DECISION INTEGRITY AND SECOND ORDER CYBERNETICS

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ABSTRACT

The rational worldview of management science has come to dominate decision theory. This chapter proposes that, despite its evident successes, this view of decision making is decreasingly effective in a global world which turns out to be unruly and unpredictable in critical areas. The result is an escalation of unintended consequences in business, public affairs and human ecology. Despite its success in some fields of management, we need to question the rational view which disconnects the observer from the observed. Decision integrity is proposed as a reflexive theory of decision making that incorporates the decision maker as part of the decision field. It requires stepping out of the observer/object paradigm of classical science and into the alternative paradigm of second order cybernetics. The decision maker is not simply an observer but also a participant who cannot abdicate from personal ethical considerations and ultimate responsibility even in the face of uncertainty.

Key Words: decision process, decision field, decision integrity, conceptual emergency, second order cybernetics, ethics, induction, learning, holarchy, scenario planning

INTRODUCTION

"Man is the prisoner of his own way of thinking
and of his own stereotypes of himself.
His machine for thinking
the brain
has been programmed to deal with a vanished world.
This old world was characterized by the need
to manage things –
stone, wood, iron.
The new world is characterized by the need
to manage
complexity.
Complexity is the very stuff of today's world".

(Stafford Beer, 1975 p. 15)

With the rise and adoption of management science as the primary worldview or metatheory in both commerce and public affairs there has emerged a largely unexamined fixation with rational decision making. Rational economic man has become the unit in modern management and mathematical decision analysis has become the dominant espoused basis of management.

A recent case is the 2008 financial crisis. The growth of markets for derivatives and more complex financial instruments was made possible by the development of mathematical

methods for valuing these new constructs. These became the adopted norm across the banking sector. In this way the very idea of "hedging" was an attempt to eliminate the risks of uncertainty. There is a paradox here. As creatures of limited intelligence in an unstable world we form definable requirements that we hope to fulfil in what we believe to be a predictable world. Commerce has fixated our goal-seeking in the context of profit games. The application of science has identified some domains of relative predictability and they have been adopted as the official view bolstered by economic theory. Management science, over the last few decades, appears to have led us into an evolutionary trap. Kay (2008, p. 43) points out that "our abilities in pattern detection often lead us to observe systematic relationships where they do not exist, or confuse underlying causes with statistical noise." For example, people view economic behaviour in the context of equilibrium theory and anticipate the future accordingly. As we shall see, there are other models that predict different futures on the same data.

The implicit view of the operating environment is something like "this is what we want; this is what is going to happen in the world; so we know what we are going to do in that world in order to get what we want." Herein lays the trap. The world is continuously changing, it is complex and it throws out events and properties which are outside any range of prediction. Such events have been characterised as the phenomena of 'black swans'. (Taleb, 2007) The Black Swan theory refers to the implications of large-impact, hard-to-predict, and rare event beyond the realm of normal expectations.

We are part of this world, not separate from it and so of the same nature. When we rationalise ourselves and our world we are asserting something which at best is of limited consistency with how things really are. The perverse consequence of this is that the more we assert we understand the world, and so limit what we do, the more we find ourselves living with the unintended consequences of our decisions.

The above view can be applied to the individual, the group, the institution, the nation and the globe. From a management perspective we focus on the institution or organisation. Organisation management, dominated by the management sciences, has analysed and systematised situations to bring them under control to pursue goals such as "return to shareholders" or "public value"

However, the real world leaks out from the boundaries of rationality, springs surprises on us and confronts us with uncertainties. Indeed, on occasion, the world smashes through the very centre of institutional life and destroys jobs, companies, industries and even whole economies. Control should then be seen for what it is, a convenient half-truth.

> "We need probabilities to help us assess risks and narratives to guide us through uncertainties – and the general knowledge and judgement to know how to approach each particular situation. It is that general knowledge and judgement that has been so lacking in the financial follies of the last decade." (Kay, 2008, p. 43)

The kind of decision making that dominates in the "controlled world" does not match the behaviour of the "uncontrollable world". Effective decisions cannot be arrived at by rational analysis alone because the rationale is inherently a limited perspective. We need the half-truth this generates but we need an approach to deal with the missing unruly half. Kay points out; "We suffer, not just from ignorance of the future, but from a limited capacity to imagine what the future might be." (Kay, 2008, p 43)

Some thinkers and practitioners have made efforts to create alternative modes of perception, analysis and decision making more congruent with this unruly world beyond the veneer of socio-economic rationality. The International Futures Forum (2009), sums up its foundational work in addressing these issues in a text called *Ten Things to Do in a Conceptual Emergency*. This puts forward ten strategies that offer prospect for working towards the other half of truth not accessible to rational analysis. The following subset of five principles, summarised below, helps to frame the approach in this chapter.

Give up on the myth of control
: We have taken our ever more sophisticated models as a proxy for reality. But our models break down in the face of the real complexity and mystery of the world.

Trust subjective experience
: The implications for how we see the world and our place in it are critical for our understanding of it and our behaviour towards it and, more profoundly, as part of it.

Form and nurture integrities
: The traditional model of organisation is struggling. Start by replacing integration with the more flexible and adaptable notion of integrity.

Re-perceive the present
: We underestimate the importance of living more deeply and consciously in the present. We need to extend our habits of what counts as 'knowledge'.

Move beyond an enlightenment consciousness
: The subject-object split is the hallmark of the Enlightenment, the separation of self from the world. We need to recognise a new context.

In a conceptual emergency it is necessary to take a different approach to decision making than the one which dominates the current paradigm of management.

This chapter will bring together a number of theoretical perspectives from the diverse fields of strategic management, scenario planning, learning theory, cognition and induction, reflexive investment theory, and new organisational forms under the overarching notions of second order cybernetics. Decision integrity will be used as a term to embrace the synthesis in both theory and practice that emerges. This synthesis will be considered in the context that a large scale shift is occurring from the modern age, in which objectivist science has ruled, to the global age in which a higher variety science is emerging that allows for a greater number of variables in the way valid science will be conducted and which will acknowledge von Foerster's requirement that a theory of biology should be able to explain the existence of theories of biology.

New Context, Old Ways

A distinction can be made between a decision field and a decision process. The decision field is the context of decision, its environment and all the external factors that will have some bearing on the decision. The field is in the present but also has attached to it histories giving it momentum and futures in the sense of trends and emerging patterns. The decision process is how the human decision maker conducts himself or herself to investigate, assess and intervene in the decision field. Aspects of the decision process are unconscious, like habits of mind and a taken-for-grantedness of the nature of the decision field. Other aspects are designed according to disciplines and understandings and could be called the

decision system. The decision system can also be viewed as the espoused theory (Argyris, 1990) of the decision makers.

Clearly, for successful outcomes, there needs to be sufficient correspondence between the decision process and the decision field, the latter usually being largely outside the control of the decision makers. For example, a market may be moving in a certain way which will prescribe the range of options for choice. In an expanding market the choices may be about investment in growth opportunities; in a shrinking market the choices may be about competitive strengthening or about exit strategies.

When the world is behaving in a reasonably predicable and forecastable way, then the decision process can be based on technical analysis, such as net present value or cost/benefit, and the outcomes will tend to be as hoped for. Indeed, accumulated successes in this way will become ingrained the generic type of decision process as the success formula for that world.

If the world is actually more complex, more interconnected and more uncertain than supposed then there is a mismatch between the decision process and the decision field. To be successful the appreciation of the decision field must keep up with changing circumstances. The decision system has to take into account an unruly rather than a predictable world. One of the more successful approaches to coming to grips with the uncertain world is scenarios planning (van der Heijden, 2005). The basic idea of scenario planning is to acknowledge that prediction and forecasting are rendered ineffective in a world where structural change is taking place and consider multiple possible futures Further, taking a systems view of the world where structure determines behaviour it follows that distinct possible futures will have different underlying structures. There will be essential discontinuities between them. No extrapolation of the behaviour of today's structure will give account of different structures emerging in the future. Each shift of structure has different behavioural outcomes over different time scales (Curry and Hodgson, 2008). So now our reading of the decision field is more sophisticated, allowing for alternate structural changes with their accompanying narratives. A scenario exercise, then, constructs several different "structures in the future" which then serve as a test bed for proposed strategies and policies. This kind of exercise can unearth hidden assumptions, challenge rigidity and stimulate option generation (Sharpe and van der Heijden, 2007). Hodgson (2007) has demonstrated how the structural differences between scenarios can be modelled using causal loop methods.

