Systemic Cognition during the Sub-Prime Crisis: Lessons and Research Implications

Abstract

This paper uses the example of the Global Financial Crisis (GFC) of 2008-9 to demonstrate how patterns of systemic cognition influenced outcomes during the crisis. This paper focuses on systemic patterns that emerged during the sub-prime crisis. By reviewing systemic patterns and reflecting on the assumptions of actors it is believed that further insight for research potential could be revealed. I argue that patterns of systemic ‘cognition’ that emerge during complex social events can be captured and reflected on. This provides useful insight into the interpretative structures of messy problems that in turn reveals previously undiscovered systemic thinking. The paper uses this illustration of the GFC to structure a debate about future research possibilities.
Introduction

Traditional ideas surrounding problem solving and decision-making found in the work of Noble Prize Laureate Herbert Simon (Newell and Simon 1972, Simon 2000) give the impression that problems are commonly available facts. Constructing solutions to problems is reflected as a process of rational choice, without thought given to issues such as complex politics (King 1993), framing (Lakoff, Hazel and Dean 2004), and sensemaking (Weick 1995). The process of cognition used assumes prior conception of the problem landscape according a fairly fixed, linear, bounded rationality (Johnson and Hoopes 2003).

There is an emerging constructivist perspective that highlights the interpretative aspect of messy problems, as being created and sustained by people (Landry 1995) as a by-product on the social construction of reality. The Berger and Luckmann (1966) treatise of the sociology of knowledge maintained an argument that reality is best thought of a process construction between actors’ internal rationalisations of phenomena, those of other actors, and those of the broad conceptualisations of society. This means that ‘social reality’ according to the constructivist perspective, is a collection of commonly held assumptions and as opposed to externally available facts. Grint (2005) uses this argument when pointing out how excited the media got when the concept of WMD (Weapons of Mass Destruction) was used as a valid reason for entering Iraq. The problem was socially constructed for a certain kind of leadership.

Some argue that way in which we construct our notions creates the world we interpret around us on a regular basis and our problems, as are social constructions (Trigg 2009)). The world we see ‘out there’ is the result of intersubjectively created meanings, conceptions, frameworks or mental models that we use to make sense of the complex web of events that bombard the senses (Kling 1999; Liebl 2002; Senge 1990; Stacey 2003). These mental models or conceptions, some known, some subconscious, reside in our minds and are stored for interpretive/appreciative (Preskill and Catsambas 2006, Bushe and Kassam 2005) purposes and so allow us to act purposefully in the world. However, these conceptual frames need comparison or contrast to define themselves so they can be reflected upon. These layers of
interacting conceptual frames (Lakoff, Hazen and Dean 2004), supported by ideological sense-making processes (Weick 1995) and meaningful decision making processes form patterns (Kaplan 2008, Rosa 2001, Bronn and Olsen 1999) of ‘cognitive engagement’ that we can analyse and study in order to improve the way we manage messy problems.

These patterns in the literature have not really been studied up to this point. The main work done has focused on applying systems methodologies to difficult problems (i.e Jackson 2006). We have several problem structuring methods (Mingers and Rosenhead 2004) but so far very few people have applied the soft systems (Checkland 1981) way of thinking to the analysis of group thinking during large-scale social movements (Benford and Snow 2005). Research discussed in Houghton (2009) suggests that a systemic epistemology is comprehensive (Ulrich 2003) yet relies on the dialectic of conflicting paradigms to be effective. In this way systemic patterns reveal complexity because inherent in the systems way of thinking, is the idea that synthesis is necessary (Houghton and Metcalfe 2010) conflicting objectives and meanings are present (Checkland 1981) and variegation presents itself continuously.

In this paper I take this idea a further by arguing that looking at patterns of emergent thought through systems thinking, patterns of cognition that relate to messy problems can be uncover. The usefulness of this for the modeller/analyst is that they can see how thinking about a complex issue is reflecting in the consciousness of those that are helping to structure. The research question I am proposing in this paper is as follows:

*Can systems thinking inform research about the role cognitive patterns play in messy problems?*

To begin this discussion I look at the literature on messy problems and explore the role systems thinking has taken in the past. From this review, I present the argument that while systems thinking has played a useful role in establishing patterns for better problem framing and structuring, we can learn a great deal about messy problems by looking at how these patterns form through emergent cognitive patterns. In particular, we can garnish new insights into messy problems by studying the emergent interpretative patterns present in social systems. To support this argument I use
several propositions for future research as well as providing an exemplar case, the global financial crisis, to show how these emergent patterns influence messy problems.

