differently depending on their reality (Carew, 2004; Mann, 2006). This fluidity is not a 'problem' rather it is congruent with the complexity involved.

Here I suggest 'ontological politics' as a conception that can aid the embedding of sustainable practice into engineering and its education. Ontology is the study of what *is*, or reality, it is different from that which the focus of most education – epistemology or knowledge and what we know (Gruber, 1993). I also extend the use of the word ontology to refer to what we *do* individually and collectively and *the way that we do* as distinct from what we know or we think we do.

Mol (1999) uses 'ontological politics' in her chapter with this title to remind us that reality is "being performed in a variety of practices". Depending on the discipline or even the tools that are used reality (and conceptions of it) varies: even within engineering this malleability of emphasis occurs. In civil engineering climate change is a potent problem especially for those that will be employed in government organisations of all kinds. For these practitioners the emphasis is on the sustainability of infrastructure. For electrical engineering it is a more distant issue for most practitioners but can be more relevant to those associated with energy production and distribution for example. Here again the emphasis is on infrastructure, but only a few practice in this area. For environmental engineers the emphasis is more on sustaining nature and the natural in among the infrastructure.

Depending on the measures that are used climate change can be viewed and understood quite differently. When thinking about or considering actions towards becoming more sustainable there are an enormous number of choices to be made – there are considerations of tangible 'waste' such as of energy, water and materials. Further, even if we consider the simplest notion of sustainability – the Triple Bottom Line (TBL) – Social, Economic and Environmental we have quite distinctly different knowledge and the practitioners in these fields have quite different ways of being. For those that work in the social arena the focus is on the human, while economists are more conceptual in their ontology – the emphasis is on numbers. These though are only broad headings, within these there are potentially an enormous number of ontologies that could be engaged in the process.

Further, Mol (1999) states that there are "options between the various versions of an object". Take for example the Wivenhoe Dam it was considered the answer to Brisbane's water problems but more recently after the recent floods it, in of itself, has become a 'problem' in relation to controlling the flow in these conditions and the engineers that controlled the flow are being questioned regarding their use of regulations during this event.

Carolan (2004) in his paper *Ontological Politics* elaborates further in an environmental context. He explores the interrelationships between epistemological distance and complexity. He frames epistemological distance through the need for instruments to detect the presence or absence of something or whether we can directly 'see' it e.g. the difference in this regard between litter and global warming. In this latter case he suggests we have to go beyond direct measurements into the collation of indirect approaches to understand this reality. He suggests that the effect of increased epistemological distance and increased complexity combine to represent different orders of ontology. An example is a way of being that understands the local and visible (of litter for example) is different from one that can understand the conceptual leap of connecting across the varied contributions to the knowledge of climate change. The range of understandings required is immense: e.g. ozone layers, greenhouse gases, measures of temperature historically to ice core histories, the concepts of probability and likelihood are also critical to understanding the contributions of humanity to this situation as described in the introduction above. There is also a spectrum of variations between these two ontologies of the local and that of the epistemologically distant: that is, some may be able to conceptualize relatively simple direct data but not the connection across expansive sets of data developed in different contexts. Further those that come from different cultures may have different ontologies again. For example indigenous Australians taught themselves thousands of years ago how to live sustainably in Australia's landscape: this connected way of knowing and way of being so different from Western ways could be an invaluable source for Australians. Many writers have started to note the possibility in this connection (Flannery, 1994; Gordon, 2012; Sveiby & Skuthorpe, 2006)

Carolan describes the tensions associated with the way that 'problems' *are*. He guesses that a

> "'problem' that *is* a condition would be more likely to be enacted through (quick) technological fixes and those alone."

We can see this play out in the medical profession – acute conditions are recognised and responded to quickly with technological fixes: this saves many peoples' lives. An example is the wonder of angiograms, angioplasty, stents and open-heart surgery to treat cardiovascular problems. In ecology we have similar responses: in relation to weather and climate e.g. Australia's "droughts and flooding rains": when these *are* problematised this way, that is, *as* conditions, technological fixes are brought to bear. A most potent example of this is the de-salination plant as 'drought proofing' of metropolitan Melbourne. In Brisbane the Wivenhoe Dam springs to mind as illustrative of this.

On the other hand Carolan suggests that a

> "'problem' that *is* a process would more likely to be performed through actions and words that redress it historically, and have aims toward long-term systemic resolution."

An example of this in the medical field is population-wide preventative health – reducing the chance that people develop acute and chronic health problems. People's lives have been extended by the use of the combination of acute and chronic health solutions but medicine is not so good at collecting the history of patients (individually or as populations) and developing solutions that prevent disease or enhance health in populations. Further even as we have reduced some e.g. polio, TB, measles, whooping cough we have had increases in others e.g. obesity, diabetes, cardiovascular and poverty continues in both developing and developed nations.