In a scenario exercise, environmental trends, uncertainties and potential discontinuities are converted to a set of future scenarios. The decision field is now more in correspondence to the realities. In the decision process strategies or options are proposed and prepared. These are tested as to success or failure in each scenario and overall improvements made in risk assessment, strengthening robustness and evaluating on options to pursue. This is the decision shaping stage. The problem comes at the choosing stage. The criteria used for evaluation, dominates by the ordered world paradigm, are largely first order analyses of using criteria like net present value, economic thresholds and so on. The practical outcome is that the even though the scenario work has transformed the perception of the decision field it has not changed the perception of the decision maker. The result is that the decision gets taken in the "business as usual" mode with at best only minor assimilation of the implications of the scenarios and consequently a massive reduction in the consideration of options. Both flexibility and anticipation are lost.

So the promising new way of viewing the decision field, scenarios, runs into the linear decision process of the previous phase. Hodgson (2007) points out that strategic thinking with scenarios in itself is also invaded by linear assumptions. The rules and practices of the decision process do not change to keep pace with the change in perception of the decision field or, worse, even prevent the construction of a valid scenario set.

So there are two obstacles to strategic decision making in the face of complexity and uncertainty. One is changing the perception of the decision field and the other the changing of the decision process. Out of the author's many experiences of encountering these difficulties two will serve to illustrate these difficulties. Both examples refer to a leading and historically successful major UK domestic retailer. The first example concerned developing a scenario set based on some agreed driving forces and uncertainties where the logic pointed towards a possible scenario of rapid internationalisation of retail competition. This provide very difficult to get management to accept and eventually was considered only if it was a remote possibility, say in three to five years time. Six months later a major domestic competitor was taken over by Wal-Mart, changing the market dynamics. The second example concerned a review of strategic expansion into a potentially lucrative Europe wide market. A successful scenario exercise provided several business streams with stimulus to create a tenfold increase in the number of options. Yet when taken to the decision stage there was no decision process that could handle the opportunities and activity collapsed back pretty much to "business as usual". Shortly after this the ownership of the company changed hands.

The constraint on decision making reflects the impact of management science. It is necessary to open up the boundaries of management thinking in both theory and practice. (Mitroff and Linstone, 1993). In the business as usual decision process, however intelligently and thoroughly carried out, the mental model of the decision maker is not treated as part of the system in question. It stands outside of it in the "observer distinct from the observed" mode. It is first order. "It is the principle of objectivity that the properties of the observer shall not enter into the description of his observation". (von Foerster, 1995. p. 3)

Decision as Learning

So although multiple structural anticipatory scenarios can help create mental conditions for revealing the hazards, they cannot deal with the framing of decisions in their context. The usual result is that decision makers, having engaged with the decision field as a set of scenarios, reach for the familiar tools of decision analysis and project the rational onto the unruly. In reaching for rules to give them the answer (say the optimum on their usual assumptions) they collapse the benefits of the scenario work. The fundamental incongruence between the complex uncertain nature of the decision field and the assumption limited algorithms of the decision process has been retained. Management lacks approaches to decision making congruent with and capable of incorporating the real value of scenario planning.

Some attempts to overcome this introduce systems thinking into the decision process. For example, system dynamics simulations of different scenarios through micro-worlds can create a game-like engagement with them and help engage the decision maker into a different frame of reference, one that has feedback on the consequences of the decision maker's choices compared to the usual one. (Langley, Morecroft and Morecroft, 2008)) This approach was clearly recognised as a step forward by de Geus (2007) in his discussion of the nature of play in learning and different process that is needed to switch from assimilative learning to

accommodative learning as defined by Piaget. The treatment of decision making as a subjective learning process as well as an objective analytical process, points to a whole new approach to decision making under uncertainty.

The need for decision as learning is strengthened by considering the decision system in the context of cybernetics. Particularly relevant is the role of Ashby's Law of Requisite Variety (Ashby, 1960) in a guidance system. Let us suppose that the decision system has a primary goal. It might be to make money, to heal the sick or to win a team game. The decision field has a quasi-infinite set of states or variables only some of which can be known and predicted. We have established the mismatch between the decision process and the decision field. Ashby's Law states in effect that the greater the variety of the context then the greater the need for variety in the guidance system. Stafford Beer summarised this as variety absorbs variety. This implies that the higher the variety (complexity) of the decision system, the larger the range of perturbations that can be accommodated or compensated. It leads to the somewhat counterintuitive observation that the decision system (individual or group) must have a sufficiently large variety of options in order to ensure a sufficiently small variety of outcomes in achieving the goal. This principle has important implications for practical situations: since the variety of perturbations a system can potentially be confronted with is unlimited, we should always try to increase its internal variety (or diversity), so as to be optimally prepared for any foreseeable or unforeseeable contingency; hence the importance of learning.

This challenge of linking the reframed decision field to the actual mental frame of the decision maker was clear to Pierre Wack, a key originator of scenario thinking. In making his final critique to Shell executives and planners of the state of strategic planning and especially the use of scenarios, he strongly affirmed the point that unless the decision maker himself or herself actually changes in the process of arriving at a choice then the exercise is useless. He names this "the gentle art of reperception". For Wack (1985a and 1985b), the shift in perception of the decision makers was an essential component of the decision system if scenario planning is to be successful. The decision maker needed to enact his or her intentions as a mental rehearsal in the context of the scenarios. To explore this further we need to consider how the interaction between decider and decision field can lead to shifts in the nature of strategies and decisions.

Long experience of helping executive and planning teams both to develop multiple scenario thinking and to frame strategy work to match process to external challenges has led the author to propose that the frame of decision making needs to move from decision maker as detached observer, through involved observation to self-aware involvement. In other words, to move from the classical scientific paradigm, through systems science to the emerging domain of second order cybernetics and the emerging understandings of embedded cognition, to a new resonance between the global decision field and the practiced decision processes. I will call this third stage of correlation, *decision integrity*.

DECISION INTEGRITY

What is a decision emerging from reperception? We must first distinguish between those kinds of decision which are delegatable to constructed systems (such as computer programmes) and those requiring the specific insight of human beings. In an age where more and more decisions are delegated to automated systems (which systems can often perform

better than most human beings at some tasks), why are humans other than a temporary expedient only needed until all significant decisions can be delegated (Kurtzweil, 1990)? The necessity for the human being in decision making arises where there is a need for integrity. Integrity has several aspects to it. It implies integration in the sense of taking into account a whole picture in which the decision is framed in a wider context than that of the immediate concern. For example, regarding the long term implications not just the short term payoff. Also taken into account is the spatial and structural context of interconnections, linkages and feedbacks. So integrity implies the *big when* and the *big where*.

Integrity also involves an ethical dimension, a sensitivity to values, and a degree of consistency in relation to those values that transcend the optimising and satisfising (Simon, 1996) nature of the situation in question. In a complex world these two sides of integrity, the holistic and the ethical, often are in seeming contradiction. In a system where economics is dominant, the ethical is considered secondary and even itself "unethical" by viewpoints such as the Chicago school who assert there is only one social responsibility of business – to use its resources to engage only in activities designed to increase its profits. (Friedman, 1979)

Another approach to decision making under uncertainty is that of risk mitigation. When faced with a set of uncertainties which cover a range of future states, some of which are unfavourable, then the uncertainties constitute a hazard. When we form an intent to act within that hazardous situation we are faced with a risk. The manner in which we deal with that risk will challenge us with an ethical dilemma. In a situation where the risk frame is more complex than a simple good/bad choice and the ethical frame is more complex than a simple right/wrong choice, then we are faced with a need for decision integrity. This is especially so when emergent circumstances present us with incalculable issues and destroy the rule book's validity.