**Literature Review**

Since the days of general systems theory (Bertalanffy 1968) scholars have sought to develop a systems understanding of natural and social problems. This understanding is anti-reductionist in that it aims for a kind of elusive comprehensiveness (Metcalfe 2004, Houghton 2009) of the world that seeks to explain ‘wholes’ instead of reducing elements down to the analytical level (Ackoff 1978). While systems thinking has been applied across many disciplinary boundaries, it has been developed quite significantly towards the study of messy problems. Instead of reviewing all of the work done in systems thinking it is my aim to review the work most relevant to this paper, messy problems and their solving.

During the 1970’s traditional mathematical disciplines such as Operations Research (OR) moved away from primarily modelling the work through algorithms and began harnessing the ideas of systems thinking as a way of better understanding social complexity (Churchman 1969, 1968 being an early example). Churchman (1972, 1968) and later Ackoff (1978, 1984) argued that to truly unpack complex social events and not to get lost in the meaning of the details (analysis), a more holistic perspective was needed. They argued that by looking at the ‘wholes’ of a situation and how they relate, new ways of thinking could emerge that were previously not available. Churchman (1979) for example, developed an inquiry system where he systematically laid out a variety perspectives that could be useful in applying systems thinking to messy problems. Ackoff (1978) used the systems approach in exploring messy problems through ‘problem dissolving’ – the shifting of problem conditions to reveal new interpretations.

Messy problems in this sense cannot be tarred with the same brush as natural problems because the conceptual framing of issues (Kaplan 2008, Bouchikhi 1998), and the social construction of problems (Grint 2005, Berger and Kellner 1981, Gergen
and Thatchenkery 2004) means that any number of interpretations could be useful in finding a way forward. In this sense they are unstructured, unformed and difficult to pin down (Conklin 2005). Even if this is the case, the emergence of pragmatic issues that demand attention and resolution still require strategic response and governance (Donaldson and Preston 1995). Further, if it does impact on higher-order problem solving in organisations and in government, how can these cognitive/sense making processes be better understood so that we can be more effective in messy solving in the future (Camilus 2008).

Checkland (1981:2000) highlighted that systems thinking does not reveal ‘reality’ as such but is a structured and useful way of thinking when messy problems arise. He also argued that systems thinking would be different for every actor because of the way in which we socially construct the meanings of problems. Since Checkland (1981) the focus of applying systems methodologies has led to a wide array of approaches (see Mingers and Rosenhead 2004, Flood 1999). Another area of systems thinking developed in the 1980’s and 1990’s was summarised in the fifth discipline (Senge 1990). This approach used systems dynamics as an approach to management problems (see Jackson’s 2006 summary). Senge’s contribution here is about seeing the potential of holistic thinking as opposed to the application of reductionism to management problems.

While Senge (1990) uses the hard principles of systems dynamics, Checkland (1981) on the other hand, does not reify the systems concept. He never proposes that systems actually exist; instead he argues that systems thinking is a cognitive exercise, designed to structure thinking about messy problems. The soft systems approach is more about understanding a process of engaging systems ideas (i.e. Houghton and Ledington 2004) as a sensemaking device. Systems thinking is an epistemological position (Churchman 1968, Ackoff 1981, Jackson 2001, Metcalfe 2004, Houghton 2008, 2009) that seeks to explain the world through the lens of variegation and dialectic. It also seeks to present ideas through a lens of emergent hierarchy and organisation, communication and control. In this way to generalise using a systemic model means you are expecting multiple contending interpretations that relate to each other to form a holistic problem representation (Ulrich 2003). These multiple
contending interpretations can be thought of as “cognitive engagements” (Houghton and Ledington 2004, Houghton 2008).

**Cognitive Engagement**

Cognitive Engagement is a frame of reference used in education literatures mainly (see Richardson and Newby 2006, see also Ho, Wong and Lee 2009 for a management example) to talk about how learners engage in the process of learning through the application of mental models. Cognitive Engagement is argued to direct our learning through perceptual filters, causing us to act; giving us access to self-directed problem solving (Jonassen 2008) and the development of multiple viewpoints (Checkland 1981). Cognitive engagement refers to sensemaking as mental models that shape, inform, direct action towards goals, and act as templates for decision-making and problem solving (see Blumenfeld, Kempler, & Krajcik 2006 for another example of how the concept is used). Conceptual framing (Benford and Snow 2000) relates how people shape and form their world while engagement refers to participation, how we act, and the theory suggests that we postulate our action based on what is thought (Stine-Morrow, Parisi, Morrow, Greene and Park 2007)). It is argued to be the reasoning processes we go through as we establish the interpretive schema we used for future actions (Harris 1994). Richardson and Newby (2006) highlight the processes of student engagement, for example, as the means and strategies learners use to participate in learning environments. This paper adopts the concept as thinking about how action is structured and decided on through formal processes.

