OHS WORLD VIEWS: IMPLICATIONS FOR PRACTICE OF OHS IN CONSTRUCTION

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ABSTRACT
In Australia there has been a steady decline in the number of construction injuries, but the number never seems to reduce below a certain level. Why are workers still being injured?

One lesson from systems thinking is that the structure of a system is understood from the pattern of observable events, such as injuries or fatalities, which result from that system. However, one’s understanding of the pattern of events is influenced by one’s world view. This paper advocates the use of Pepper’s four world views based on metaphors of similarity, machines, organisms, and systems in environments, as a framework for interpreting a system’s patterns of behaviour.

The hypothesis of this paper is that the construction industry needs to recognise the way the different systems approaches associated with these world views provide a systemic approach to managing risk associated with different levels of complexity. In terms of the construction industry this translates into an integrated hierarchy of OHS management approaches ranging from the classification of hazards, to a process view of risk, on to approaches that help conceptualise catastrophes associated with the failure of tightly coupled systems as the result of a small change, and ultimately to an integrated experiential learning approach to risk management.

Keywords: Construction, OHS management systems, Systems approach, Risk management, World views

INTRODUCTION
The construction industry in Australia, as in most countries, is characterised by the speed with which it reflects economic activity, particularly relating to economic outlook, government spending, and interest rates. This volatility is evidenced by the relatively strong deviations around the industry trend line (Figure 1). The Australian Construction industry employed 876,000 people in 2005–06, representing 9% of the Australian workforce (ASCC, 2008). It is characterised by its organisation around a diverse range of housing and infrastructure projects each demanding high standards of construction and timeliness, and by reliance on contractors and a mobile workforce (Lingard and Rowlinson, 2004). To add to this complexity, the industry’s industrial relations scene has a history of conflict.
On the side of safety, Lingard and Rowlinson (2006) report that in international terms the construction industry “continues to maim more of its workers each year than any other industry” (p.1). Data for Australia shows that in 2005–06, 14,360 claims for compensation were made by employees in the construction industry, accounting for 10% of all serious workers’ compensation claims. This equates to 39 employees each day requiring one or more weeks off work because of work-related injury or disease (ASCC, 2008). This incidence rate is significantly worse than the Australian average (Figure 2).

So we are confronted with a significant challenge: how can OH&S effectively be managed in an industry characterised by such complexity?

Lingard and Rowlinson (2006) provide a useful summary of past approaches and some insight into how we may progress into the future. In particular, they stress the importance of design, the need to build OHS standards into competitive tenders, and the importance of understanding safety as a social and moral responsibility. They discuss the perennial question of whether accidents are the result of the worker or the system, and survey a range of modelling approaches that help us to better identify and understand risk. In particular, they comment on “the need to change the culture of the construction industry from one in which risks are regarded as an inherent part of the job to one in which employees at all levels actively care about not only their own OHS, but also the health and safety of others” (p. 318). They argue all levels of managers must demonstrate commitment to OHS, and emphasise that OHS management systems should not be centralised and bureaucratic.
But how is this to be achieved? Lingard and Rowlinson (2003) draw on their observation that the construction industry fails to learn from its experience of occupational injuries and illnesses to point the way to the future; they argue the way forward is to apply the principles of “organizational learning” to OHS management.

This paper supports this view and argues that in order to create this future we need to better understand the way OHS management approaches are framed and how these approaches facilitate learning.

To develop this argument, this paper explains the way in which safety and OHS management systems can be framed using different “world views” and corresponding systems approaches and the way in which this relates to learning on the job. In fact, these approaches are not entirely new in the safety industry, but in this paper they are framed as a hierarchy with increasing explanatory power; they provide a systemic approach to managing risk and OHS. Failure to recognize the importance of this hierarchy has been revealed in the Victorian Bushfire Royal Commission where it it has been reported (ABC News, 1 July, 2009) that “Counsel assisting the Commission have found Victoria’s fire agencies were ill-prepared for Black Saturday”; management, communication, and physical systems with relatively low levels of capability were no match for the catastrophic events of Black Saturday.

FRAMING OHS LEGISLATION AND MANAGEMENT SYSTEMS

Harcourt (1996) identifies four different approaches to OHS:

- The “market” approach in which dangerous work is compensated with wage premiums;
- The “regulatory” approach in which standards are set to limit hazard levels or prescribe safe production methods approach;
- The “accident compensation” approach in which employers are rated on their safety record with consequent effects on insurance premiums; and
- The “workers’ rights” approach, in which workers can refuse unsafe work.