The discussion so far would lead us to believe that as long as we can learn enough we can decide. But given the gap between the high variety of the decision field and the restricted variety of the decision system, there are increasing numbers of questions which are not decidable by those rules and assumptions. This leads us to make the step from first order to second order cybernetics.

In the first order mode, however intelligently and thoroughly carried out, the mental model of the decision maker is not treated as part of the system in question. It stands outside of it in the "observer distinct from the observed" mode. It is first order.

The Inseparability of Decision Maker and Decision Field

Von Foerster (1995) points out that it took some time in the early days of cybernetics for the idea that there is a limitation to the classical scientific paradigm in which the observer is separated from the observed. This paradigm dominates management science and decision analysis. The implication in management is that the properties of the decision maker shall not enter the analysis of the decision space. Breaking out of this paradigm to the view that the observer has to give account of him or herself in the system in question, creates a whole new perspective. He points out that "this perception represents a fundamental change not only in the way we conduct science, but also how we perceive of teaching, of learning, of the therapeutic process, of organisational management, and so on and so forth…" (p. 4). From this perspective, known as second order cybernetics, the decision maker is a participant in the world about which and within which decisions are being made.

Now von Foerster goes on to make a profound but simple observation that relates back to the introductory remarks about decision integrity. In the first order paradigm, decision analysis is considered independent of the analyst and so can be informed by the rules of analysis as to what the "optimum" decision is. Any non-quantitative judgement is based on an explicit or implicit moral code. By contrast, in the second order paradigm the decision maker is considered part of the system under decision and so can only tell himself or herself what the "best" decision is. This, von Foerster (1995) points out, is the origin of ethics and that ethics cannot be articulated as a code. The rewards of ethical action lie in the action itself.

In the paradigm where the decision maker is independent of the decision field, as in the mode of classical science, then the aim of decision framing and analysis is to render the initial question decidable. Von Foerster (1995) also points out that as well as this type of question there are other kinds of question that are in principle *undecidable*. Whether we recognise such questions and how we treat them if we do, is the crux of the matter.

This brings us to need to consider the mental model of the decision maker, and indeed for him or her to consider reflectively their own mental model. Clemson's (1984) treatment of management cybernetics is helpful in representing the basis of this issue. In his discussion of the operational unit in the context of Beer's VSM (viable systems model) he describes a set of relationships as shown in Figure 1a.

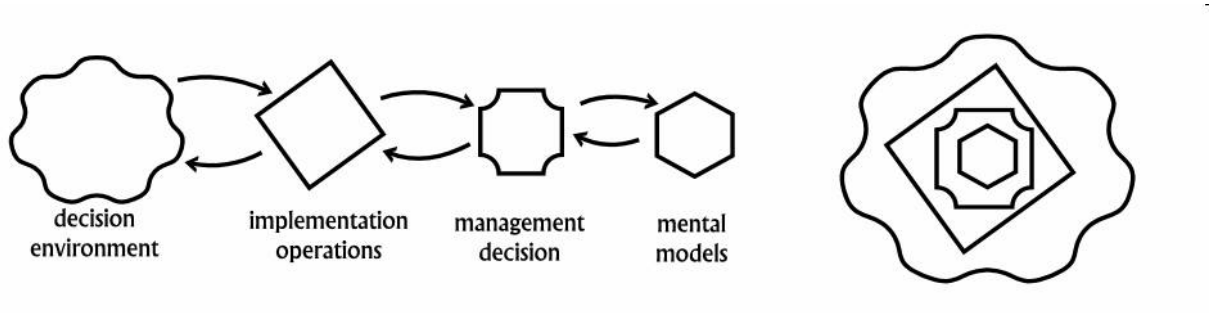


Figure 1. a. An Operational Unit in Viable Systems b. Nested Nature of the Levels

Modified for decision making, the *decision environment* is the contextual field in which the decision is taken. This is also the high variety, unpredictable and unruly world upon which we impose our scientific or rational order. Within that environment and of considerably less variety is the *implementation operation* which is the vehicle of the decision. It could be an organisation or a project. It has a reciprocal relationship with the environment, acting upon it and being acted upon. This, in turn, is subject to a *management decision* that is an intervention by the decision maker. He or she is steering the ship, so to speak, also with a two way interaction based on a *mental model*. Interventions are of even less variety than the operations themselves and the feedback from the operations is highly filtered information. The variety of the decision system is less than that of the decided upon operation. The decision maker's approach to the steering action is therefore framed by the mental model of the decision maker, represented in Figure1a as the hexagon. In other words, how they view the world is a determinant of the interventions made. This is also a two way relationship which may be static or dynamic. In the static mode, equivalent to Argyris's (1990) single loop learning, the main interaction between the mental model and the management intervention is error correction. In the dynamic mode, equivalent of Argyris's (1990) double loop learning

the interaction is assumption revision implying an enrichment of the mental model. If this second order learning does not take place then there is a gap between 'espoused theory' and 'theory in use'. At either level the mental model is being enacted in its engagement with the decision field.

The mental model of the decision maker may be more or less sophisticated. It may be very complex but still linear. It may be informed by systems thinking and cybernetics and enriched with dynamic loops. In this case we could say that the decision system of manager/operation/environment is working in a frame of first order cybernetics. This offers some movement towards decision integrity in a complex interconnected world.

We can make a step towards the second order perspective if we realise that the different components in the above diagram are actually embedded in each other. In other words the mental model is embedded in the decision maker is embedded in the operation is embedded in the environment as shown in Figure 1b. Thus we can see that the decider is actually part of the decision environment or decision field. The decision maker then is exercising a cognitive system which is not distinct from his or her history of action in the decision field. This perspective has much in common with the view that cognition is enactive. In this view representation is taken to be separated from action, whether the realism of construction of a mental model from external information or the idealism as the projection of a pregiven inner world. Varela, Thompson and Rosch (1991) consider the real situation to be a "middle way" between these two opposites. They state that we can

> "…situate cognition as embodied action within the context of evolution as natural drift provides a view of cognitive capacities as inextricably linked histories that are *lived*, much like paths that exist only as they are laid down in walking. Consequently cognition is no longer seen as problem solving on the basis of representations; instead cognition in its most encompassing sense consists of the enactment or bringing forth of a world by a viable history of structural coupling." (Varela, Thompson and Rosch, 1991, p. 205)

From this perspective we acknowledge that the whole of the above cybernetic structure is itself enclosed in a meta mental model which might be considered as the world-view of the decider.

From the perspective of both second order cybernetics and enactive cognition, the separation of decider from decision field is a misleading construct. They are inseparably bound together and the pathway taken by the decider is reciprocally bound up with the decision field and the outcome of any decision.

Induction and Learning

The decision maker is actually more complex than just an observer. To take a decision is to commit to some interaction with the field of the decision and "bring forth a world". An investment decision places financial resources at the disposal of the situation the decision maker has been observing and analysing. From a systemic point of view, the decision maker is an integral component of the decision systems. Yet in judging the efficacy of decisions the dominant viewpoint taken is to exclude or bracket the decision maker and attribute (or blame) ineffective decisions on vague features of the decision maker and blame the decision analysis or the changed environment.

The perspective we are constructing here requires that we recognise, as does de Geus (2007), that decision making and learning are basically two ways of describing the same act. However, taking a perspective from learning theory gives us a different traction on how change of assumption might occur. We explore the proposition that reperception is pretty much the same mental action we refer to as induction.