Research has pointed to idea that sensemaking (Daft and Weick 1984, Weick 1995, Tucker et al 2002, Tucker and Spear 2006) impacts problem solving (Metcalfe 2005, and as early as Polya 1962, Newell and Simon 1972) and in turn our cognitive engagement (Newby and Richardson and Newby 2006), mental models and thinking patterns directly impact how we frame and solve our work problems (Houghton and Metcalfe 2010). Landry (1995) for example unpacked the meaning of a problem by tying it epistemologically to the way in which actors interpret problems. For example, a reductionist will reduce problems to a cognitive explanation that is
reductionist. A systems thinker will employ a model of cognition that interprets and understands the world through holism (i.e. Senge 1990, Checkland and Holwell 1998). The reduction of the complexity of cognitive engagement into isolated units produces a fallacy that misrepresents the holistic qualities of messy problems (Ackoff 1978, Checkland 1981, Jackson 2001, Ulrich 2003). It brackets out macro-causality and generalisation in favour reducing explanations down to isolated factor-by-factor relationships or mathematical models (Ackoff 1979).

The problem with this is that the richness of the messy problem is lost through reductionism (Checkland 1982). The second problem is that when the phrase ‘cognitive engagement’ is used people are often referring to reductionist models that seek to explain elements of behaviour (for example Ho, Wong and Lee 2011, 2009). This is directly opposed to a systems view that would seek to relate that behaviour to another ‘whole’ instead of reducing it down into constituent parts. To take this further, a soft-systems based exploration of cognitive engagement would admit the constructivist point that thinking is a product of observer dependence not a matter of observer independence. The question is: can anything be learned by exploring emergent patterns of cognitive engagement? That is, if we notice the emergence of cognitive patterns in social groups, could this ‘systemic’ form of cognition help us to understand messy problems more deeply (see Stacey 2003)?

**Systemic Cognition**

Systemic cognition is defined as recognisable patterns of beliefs that emerge in social systems. For the systems thinker this means studying patterns of action and observing areas where there is noticeable ‘resonance’ stemming from social action (see Benford and Snow 2000). On the scale of large messy problems, these would be noticeable as the interpretations offered by people who are meaningfully engaged in the problem. As mentioned earlier, systemic cognition, is a product of thinking about the world of action in a certain way. This gives rise to the intersubjectivity of conflicting paradigms (see Checkland and Scholes, 1990, pp.280-4). It should be noted here that I don’t wish to indicate that these patterns ‘exist’. For the sake of efficacy, I am using the term systemic cognition as shorthand for: Applying systems
ideas to patterns of emergent action. Secondly, I am arguing that by doing this much insight can be gained into large-scale messy problems. As noted by Rosenhead (2006) this is an area where those studying problem structuring are still breaking new ground.

This paper uses the argument that because problems are best thought of as social constructs, it’s precisely these ‘mental models’ that impede, direct and enforce change. It’s useful to apply systems ideas to group actions to tease out what kinds of beliefs help to create messy problems. I believe by applying a systemic epistemology (Houghton 2008) to cognitive structures in groups, we can learn a lot more about the motivations and beliefs of actors in messy problem situations. Secondly, we can develop a better understanding of how these large-scale motivations influence the actions that lead to messy problems.

Three exemplar patterns of systemic cognition, used during the GFC, are analysed and discussed for the purpose of showing how cognitive engagement, underlying assumptions and conceptual framing impact upon decision making and in turn act as defences to maintain the status quo instead of enacting new discourses about change. This illustration also exemplifies how cognition forms the problem to be acted on and creates the ‘engagement’ pattern for ensuing action.