Harcourt is critical of the first three approaches; he argues that the market approach can be subjected to employer coercion and the lack of employee power to bargain for appropriate rates; the regulatory approach is hard to enforce and difficult to apply in hazardous situations; and the accident compensation approach fails because it does not link employer costs to unsafe conditions. He favours the fourth approach because it helps detect hazards and provides the incentives for their prevention and rectification. There can be little doubt that workers in the
construction industry would support Harcourt’s preference. Employers may not be so convinced and would cite cases in which unions are alleged to use this approach to coerce other workers into boycotting sites for political reasons under the aegis of safety.

It is not the purpose in this paper to explore the advantages and disadvantages to these approaches, but to simply point out that each approach adopts a different perspective of the OHS situation and that we learn by debating the differences and adopting one or another approaches as a basis for practice. That is, we recognise the “creative tension” inherent in studying and applying these different approaches.

This is the essence of what is being proposed in this paper: we identify four world views and corresponding systemic ways of approaching OHS, and we debate their advantages and disadvantages and secondly, we learn from our attempts to implement them.

Before detailing the hierarchy of systems approaches being advocated, it will be useful to clarify the usage of the term “system”. As Lingard and Rowlinson (2006) explain in reference to their discussion of the “socio-technical approach”, AS/NZS 3931:1998 defines a system as:

[A] composite entity, at any level of complexity, of personnel, procedures, materials, tools, equipment, facilities and software. The elements of this composite entity are used together in the intended operation or support environment to perform a given task or achieve a specific objective (Standards Australia, 1998).

This definition emphasises the notion of physical “parts and wholes”, and the way they combine in support of a given outcome, the “systems’ purpose”. Specifically, parts are identified with tangible entities such as personnel, procedures and materials etc. This definition pretty much aligns with the colloquial use of the term “system” and what systems theorists identify as a “mechanical” view of the universe. But, this definition makes no sense when, for example, you refer to a “system of ideas”. This indicates that we need a more general concept of what a system is. One such definition is that a system is a conceptual framework that we use to help make sense of complexity (Lilienfeld, 1978; Barton and Haslett, 2007).

Digging a bit deeper, we learn from cognitive science that conceptual frameworks are essentially metaphorical (Lakoff and Johnson, 1999) and that there are essentially four metaphors that drive our thinking (Pepper, 1942): Formism, a lens through which one sees categories of similar and different events; mechanism, a world view that causes one to see controllable machines with inputs, outputs, processes and feedback; Organicism, a world view sees the world as an organism evolving in response to the environment; and Contextualism, which sees operators in the world who influence the environment and are influenced by it.

Applying this thinking to OHS, depending on your world view, you see different management systems, develop different organisational cultures and use different risk equations to think about risk.

Using Pepper’s world views we can establish a hierarchy of systems approaches:

- Classification systems. These systems are based on being able to recognise similarities and to group things accordingly. Common examples include library classifications, accounting systems, and hazard classification systems. Classification systems provide a language which allows us to communicate about systems. They usually constitute our first mode of thinking when we see something new: the first questions that come to mind are “have we seen this before?” and, “is it like anything else I know about?”
- Mechanistic systems. These systems view things as machines. They can be static or dynamic machines. Examples include thinking about organisations as machines; supply chains; competitive markets; economic systems; process models; and building systems.
- Organic systems. These systems view entities as organisms that go through a life cycle. They exist within an environment and passively adapt to environmental change. Examples include
thinking about networks of relations; self-organising systems and emergent systems. An important organic systems perspective that relates to risk is the study of highly interconnected systems that can turn catastrophic as the result of some small change within the system— the “butterfly effect”. This framework helps us to understand the dynamics of weather systems, bush-fire behaviour and structural collapses.

- Open systems in which people and organisations form systems that interact with their environments, or contexts; they constitute “social ecologies”. Four sets of dynamics interact: internal dynamics of the system; external dynamics in the environment; dynamics in which the system impacts on the environment; and dynamics in which the environment impacts on the system. Such systems allow for the purposeful adaptation to and by the environment. They allow for learning and reflection and provide the basic metaphor for understanding human learning and the co-evolution of systems and their environments. Such learning systems lie at the heart of team learning constructs such as those found in quality management (the Deming cycle) and six-sigma processes.

Pepper’s world views and their corresponding systems approaches are summarised in Table 1.