Holland et al. (1986) in their study of induction go some way to explaining why there are strong barriers to engaging in the kind of learning or reperception required to make decisions under uncertainty. Returning briefly to the Clemson diagrams in Figures 1a and 1b, we note that the triangle represents the mental model of the decision maker. This mental model is a short hand for the cognitive patterning of the decision maker. Holland's approach has similarities to embedded cognition in that the emphasis is on the transactions between the learner and the environment. We encounter the world through transactions between our mental models and the behaviour of the world. When we improve our effectiveness in the world we have made a step of improved correspondence between the mental model and the world. In a quasi-infinitely complex environment, the extent of this correspondence is limited by the law of requisite variety which states that the variety in a control function must match that of the environment under control. For effective decisions there ideally needs to be a sufficient degree of structural equivalence between the mental model and the decision field.

Where we appear to be dealing with the world in a way where its behaviour matches our expectations, we codify and categorise the elements of the world. This correspondence is called by Holland et al (1986) homomorphism. A homomorphism differs from an isomorphism which would require two situations to have equal variety in their equivalent structures. In that sense a homomorphism is a pragmatic approximation. We can link this to the first order view of the world where the homomorphism of the mental model becomes the subconscious assumption that we are the detached observer seeing the world as it really is. If nothing major contradicts this then we apply our categories and rules and so are in the world of single loop learning where deviations are treated as errors to be corrected rather than challenges to the deeper assumptions ingrained in the mental model.

To evoke the possibility of a shift from a first to a second order state of mind the homomorphism must be challenged by a shock or anomaly. We need to examine this effect in context.

The cognitive system can be viewed as a holarchy (Koestler, 1967). The most general level is H_0; within this are sub-holons H_1, H_2, and so on; and within any of these are further sub-levels $H_{1.1}$, $H_{2.1}$ and so on. H_0 establishes a general homomorphism based on a set of categories limited by rules and patterns. If these are in correspondence, they are able to predict future states of the environment or decision field. However, significant anomalies provoke new categories and rules that expand the predictive capability of the cognitive system. For example, a falling leaf, classified as "airborne" is observed to move from flower to flower and is re-categorised as "self-propelling" butterfly. In this way the variety of the cognitive system is expanded. This is a normal sensemaking activity.

However, in the face of high uncertainty there is another level of challenge which is "in spite of adjustments, things still don't make sense". New situations require new cognitive rules of interpretation. New rules can be considered in the context of decision making as "options in waiting".

> "New rules get a chance, typically, in situations where none of high-strength rules have their conditions satisfied. That is, new rules are tried in situations where the system does not know what to do. The generation of new rules is triggered by just such situations for just this purpose. The new rules fill new "niches" corresponding to domains in which the system has inadequate sets of rules, as revealed by its inability to make reliable predictions." (Holland et al., 1986, p. 79)

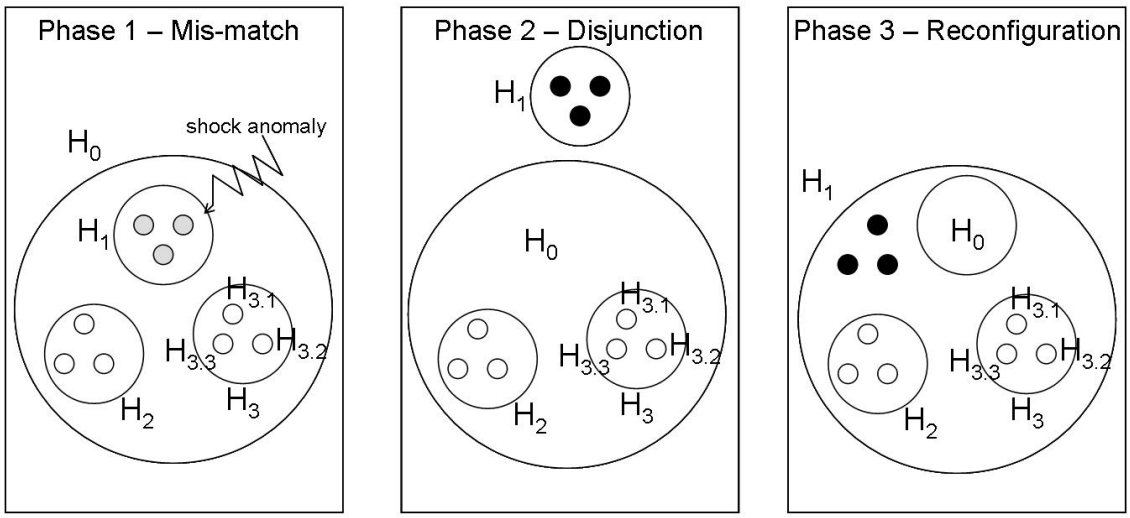


Figure 2. The process and stages of induction

As an example, a good scenario set builds up in the mind of the decision maker at least two competing 'memories of the future' (Ingvar, 1985). What usually happens is that a trial sub-holon H_1 that might fit with the new realities detaches from the homomorphism H_0 and becomes a parallel competing cognitive orientation. As the "business as usual" becomes increasingly implausible through considering the scenario implications and the gathering of more indicative evidence, a flip occurs and H_1 becomes the new top level or inclusive homomorphism H_{00} with H_0 becoming a sub-holon. This is illustrated in the Figure 2.

The degree of shock delivered by the anomaly is critical. If it is too low, then it is subsumed in the current mental model. If it is too great then it leads to denial, rejection or even staying in a blind spot. The best opportunity for reperception is where the Stage 1 shock factor is intense enough to move the mind to stage 2 and provoke a temporary crisis of "parallel competing homomorphisms" which then resolves into a Stage 3 reconfiguration of the holarchy. When the impact of the anomalous factor is at its optimum, Holland et al (1986) call this "graceful entry" which is related to the degree to which the decision maker or learner admits of uncertainty and is willing to entertain alternate views shown in Figure 3. "The property of *gracefulness* is vital for inductive systems that are to operate in realistic, complex environments." (Holland et al., 1986, p. 78)

The critical factor in moving from stage 2 to stage 3 is the extent to which the decision maker is willing to play with possibilities. In using scenario method one of the most crucial steps is to get the subjects to entertain the scenarios, however unbelievable, and play with

them as if they were real. This discovery by Arie de Geus became central to his efforts to change the paradigm of decision making to incorporate the role of reperception.

> "One characteristic of play, as the Tavistock Institute in London has shown, is the presence of a transitional object. For the person playing, the transitional object is a representation of the real world. A child who is playing with a doll learns a great deal about the real world at a very fast pace." (de Geus, 1988, p. 5).

The important distinction here is that, in the face of uncertainty, there are multiple representations of a possible reality that have not yet happened. The uncertainties have not yet been resolved by subsequent events.

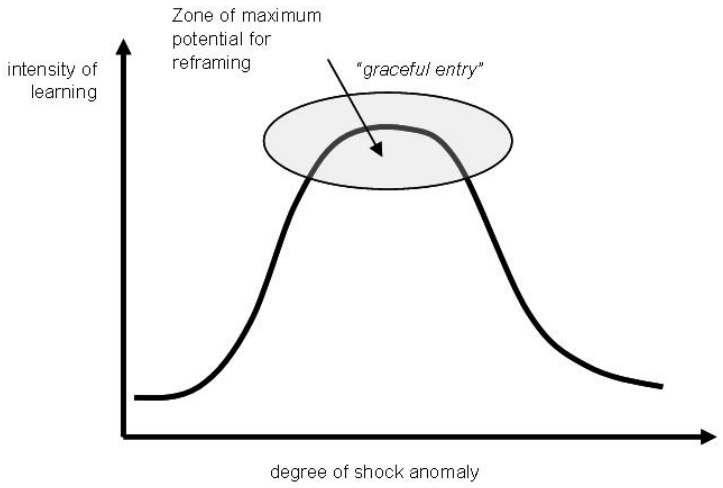


Figure 3. The positioning of graceful entry

The Notion of Undecidable Questions

The next stage in our hypothesis is to take further the implications that the decision system includes the decider. This is an issue of consciousness and its relationship to the properties of systems. Consciousness comes into consideration because we are now affirming learning as a function of the human decider and because there is an ethical dimension to choice. The properties of systems enters our considerations because, in a holistic decision system there is feedback or reflexivity. Reperception implies a change of consciousness and choice implies taking responsibility for the consequences of decisions.