**Systemic Cognition at work in the Global Financial Crisis – the Housing Bubble**

The Global Financial Crisis (GFC) of 2007-2010 is considered to be one of the worst financial disasters of all time. While the outputs of it’s are largely financial, the argument put forward here suggests that it was dominant models of emergent and historical cognition that drove the crisis to epidemic proportions. For the purpose of space, this paper will draw on three key examples and explain how the cognitive engagement of key actors involved in the crisis framed, shaped and facilitated the eventual crash of the global financial systems. I apply the ideas of systemic cognition in the following case to demonstrate this argument.
Systemic Cognition Pattern #1: Irrational Enthusiasm: The belief of a stable market

In his book, *Subprime Solution*, Professor Robert Schiller points out that an underlying assumption of the housing bubble in the United States, was the idea that house prices will continue to rise no matter what.

"Even, intelligent well-informed people who knew certainly that there had been bubbles throughout history and could even recite examples-typically did not comprehend that an epidemic of irrational public enthusiasm for housing investments was the core of the problem (Shiller, 2009, pp.3-4)."

Shiller goes on to argue that the irrational enthusiasm created a 'bubble' where house prices were seen to only ever increase, thus giving solid returns to buyers. The other party in this equation, the now infamous mortgage brokers, believed that future equity in houses would offset big repayments. Another angle came from risk management. They believed that because house prices would increase, the risk of massive defaults, now a fact in the US housing market, was unlikely, therefore securing the loan was safe. Yet a fundamental analysis of housing data, argues Shiller, shows that growth over a hundred year period tends to keep pace with inflation.

Putting the economic arguments aside it is important to address what Shiller calls the 'social contagion' of the US housing bubble. It was built not around sound economics, but a *way of thinking* rooted in the concepts of perpetual growth, that rather than keeping pace with inflation, prices would continue to climb higher and higher making everybody more wealthy. That one assumption triggered a large group of actions, from many actors, that eventually caused a ripple effect in the world's credit systems. This first view could be summarised as an irrational belief in the stability of the housing market.
Systemic Cognition Pattern #2: Big Score Mentality – The promise of 'equity'

Another real issue in the GFC was the perception of value. If the first pattern caused people to believe in a market that has unending growth, the second example presented here is an irrational belief in possibility of equity gains based on Systemic Cognition Pattern #1. The rapid decline in the US housing market largely shows how rapidly a 'perception' of value can shift actual assets. This model relies on two assumptions, house prices will always rise (Systemic Cognition Pattern #1 – shown above) and there is a substantial profit to be made by buying a house, renovating it and selling it (commonly referred to as flipping) because of this on-going rise. The results of this perpetual increase were perceived to be uninterrupted equity. As the idea became resonate, a great deal of people believed this.

According to Shiller, a new form of mortgage was offered to Americans that enabled those previously locked out of the market to establish themselves as homeowners. The now infamous 2/28 'teaser' mortgages, offered homeowners the chance to get into the housing market at a lower interest rate for the first two years and then pay a larger interest rate later in the amortisation schedule. The loans were offset by a perceived lack of risk in the housing market because underpinned by the idea of perpetual growth. In particular, buyers believed the risk of higher interest rates would be offset by future gains. Shiller (2009, p.55) draws attention to this by arguing that the lack of inherent value in the houses, their overall equity in the market, was possibly caused by changes in thinking.

The systemic cognition was arguably created when people saw massive gains in the market and saw other people around them growing equity. Combine this with the availability of cut-price 'teaser' mortgages and the lowering of overall buying standards and you have the emergence of the concept that investing in property was a good idea. Green (2008) puts a more specific title on this by labelling arguing that there was an underlying promise of equity growth in the subprime crisis that fuelled speculation:
Some commentators, such as Melvin Oliver and Michael Sherraden, have shown that housing equity has been the principal method by which middle-class and lower-middle class Americans have accumulated wealth. The disparate rates of homeownership may, therefore, prevent minorities and low-income households from accumulating wealth. Oliver and Sherraden are hardly alone in sharing this view—politicians in particular seem to think that both wealth and good social behaviour arise from homeowning (Green, 2008, p.264).

The idea that real value would grow in houses exponentially gave rise to the hope that equity in a house would lead to eventual wealth. As Green notes, the principal method for US homeowners to gain wealth is through the equity found in homes and in general long-term homeownership. In Australia, the author's home country, the situation is exactly the same. One only has to turn on current affairs programs to see how many ratings are drawn from the idea that home ownership is an established norm in our culture. The core concept though has clearly shifted from the idea of home ownership, to the idea of creating massive gains in real estate through equity. This second systemic cognition pattern could be summarised as: the idea that because of a stable ever-increasing market, real wealth could be derived from home ownership and all risk would therefore be acceptable.