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<thead>
<tr>
<th>Pepper’s World Hypothesis (Metaphor)</th>
<th>Systems Approach</th>
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<tbody>
<tr>
<td>Formism</td>
<td>Classification Systems</td>
</tr>
<tr>
<td>Mechanism</td>
<td>Physical/Engineering/Hard Systems</td>
</tr>
<tr>
<td>Organicism</td>
<td>Organic/Biological Systems, including complexity and chaos; evolutionary systems</td>
</tr>
<tr>
<td>Contextualism</td>
<td>Open/ Purposeful Human Systems; social ecology and co-evolution</td>
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While the first two systems approaches emphasise analysis, in that you attempt to learn about the whole by studying the parts, the second two emphasise synthesis in that you attempt to learn about the parts by looking at properties of the whole. Analytic systems tend to explain how something works; synthetic systems help us understand the system’s purpose; why something exists (Barton and Haslett, 2007).

It is important to understand that these systems frames complement each other. But as you will find, it is sometimes argued that for example, viewing an organisation, as a “machine” is "inappropriate", but viewing an organisation “organically” is acceptable. In fact, both views are important. Overall this hierarchy of systems approaches increases in its power to explain a given situation as we move from classification systems to an open systems viewpoint. For example, while the classification of the sectors within the building and construction industry is very useful as a reference point for classifying data etc, it does not have the explanatory power to help us understand the full dynamics of the industry as it has developed over the past twenty years. A mechanistic interpretation of supply and demand will give us a better understanding, and better still will an organic view of the way the industry has emerged with developments in building technology, for example. But the most complete explanation will be obtained by understanding the way the industry has co-evolved within its socio-technical context, in which certain areas of human enterprise will have transformed the industry by adopting new building practices such as the use of rendered “blue sheet” in house cladding, or prefabricated structures in multi-story buildings, or the use of design construct contractual arrangements.

In general terms we view the first three systems frames as relating to “closed” systems and the fourth as an “open system”. In thinking, we use closed systems to form hypotheses as in a laboratory, but we only really understand the implications of our hypothesis when it leads to action in the real world. Consequently, in considering risk, we can make an estimate of the risk based on closed system laboratory tests, but the risks may only be revealed in the longer term as a result of
using a material in the open systems context of the actual construction process as we have found with materials such as asbestos.

When developing a more complete approach to OHS we need to apply all these modes of thinking. In fact, as will be discussed below, aspects of each of these approaches have been used in OHS; it is just that the way they complement each other to form a more robust systemic approach is not recognised.

**APPLYING SYSTEMIC THINKING TO OHS IN THE CONSTRUCTION INDUSTRY**

One of the most significant examples of the application of systemic thinking in OHS in construction relates to the shift from the traditional approach of detailed and prescriptive standards to performance and process-based standards (Johnstone, 1999; Breslin, 2004). The prescriptive approach is based on classification systems and assumes an ability to be able to classify hazards and design corresponding processes for their mitigation and/or control. For example, we recognise that falling objects represent hazards on a building site so we institute a standard for wearing hard hats and back this with compliance legislation. Such approaches are very beneficial in creating awareness. For example, evidence suggests that regulations (based on classification systems) relating to the handling and storage of hazardous chemicals in the construction industry show promise by increasing awareness of chemicals in the workplace, better control of hazardous substances and improved integration of chemical safety into workplace management (Pearson et al, 1995).

But as Breslin (2004) reminds us, the Cole Royal Commission into the building and construction industry has highlighted the fact that despite the “overabundance of laws and tribunals set up to regulate OHS in this industry in Australia, it has one of the poorest safety records in the country” (p. 563). In the language of systems, it is being suggested that the prescriptive approach does not have the “requisite variety”, that is “the smarts”, with which to adequately manage all aspects of OHS in an industry as complex as construction.

The shift to more process orientated (mechanistic) approaches is usually traced back to the Robens Report 1970-72, which inquired into safety and health at work in the UK (Brooks, 2001). Brooks traces this development over a period of 30 years and attempts to make an assessment of “systems-standard legislation” (p. 363). He concludes that a key benefit of this development has been the ability to link performance measures with systems standard provisions (p.363). Of course, the systems construct that Brooks is referring to is the mechanistic framing of processes that, for example, ignores systems of power, which would be a significant oversight when considering the building industry. In the same vein, Mitchell (2000) considers the importance of both input and output performance measures for the construction industry and proposes a set of 22 “positive performance” measures. Perhaps of greater significance to safety in construction is the attempt to develop safe design guidelines so that upstream hazards can be eliminated (Breslin, 2007) which is clearly using a mechanistic process view of construction.