It is necessary to break out of the type of science that believes that observer and observed are distinct, separable and non-interactive and circularity is an incorrect viewpoint. In contrast, the reflexive worldview leads to assertions like the following:

A implies B, B implies C, C implies A
or
A implies B, B implies A
or
A implies A

In other words the result is caused by itself. In terms of worldview we might say that the separation, made earlier in this chapter, between the decision process and the decision field is a false dichotomy. The decision process creates the decision field which creates the decision process.

An interesting example of this described by Umpleby (2007) is the reflexive view of George Soros in his approach to markets and wider social systems. Soros takes the view that in social systems there are two processes – one of observation and another of participation. Science generally only applies observation. Participation places the observer as also a player. It is therefore congruent with second order cybernetics. A second order view leads to quite different assumptions and actions. For example, the first order perspective and the second order perspective lead to quite different models of market behaviour.

The first order view of, say, a shares market is represented by a dynamic balancing causal loop in which as stock price goes up and becomes more expensive, it has an inhibiting effect on demand which, in turn, holds the price in check. In the second order view, the market is represented by a dynamic reinforcing causal loop in which as the stock price goes up the demand increases as buyers "follow the herd". This second order view is reflexive in the sense that it makes sense if the motivation to participate in the market gains is factored in as well as the supply demand balance.

The second order "game" of the decision maker is to read the biases and preconceptions of the various players in the social system. These actors, through enactive cognition are "bringing forth the world" of the game. However, those biases also filter out aspects of the situation and lead to gaps opening up between perception and reality. This eventually leads to instability and a reperception on the part of players which collapses the game system. For example, a credit bubble bursts or a political system collapses.

Umpleby (2007) raises the question as to how a second order framework would change the frame of reference of decision makers.

> "What would economics look like if beliefs in perfect information, rationality, and equilibrium were replaced with bias, interaction between cognition and participation, gaps between perception and reality, disequilibrium, and boom and bust cycles?" (Umpleby, 2007, p. 7)

What is the nature of decision making in the context of an uncertain world in which the biases and actions of the decider is part and parcel of the uncertainty in the system? This also raises the question of ethics, an essential aspect of decision integrity. Von Foerster (1995) makes the point that only decisions about undecidable questions carry the quality of ethical responsibility. Where a question is decidable through rational analysis or "mathematical economics", then there is no real decision and the best we can hope for is some kind of application of a moral rule behind which the decision maker takes shelter. Faced with an undecidable question there is nowhere to shelter. In this latter case, responsibility must reside in the decision maker's action or choice itself. The reason that only *undecidable* questions demand *real* decisions is:

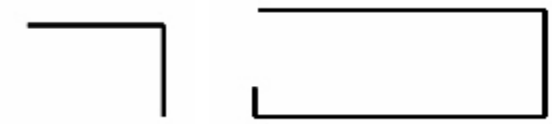
> "Simply because the decidable questions are already decided by the choice of the framework in which they are asked, and by the choice of rules of how to connect what

> we call "the question" with what we may take for an "answer". In some cases it may go fast, in others it may take a long, long time, but ultimately we will arrive, after a sequence of compelling logical steps, at an irrefutable answer: a definite Yes, or a definite No." (von Foerster, 1995, p. 7)

If we separate the decider from the decision field then decision rules can be applied to the field and, if sufficiently ingenious, the question and automatic selection of an answer is rendered decidable. But selecting is not true choosing. "Only those questions that are in principle undecidable, we can decide". (von Foerster, 1995, p. 7)

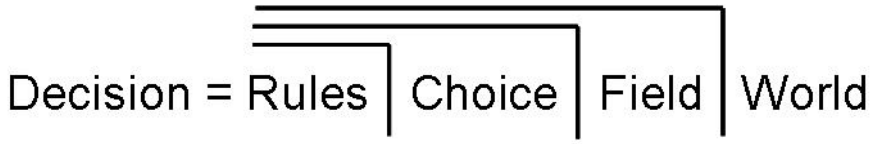
At this stage of the discussion we begin to come up against the limitations of language, especially the linear language of subject-verb-object. In systems thinking this limitation is generally overcome by the use of loop diagrams which, for example through arrows connecting variables, are able to state that an effect is influencing its cause as well being caused. There is another discipline that can express these ideas in a more general form.

Spencer-Brown (1969) developed a mathematical language he called the laws of form in which he based on the notions of distinction and self-reference. Distinction is represented by the first mark



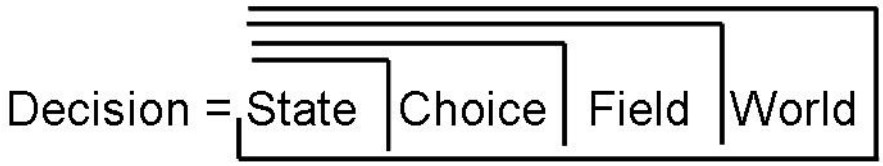
The mark splits a domain, say the decision field, into an inside and an outside. Self-reference is represented by the second mark which loops back on itself implying the basic second order relationship of "A implies A ". This type of structure is basic to biological systems which have the capacity of self-forming or autopoesis. This is also referred to as a reentrant system.

In this language the structure of decidable questions can be represented like this.



This reads "*decision* is a function of a set of *rules* which determine a *result* within the decision *field* in the context of the *world*." This is topologically a nested structure.

The structure of undecidable questions can now be represented in this symbolism, showing the structural distinction.



For an undecidable question this reads "*decision* is a function of the *state* of the decision maker which determines a *choice* in the context of a decision *field* which is in *world* which itself includes the *state* of the decision maker." This is also expressed in the never-ending sentence: "The world context of the decision affects the state of the decision maker which determines a choice which is embedded in the decision field which is itself embedded in the world which affects….." In commenting on the general mathematical form of this nested and re-entrant relationship Kauffman (2008) points out that in essence

> "… the reentering mark would represent autonomy or autopoesis. It represents the concept of a system whose structure is maintained through the self-production of its own structure. This idea of a calculus for self-reference, and the production of a symbol for the fundamental concept of feedback at the level of second order cybernetics captured the imaginations of many people, and it still does! Here is the ancient mythological symbol of the worm ouroboros embedded in a mathematical, non-numerical calculus." (Kauffman, 2008, pp. 12-13)

All this takes us right back to the reentrant condition that the decider is part of the decision field. If the decider changes state then the decision field changes state and therefore both the practical options and their ethical implications come into the foreground. The induction theory of Holland et al (1986) helps us to understand that there is a different operation of the cognitive system needed to deal with undecidable questions. But the cognitive system must also be recognised as a reentrant system. The implications of this are summarised by von Foerster like this:

> "… we are under no compulsion, not even under that of logic, when we decide upon in principle undecidable questions. There is no external necessity that forces us to answer such questions one way or another. We are free! The complement to necessity is not chance, it is choice! We can choose who we wish to become when we have decided on in principle undecidable questions." (von Foerster, 1995, p. 7)
>
> and
>
> "… With this freedom of choice we are now responsible for whatever we choose. For some this freedom of choice is a gift from heaven. For others it is an unbearable burden: How can one escape it? How can one avoid it? How can one pass it on to somebody else? With much ingenuity and imagination, mechanisms were contrived by which one could bypass this awesome burden. With hierarchies, entire institutions have been built where it is impossible to localize responsibility. Everyone in such a system can say 'I was told to do X'." (von Foerster, 1995, p. 7)

The implications of this insight about choice are critical. Second order systems are participative and have the capacity of choice beyond any inherent rule system. This view simply does not fit the deterministic view of systems.