**Systemic Cognition Pattern #3 – Homeownership as a social norm and a social good**

Poon (2009) highlights this issue by stating that not only is homeownership in the US (and indeed Australia) considered to be a social good, it's actively promoted by the government. The government has even developed schemes for first homebuyers to take advantage in order to gain entry to the least affordable market in the western world. Home buyers can take up to seven-thousand dollars as a grant for a first home and place saved deposit money into a home loan account for the government to apply interest to. Systemically this means that government led support helps facilitate the belief that owning a home is a social good. The social pressure to have a house is tied to social status as Shiller notes. This 'natural progression' is a social rite of passage that is ingrained in the minds of people and brings forward concepts of social worth and value, as well as those promises of wealth (Systemic Cognitive Pattern #2) and
the irrational enthusiasm of the buyer (Systemic Cognitive Pattern #1). This concept underpins the idea that pattern #2 and pattern #1 shown above could work because it's an emotional and deeply ingrained social norm.

It is understandable that such a powerful motivator would lead to the idea that housing can be profitable and that there are fortunes to be made. Gramlich (2007) highlights the reality of the situation and gives some insight:

A mortgage foreclosure is a dramatic culmination of a process… A household may be struggling to make repayments and if a situation goes wrong, the household will fall behind. Things that could go wrong include loss of a job, a health problem (many of these families subprime mortgage holders are among the 45 million Americans now without health insurance), or a problem with the house itself, such as a leaky roof. (p.7)

Taking the systems view, this third pattern is one of the most important of the three because it stems from a resonate framing shared by millions of people. Combine this with the second pattern and the dream gives rise to promises of wealth that’s linked to the hope of a growing market.

Discussion

At the time of this writing the American market forecast is gloomy to say the least. CNN money is reporting massive declines across America with people still to loose thousands of dollars. In summarising the three broad models conjectured to be relevant to the housing crisis in America, the following concept map is offered:
Figure 1 - Cognitive influences on Housing Bubble: Patterns of systemic cognition

The map shows the desire to own a home (Pattern #3), coupled with the promise of big returns (Pattern #2), underpinned by the on-going social desirability to own a home (Pattern #1) are key ways of thinking that help to facilitate the crisis. There is of course another side to this problem that is on the mortgage lending side. It wasn't just homeowners who felt that the on-going rise of the market would lead to stability and future growth. The reality is, mortgage lenders and insurance companies also played a role as Shiller (2009) discusses. This was more than likely Pattern #1 but it caused other issues in global credit that eventually led to the collapse of bigger banks and more important stakeholders in the world financial system.

Shiller notes that the expectation that house prices would rise caused the securitization of loans that were not a good investment. So while on the one-side homeowners that were excluded by society from buying a house were suckered into a market they couldn't afford, on the other side mortgage lenders were relying on pattern #1 because they believed that such loans would be covered for risk by on-going stable house prices. Gramlich (2007) and Shiller (2009) both note how that lenders built very risky assumptions on the fact that the market would continue to climb and house prices would increase. So while these ideas here are oversimplified, the broader concept of home ownership summarised by the below diagram, highlights the underlying assumption that was proven false by recent economic events.
There is a much more sinister side to the debate that others such as Shiller (2009) have alluded to. The idea that mortgages should create a sustainable housing market for the nation points toward the creation of social pressures. Namely, the housing lenders, insurance brokers and the broad array of financial institutions that currently drive and facilitate the housing market. While the above represented set of concepts is limited, it does raise questions as to why society is so hell-bent on homeownership as a model of equity development. It also raises serious questions that others more qualified will have to answer such as why do we allow such models of cognition to dominate us? Issues such as: is homeownership a right or a privilege, do we have the right to facilitate on-going growth in light of uncertainty and incomplete information as Gramlich points out. Also, is it fair for two-thirds of society to win when one-third remains poor and ill-equipped to clothe and house themselves. Such issues are for sociologists and it will be interesting to see if they can answer them in the coming years as American the global financial systems of the world recover.
Putting aside these social concerns for a moment, the benefits of exploring systemic patterns of cognition can now be discussed. In the following section I lay out some areas for future research.

Towards systemic cognition

There are several key lessons for scholars interested in unpacking and learning about how systemic patterns of cognition influence messy problems. Taking the systems view of cognition means we develop a toolset for exploring the mess through the thinking patterns of actors. Firstly, actors expected that growth would continue. The underlying concept used to assess the viability of the loans by insurance agencies and mortgage lenders became unhinged when the housing market plummeted. It was the power of this belief that drove people to overcompensate themselves to the point where they couldn't afford to make repayments on ridiculously high loans. Emergent patterns of systemic cognition point us towards the underlying assumptions of actors in group situations. This gives insight into the perceptual mechanisms groups of people carry around as mental models of the situation.