In Victoria at the same time that flooding and drought were performed as conditions they were also performed as processes: during the long period of drought the 155 litres per person program was in place over an extended period, with a view to changing people's relationship to water. This program was dropped with the change of weather and a new government, but it or some variant will probably return when drought returns to southern

Victoria. All our history and our geography points to this occurring – our indigenous peoples have recognized this cycle (Museum of Victoria, 2005) and more recently we have described this pattern as ENSO (Zillman, 2001)(Zillman, 2001).

Carolan suggests that the viewing of any crisis as either a condition or a process shapes how the crisis is *done*, what the crisis *is*, and ultimately what the response will be. This then adds a further layer of complexity as crises manoeuvre and shift. We can see how this has happened over time in Australia as we have grappled with the idea of climate change within our boundaries and how this interacts with the wider world particularly through trade and as we renew our understanding of our place in the world – as a nation state or as global citizens. As professionals we need to keep across this moving picture.

In the Knowledge Sharing Technology project Gruber (1993) recommends descriptions of concepts and relationships that exist for an agent or a community of agents be developed as these allow what he calls ontological commitment. Further he notes that if this set of descriptions is designed appropriately it can be useful in enabling knowledge sharing and reuse beyond that agent or community. An example of this is the glossary of terms and other descriptive pieces used in the Swinburne Engineering Program Renewal process: these have allowed a commitment to the process of renewal to occur. The development of these pieces did not occur out of the 'ether' but out of an ongoing process of engaging with the question of what is engineering and what should it be, together with the academic literature, relevant engineering institutions requirements, university requirements, as well as, a developing sense of how to embed these emerging ideas into a range of engineering programs.

In another powerful model (or ontology) innovation arises from the 'circulating reference' between human and non-human actants, especially the extraordinarily powerful 'ideas' (Latour, 1999, Ch. 2 and Harman's (2009, p. 73-79) treatment of this). This is in counter-distinction to the usual approach of separating out the different stories into say political or economic factors (or indeed cycles of invention and adoption (Denning & Dunham, 2010)).

The approach of Latour says that during the process of an innovation emerging you cannot know what is real and what is unreal, what will win in the "trials of strength" – it could be that an argument developed by economists wins out and circumscribes the technical decision, or that politics will win over the economists and in so doing creates a situation in which the totally new solution is impossible to adopt.

In these "trials of strength" the winners are those that bring together as many connections to as many of the 'pieces' of reality as possible in such a form that it has strength of hanging together well, it is flexible and resilient under attack. In this philosophy the actants gain strength through their alliances. This then is the form of 'ontological politics' to which I can subscribe, especially when creating anew.

Through the lenses described above politics becomes about understanding the many and varied practices (and the multiple ontologies that emerge), the sorts of evidence provided and the potential choices that are available. As objects and people potentially carry new ontologies with them and reality is done and enacted, reality is *re-cognised* as impermanent and mutable. At the same time there are some things that are more permanent and more immutable (our understandings of the physical world and our technologies are examples of those that are more fixed but not totally immutable – witness our shift in understanding with quantum and chaos theories).

Towards transforming engineering

We, as engineers and engineering educators can, using 'ontological politics' as a framing, understand our research, our designs, or our innovations as propositions, as possibilities or choices, rather than as singular answers. Engaging in this type of politics becomes about informing choice of possibilities that may transform.

There is an issue with *how* to 'transform' practice within engineering. I suggest that we consider this *as* a *process* which means that we need to take into account the history and how it came to be this way in all its complexity and dynamics. We also should be seeking a long-term systemic resolution rather than a quick fix.

There are a number of paths that engineering institutions could take:

- Continue embedding these ideas into undergraduate engineering programs and thus into the practice of engineers who are graduating from programs now and into the future. In this regard though thinkers and practitioners with broader, more integrated conceptions need to be employed in the design, development and implementation of programs and their renewal.
- Engineering Institutions such as EA and ABET and engineering Schools need to consider how to move these ideas into the practice of existing professionals through engaging with industry and government bodies. Again some more integrative and potentially transformative practices may need to be employed to connect the various threads required.
- Another approach may be to develop a new (engineering) discipline that works in the spaces between disciplines and organisations.

In this paper 'ontological politics' is offered as a valuable and useful conception to be embedded in our practices. It is congruent with the complexity and dynamics of the situation we find ourselves in and can aid us in moving forward in navigating our adaptation with our context towards more sustainable futures.

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