These process approaches reinforce Reason's (1997) socio-technical systems-based model of human error. “According to Reason, organisational factors, such as budget allocation, communication, planning, scheduling and unwritten rules about acceptable practices within the company are the starting point for organizational accidents” (Lingard and Rowlinson; 2004, p 25). But, as Emery and Trist (1965) point out, the socio-technical perspective is still essentially mechanistic in nature; it was this realisation that gave birth to the social-ecology perspective (Trist, Emery & Murray, 1997).

It is significant that the majority of OHS thinking applies the first two systemic frameworks-classification systems and process/machines. These presume a relatively clear view of risk, but start to struggle when it comes to incorporating more extreme hazardous situations, for which organacist approaches are more appropriate. Suddenly we are in a sparse landscape where we find an emphasis on approaches such as “crisis management” (Lingard and Rowlinson, 2003). But, despite attempts by Campbell (2004) and others to include processes for the early identification of
major hazards and their mitigation, they have an aura about them that suggests we become experts on cleaning up the mess resulting from catastrophes rather than preventing them. Apart from a small number of examples, such as McLucas (2003), where attempts were made to better understand the non-linearities of catastrophes, there appears to be a significant gap in research into catastrophic processes in the building and construction industry. Too often, as McLucus points out, recommendations by inquiries into catastrophes are made within the context of the prevailing world views that are really part of the problem, and so nothing really fundamental changes.

McLucas uses methods such as causal mapping, developed from investigations into aircraft accidents, to describe feedback dynamics; this method may have a significant role to play in understanding the dynamics associated with extreme accidents such as building collapses. In addition, there would appear to be an important opportunity for researchers to consider the role played by "local rules" in establishing what really goes on in managing safety on a construction site (Haslett and Osborne, 2000).

Significantly, there is considerable evidence of attempts to adopt the learning constructs inherent in the fourth approach to systemic framing: the social-ecology or open systems approach. This is the domain of purposeful behaviour and learning, the approach Lingard and Rowlinson (2003) see as the way of the future. An interesting feature of this approach is the way in which it utilises the power of the previous three approaches in support of its learning agenda. In this approach, frameworks using the first three world views can be used within the learning approaches defined by the fourth world view. Although not identified as such, this approach is demonstrated in the Victorian WorkCover Authority’s approach to safety management systems (SMS) for major hazard facilities (see Figure 3). This approach advocates a series of SMS tests based on classification, and control measures based on a mechanistic control systems approach as major inputs into a co-evolutionary, open systems, management system which can be described as an action research cycle (Barton and Haslett, 2009; Tepe and Barton, 2009).

Such open systems learning frameworks are also implicit in the discussion of self management and team processes (MacIntosh, 1994); worker participation (Gunninham, 2008) and union participation (Warren-Langford et al, 1993).

Consequently, while we observe that various systems approaches have been applied to OHS management, they have been applied without recognition of the existence of a hierarchy of systems thinking approaches. This hierarchy is based on a number of world views or metaphors that frame complexity and show how we can manage risk within an experiential learning framework (Tepe and Barton, 2009). Indeed, this pluralistic approach constitutes a risk management strategy in itself, hedging against the type of human fallibility evidenced by our continuing difficulties in understanding the nature of systemic risk.

In summary, recognition and understanding the systems hierarchy based on Pepper's world views facilitates a systemic approach to OHS whereby the complexity of individual risk situations can be matched with an appropriate systems approaches and learning frameworks and where the viability of the total risk management system can be understood (see Tepe and Haslett, 2002).
CONCLUSION
All will agree that the construction industry is complex and, with the increasing rate at which the workplace is being “refashioned” to encompass more flexible work arrangements and increased worker participation (Johnstone et al, 2005), new approaches to OHS need to be developed. This paper supports the contention that on-the-job (experiential) learning will form the core of these new approaches. But for these approaches to work, this paper argues that they need to be linked to a hierarchy of systems approaches that have the intelligence to cope with all forms of hazard that exist on a construction site.

At the present time, while there is significant evidence of experience in applying these approaches in one form or another in the construction industry, but the overall approach is not systematic and is particularly exposed to systemic risk and catastrophic events.

REFERENCES