Locker (1997) takes a similar viewpoint in formulating Trans-Classical Systems Theory, TCST, which is a form of second order cybernetics. His approach also recognises that a true system can never be fully explained by its properties alone, but has to be considered in conjunction with the systems theory the designer already holds prior to designing the system. In this approach, observing and describing the system fuses with knowing and understanding it. Translating this into the arena of decisions we can suppose that the true nature of a decision field cannot be completely known by its description and analysis, but has to be considered in conjunction with the mental model of the decision field that the decision maker holds prior to engaging with the act of choice. Thus any genuine decision system cannot avoid the question of the human being as the ultimate decision designer, and being humanly responsible within the decision field of concern. This is itself a system that is a mutually interactive engagement. As Markus-Ekkard Locker expresses it:

> "Whenever the observer enters into the system in concern he alters this system and himself. Thus in TCST, both the access system and the system in concern are changing and open systems that mutually interact with, and depend on one another." (Locker, 2006, p. 9)

ORGANISATIONAL IMPLICATIONS OF DECISION INTEGRITY

So far we have concentrated on the second order system {(decider)(decision field)}. But decisions are also taking place in contexts of multiple human beings in organisations. The system in question then becomes more complex. With regard to an organisation of human beings is it possible for there to be genuine decisions about undecidable questions? As pointed out earlier, generally our institutions are invented to avoid ethically responsible decisions and place them in a context of rules and frameworks in which everyone either is "told to do it" or "had no choice".

Reichel (2008), drawing on Luhman's social systems theory, has explored this question in his work on the paradox of second order cybernetics in a social context. He points out that the "next organisation" is an observation of the process of organising in the context of interaction in the context of society, represented in the notation of the Laws of Form as

This reads "the next organisation is an observation of X in the context of interaction in the context of society. The X is the process of organising, with the mark from society pointing to a reentry, thus creating the self-reference of the next organisation." The process of organising is also a function in classical organisation theory as management, but in this case it raises the question what is second order management?

The restlessness Reichel refers to here is similar to what was referred to in the early part of this chapter as the unruliness of the real world. This second order cybernetic description sets a context for decision making where multiple deciders are involved. What is inside and what is outside is thus continuously negotiable and hence has no formal framework. Institutions to date have tended to be designed (organised) by sets of rules that are

decidable questions - for example reporting structures, work force structural planning, functional hierarchies and so on. But the shape and nature of a perpetually self-reflective organisation falls into the category of undecidable questions. Thus managers (decision makers) in such an organisation are of necessity reflective learners. An example given is that of Wikipedia which is an autopoetic organisation that references on itself, its processes and goals, while at the same time ensuring sensemaking for all its members. Reichel points out that it is not only restless as regards its name and its boundary but also its goals. It is a teleogenic system, able to reframe its own purpose.

Building on Reichel's analysis of second order organisation we can make some attempts to formulate how this translates into the idea of collective decision making. This will place decision integrity in an organisational context.

- Decisions are a co-created production in a context of openness and peer review
- The boundaries of the decision field are continuously reshaped by the self-referential and reflexive nature of the shared consciousness
- Control over decisions is exercised by non-control, that is, handing the undecidable questions to the members of the organisation itself. Note that this is not the same as an abdication of choice or responsibility. It is rather a step to an existential recognition of the nature of collective intelligence and its shared responsibility

Reframing for Decision Integrity

How does this exploration of the structure of reentrant decision systems change the way we need to think about decisions on undecidable questions? There are a number of interconnected points.

a) The undecidable question, because of its inherent uncertainty, requires an ethical commitment that cannot be arrived at by applying business-as-usual rules whether they be financial or moral.
b) This also means that the decision maker's current mental model, which is a fixed holarchical structure of categories and sub-categories, is an inadequate basis for his or her real decision.
c) Therefore a voluntary cognitive reconfiguration is an essential step to prepare the decision. This can be described by such terms as inviting reframing, reperception, induction or double loop learning in the context of reflexivity
d) For this to take place, the conditions of graceful entry have to be established with scope to "play" with an appropriate transitional object.

From this analysis we can now look at some of the implications for strategic management of the second order view represented by decision integrity. Strategy work in management weaves together understanding of the decision field (for example, the global market for energy) with the decision process (for example: how do we make the shift from fossil to renewable energy systems). An executive group or team running a business will form, from this weaving together, a decision system. This will include formal and informal components and be guided by explicit and tacit knowledge of the team members. The more long range their strategic concerns, the more the decision field will be filled with complexities and uncertainties and the more further strategic progress will confront them with undecidable questions.

To grapple with the decision field they may create a set of scenarios incorporating speculative narratives about trends and uncertainties recognising that the nature of their challenge is not a simple "yes or no". If they are to employ the scenario set and its supporting analysis effectively they will recognise that much of their usual economic analysis to arrive at conclusions, though necessary, is not the way to arrive at strategic choices.

Van der Heijden (2005) recognises over many years of observation and participation in high level strategy work that decisions are arrived at by a reflexive decision process which is essentially one of mutual learning.

> "The learning loop model shows the interwovenness of thinking and action. If action is based on planning on the basis of a mental model, then institutional action must be based on a shared mental model. Only through a process of conversation can elements of personal observation and thought be structured and embedded in the accepted and shared organisational theories-in-use. Similarly new perceptions of opportunities and threats, based on the reflection on experiences of actions playing out in the environment, can only become institutional property through conversation." (Van der Heijden, 2005, p. 43)

However, the reflexive mutual accommodation of strategic conversation is still a rarity in management. Management cultures are dominated by non-negotiable hierarchy and by the domination of powerful individuals who may seek advice but are not open to reflexive review of their biases and beliefs. The result is an absence of learning, a tendency to repeat previous mistakes, large scale external diseconomies and an absence of ethical decision making.

Managers practising decision integrity will reflect on their role more on the following lines, consistent with a second order viewpoint.

a) The recognition that I, the decision maker, am faced with undecidable questions that are nevertheless unavoidable
b) That this places me within, not outside, the system in which I am a manager and hence in the reflexive context
c) That I am inescapably faced with ethical dilemmas that cannot be reduced to moral rules. I must therefore make free choices and take responsibility
d) That any choice amongst options made are a function of my own state of mind and understanding in conjunction with my colleagues
e) That the nature of being in an organisation with mutual responsibility with others means that the essence of shaping a decision is dialogic and emergent as distinct from analytic and persuasive
f) That if my exploration of the nature of the decision field and its context (stimulated, for example, by a well crafted scenario set) does not alter my perceptions then I have not properly engaged with the decision task (the reperception issue). If the possible future worlds do not change me then I am still in the detached observer paradigm and failing in responsibility.

Von Foerster (1995) summarises the position this way:

> "With the essence of observing, namely the processes of cognition, being removed, the observer is reduced to a copying machine, and the notion of responsibility has been successfully juggled away." (von Foerster, 1995, p. 7)

The act of reperception is the antithesis of a copying machine. It is an act of induction, of learning. The support that framework-based decision making becomes a weakness in the face of undecidable questions. This weakness arises from ingrained subconscious mental patterns that are difficult to change. We think we are peering into the windscreen of the future but are actually fixated on the view in the rear view mirror. It usually takes the shock consequences of a bend in the road to realise that we have ceased learning. The point here is that our decision making needs to be, as well as consistent with the above six points, a learning process.

De Geus (1999) makes the point that

> "… the real decision-making process is a learning process rather than the application of knowledge. Many at high levels of management are convinced they are there because of what they know and how they represent what they are. These statements were saying you're not there because of what you know. You're there because you're reasonably good at intuitively or otherwise finding your way to a learning process together with your colleagues, such that you learn and arrive at new conclusions that are more or less successful." (de Geus, 1999, p. 1)

There is an inherent psychological and cultural resistance to the proposition that real ethical decisions inevitably change the decision maker who cannot be abstracted from the decision system. In today's world of applied management science in fields such as financial management, the mathematisation of making money inevitably leads to breakdown both systemically and ethically. There are no "masters of the universe" because, in reality, the fallible human being has not actually been removed from the decision system. The abdication of responsibility to 'copying machines' has its unavoidable consequences. The factors which colour ethics and responsibility are buried in propaganda and kept there by greed and attachment to power over reality. But in actual fact the decision maker is never outside of the decision system.

Decision Integrity As A System

The proposition for management is, then, that decision theory should shift its attention from first order systems to second order systems in which the neurobiology and cognitive psychology of the decision maker is included in the decision system. The overall case is summarised in Figure 4. There is a new context for management which has higher complexity, higher uncertainty, dislocation and breakdown of the usual success formulae. There is also increasing moral hazard with destructions on a large scale from money to biological species. The dominant paradigm is one of management drawing on the current science paradigm as seen as an objective and detached measure of things. This is so ingrained that the "old ways" continue to be applied to try and solve the escalating problems.

Figure 4 – The Role of Decision Integrity

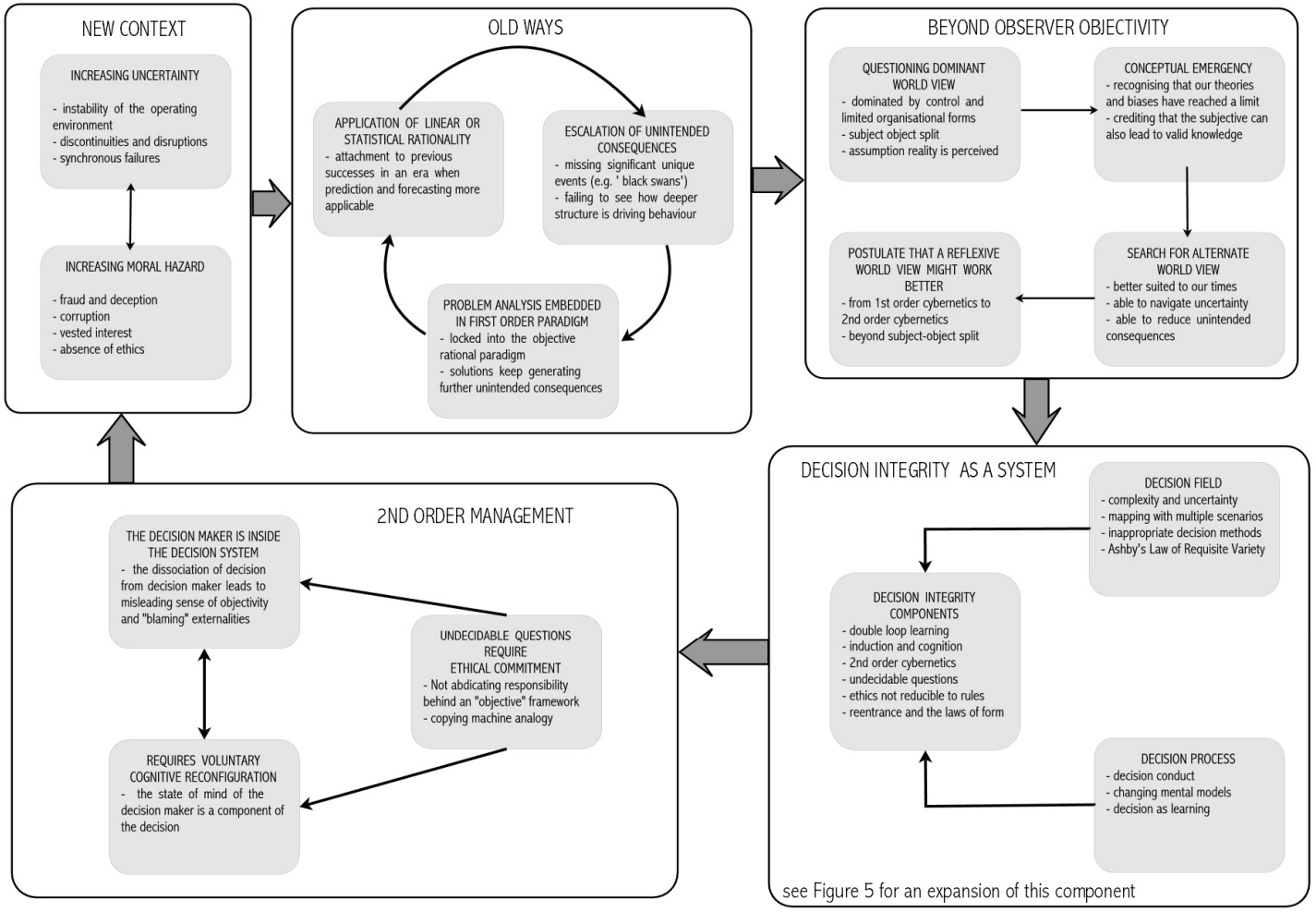
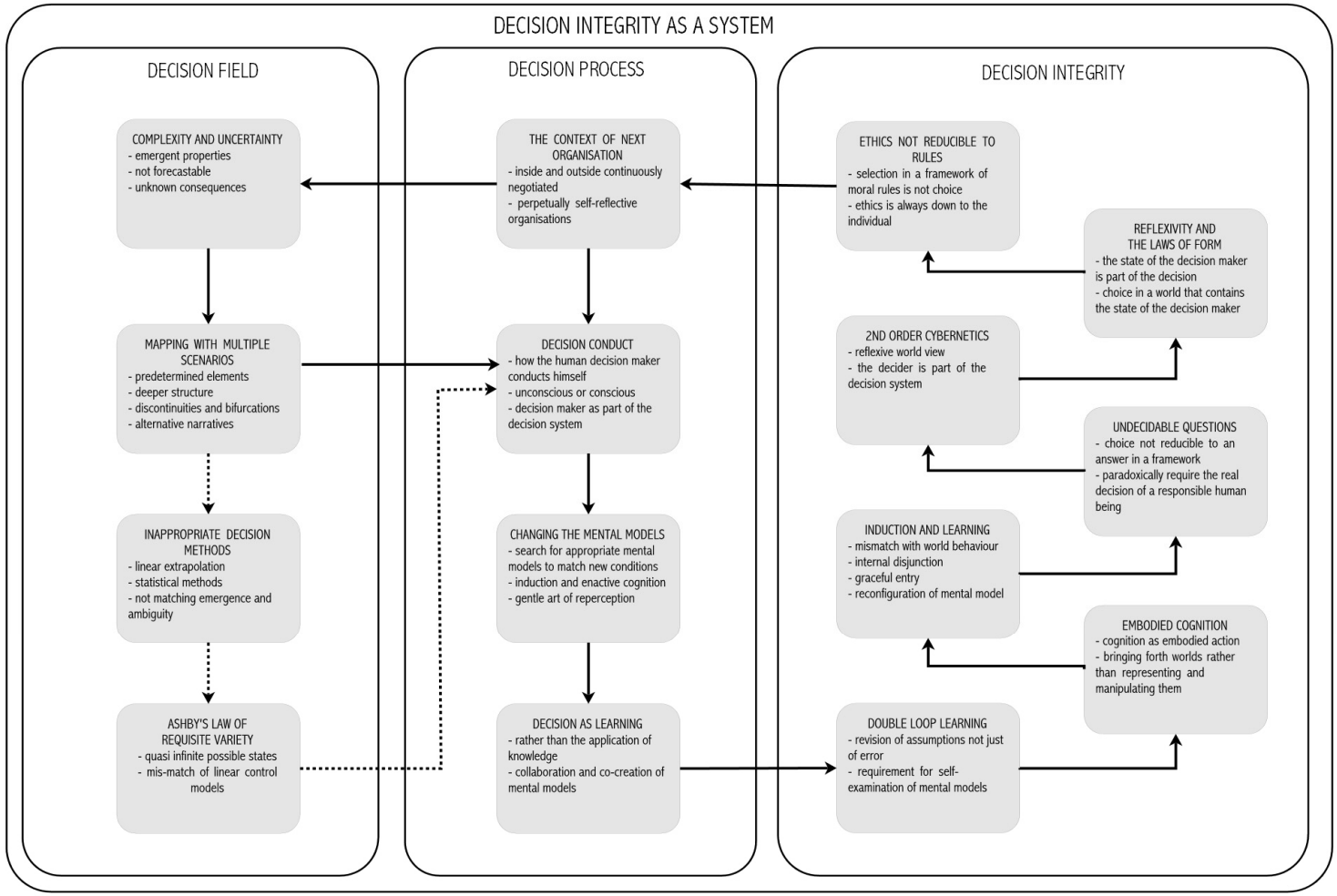


Figure 5. Decision Integrity as a System



This leads to a questioning of the dominant world view and the suggestion that reflexive theories may offer better prospects. This entails a shift from first order cybernetics to second order cybernetics. Decision integrity is postulated as an approach that integrates a systems approach in a second order context and includes the ethics of the decision maker as a scientific component. This offers the prospect of changing the way difficult or undecidable questions are tackled. Better decisions will be made in the sense that they will lead to better short, medium and long term outcomes. Better as used here can be judged by a number of criteria; reduced unintended consequences, acceptance of responsibility by decision makers rather than abdication, fast learning when circumstances change. This, however, will require nothing less than a paradigm shift in management theory and practice.

Decision integrity as a system, summarised in Figure 5, requires an internal understanding of how the decision field "out there" and the decision process "in here" are one and the same system which is participative as well as observational. It also requires recognition that new organisational forms are emerging that are more congruent with the new second order paradigm and demand the shift to second order management. This will not be easy due to the deeply ingrained defensive routines in the current human organisational systems. It will require innovative applied research into fields such as embodied cognition, distributed cognition and next organisations.

Implications for Management and Governance

One conclusion from this exploration is that we have a legacy of applied management science that is incongruent with the increasingly unruly nature of the real world. Further, by carrying on with mis-matching decision processes we are actually exacerbating the situation. In the new global era, continuing the objectification of the world assumes that we are not part of the world system, obscuring the reflexivity of our actions in the quest for control, certainty and predictability. Just as Newtonian science finds itself subsumed in a larger paradigm of relativity and quantum physics, so observer detached management science will find itself subsumed in a larger and more reflexive notion of that science. Discussion of this is beyond the scope of a single chapter but it is important to recognise that management science is not actually detached from the current transition to the global age. Albrow (1996) puts this in context by making the case that the era of modernity, which is deeply enmeshed in the objectivist science paradigm has come to the end of the road. The new situation is globality which confronts us with bigger and potentially more fatal issues of responsibility for limits and consequences of our decisions.

We do not need to cast aside the decades of development of management science; rather we need to assign them a diminished role and realise that the dominant paradigm of science itself needs reforming into a science which includes consciousness and the human quality as primary factors. Theoretical physicists like Goswami (1993) have made incursions into the idea of consciousness as a primary basis of a coherent quantum physics. The idea of decision integrity opens up a field for exploring self-aware management. The disciplines surrounding the idea of second order cybernetics and Trans-Classical Systems Theory (Locker, 1997) offer a potentially fruitful basis for reframing decision science.

Decision integrity, as a management capability can only be developed by its practice. It requires the courage to take decisions and ethical responsibility in the face of consciously recognised undecidable uncertainties. Where things are predictable and decision analysis is used there is no real choice in the sense of discriminative cognition because the answer falls out of the rules, not from a reflective human choice. Some differences between first order and second order decision making are summarised in Table 1.

DECISIONS IN FORECASTABLE SITUATIONS	DECISIONS IN UNCERTAIN SITUATIONS
• Susceptible to decision analysis	• Decision analysis insufficient
• Can be modelled with first order cybernetics or systems theory	• Requires shift to second order cybernetics
• Abdicates responsibility to "the system" or decision rules	• Requires decision maker to assume ethical responsibility
• Values are "mechanised" as impersonal moral (or immoral) rules and conditions	• Values embodied in the personal ethics of the decision maker
• Consequences subsumed into the predictive tools and techniques	• Consequences continuously monitored in the act of observing the observer - reflexive
• Skills of decision *analysis* predetermined or configured to give a calculable outcome	• Skills of creative decision *thinking* and dialogue exercised by the decision maker
• Error and failure are attributed to changes context and external circumstances	• Error and failure are treated as feedback to the decision maker as learner

Table 1 – Comparison of decision making in certain and uncertain situations

The implications of this analysis are that, from the perspective of second order cybernetics, most decisions are not decisions at all but selections derived from systems which logically or computationally provide a "decidable" answer for a passive observer. Since the passivity of the observer is never-the-less subject to psychological biases, distortions of motivation and even deliberate corruption it is hardly surprising that we live in a society full of unintended consequences for which no one will take responsibility. There are not only consequences for decision outcomes of decision makers but also for the whole future of organisations and society. On the other hand, we also live in a time when forms of co-operation are reconfiguring social integrities beyond the forms of institution that combine classical power hierarchy and applied management science.

CONCLUSION

This analysis puts the whole of business practice and management education up for review. Equally, it opens up a whole new area of research possibilities which might be inspired by one of the prime originators of the second order cybernetics proposition. Heinz van Foerster's Biological Computer Laboratory which existed from 1958 to 1975, was a living example of applying reflexive dialog to the generation of ideas and the choice of research themes and programmes. (Umpleby, Anbari and Müller, 2007) It would be very

timely that there should appear a new laboratory (probably with many virtual players) that would illustrate the same principles of highly innovative research directed towards the field we might describe as "Second Order Management".

The next organisation (Reichel, 2008) is emerging with some very different configurations and arrangements where a new kind of decision praxis is emerging which is better suited and matched to the unruly nature of the emerging world. The next organisation tends to include

- open source collaboration
- networks with little institutional structure
- multiple motivational values (beyond the financial)
- control exercised through trust (ethics) rather than rules
- performance is emergent
- management is vested in a founding community that is not necessarily a recognisable legal entity but a social integrity

In this emerging world we need to move from the idea of a certain organisation navigating through a world of uncertainty to a world in which *the enterprise itself is inherently uncertain.* Put simply, we are dealing with *uncertainty multiplied by uncertainty*! Being caught in our previous set of assumptions and world views drives us deeper into the conceptual emergency indicated in the introduction to this chapter. The way out of the emergency is to evolve our scientific worldview to a new level of insight and complexity.

In this world the scope and implications of undecidable questions is vastly expanded and it calls for a shift to a second order thinking and account of what decision making under uncertainty is. Decision integrity as discussed here a vital core component of understanding and guiding (perhaps even the word managing will be replaced by a better one) complex self-observing systems with the power to generate their own purposes.

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Key Terms

Conceptual emergency: a situation in which the well established mental models and world views no longer fit with or perform successfully in the current reality

Decision field: the external context within which an intended decision will operate

Decision integrity: a holistic way of taking decisions in which the decision field and the decision process are integrated through the consciousness of the decision maker consistent with second order cybernetics

Decision process: the way the assumptions and beliefs of the decision maker are structured and sequenced to arrive at a selection or choice

Enactive cognition: a constructivist view of cognition which the knower actively brings forth and sustains a viable world that is inextricably related to the structure of the knower.

Ethics: the values which reside in an action itself without reference to external supports of reward and punishment

Holarchy: a structure in which components at any level have both autonomy and integration and in which the function of the whole cannot be inferred from the parts alone

Induction: those inferential processes that expand knowledge in the face of uncertainty.

Learning: a feedback system in which errors are corrected (level 1) or assumptions about the world or self are questioned and changed (level 2)

Next organisation: an organisation which is in process of organising itself into existence

Scenario planning: a method of cognizing an inherently uncertain decision field by means of multiple narratives of the future against which intended decisions can be challenged and refined

Second order cybernetics: a view of feedback systems that incorporates a circularity that the observer of the system is a member of the system in contrast to first order cybernetics where the observer in not considered as part of the system.

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