Secondly, even though we have the work of Karl Weick pointing out how and why sensemaking occurs in organisations, we still fail to recognise damaging cognitive patterns that emerge in our day-to-day lives are built on dangerous assumptions. Myth-making and concepts in use by key players such as homeowners in the GFC, drove us to the point where we are now. Scholars can learn to understand the models of engagement used by employees and stakeholders, and from this unpack key assumptions that may be harmful over the long-term. This would require a shift from understanding causal relations, to move towards more meta-analysis and cross-referencing in research. This could help to establish patterns of behaviour and begin a modelling process that was more holistic. The benefit of this is a clear articulation of the meaning of cognition as it rests on the assumptions of groups of actors. We recognise this form of cognition by applying systems thinking to actions noticed (or outputs) and begin to structure holistic interpretations of the reasons why people act. Granted, our interpretations of these actions are equally as subjective. Yet, the
usefulness of the exercise gives insight into how behaviour shapes and informs messy problems.

Thirdly, research in management relies heavily on the assumption of rational behaviour (see March 1993). The cognitive engagement demonstrated by key players in the crisis, was considered at the time to be highly rational and ultimately justifiable in terms of the actions and outcomes that had been experienced previously. It was normal to expect house prices to keep rising and the average person carries this deep desire to contribute to the social good of home ownership. These are considered to be 'rational' modes of cognitive engagement. Yet, it was this very model of rationality, driven by previous expectations and the desires of the common person, that ultimately led to the disaster that is the housing bubble. Looking through the lens of systemic cognition, we can begin to draw connections between the reasons why the bubble occurs and what actions led to its creation.

This is in direct opposition to the reductionist who will seek to explain human behaviour in reference to the individual and their stimuli for cognitive engagement. The key argument of this paper is that beliefs can emerge as group phenomena that would appear disaggregated to a behaviourist, yet to a systemist, it could be the seeds of something related to another part of human perception. It could be related to how people create problems by engaging beliefs into action in large groups through commonly shared assumptions.

**Limitations of Systemic Cognition**

The main limitation of this approach is that it will look for emergent patterns. When applied to a messy problem context it will reveal the emergent but it won’t necessarily interpret the meaning within the emergent. A criticism of this idea may be that while it reveals emergent patterns, it does not reveal the context of those patterns and the reasons why people in that messy problem are rallying around beliefs in the manner they are. We are left with the assumptions building those beliefs that could in essence produce more confusion about the problem because a revealed pattern won’t make a lot of sense unless it’s placed within the context key actors are involved in.
Secondly, if a systemic approach to cognition is taken it will create dialectic generalizable patterns based on the unique ideals comprehensiveness stemming from the underpinning epistemology of systems thinking. It will present fractured or confusing models of cognition that are not reductionist. In this way the models may require a more complex interpretation that is dynamic and non-linear. For example, when a modeller introduces systems dynamics into a problem, the shape is the result of the model applied. The use of systemic cognition may present modellers with the same problem because systems thinking is unique in that it seeks explanations that are holistic.

Lastly, a limitation of this approach is that it is seeking to explain cognition in the broad sense as noticed by people who model the emergent patterns. Traditionally, cognition is thought to be explainable through causal models. A systemic model of cognition argues that patterns emerge in social systems broadly as the result of many possible factors. These ‘factors’ would be knowable because of the nature of messy problems. Therefore a major limitation of this approach is that explanations, such as those offered above, lack the kind of rigour that behaviourists are used to. This does not mean that the approach is not useful. It means that systemic cognition trades off linearity for complexity and factors for systemic generalisation. It would therefore be impossible to generalise findings in ways in which traditional cognitive scientists do. Instead, explanations could be thought of as a ‘working model of systemic cognition’ designed to drive insights. This is the kind of generalisation through experience that Checkland and Holwell (1998) spoke about. In spite of this limitation, the effects and broad complex interrelationships that can be uncovered through systemic cognition would be useful for future research.

**Future work**

This paper presented some initial ideas for a model of systemic cognition. Future projects could develop this with some empirical data. This would take the form of an action research project or perhaps a secondary data analysis where the ideas presented here were applied to records of human behaviour. Another problem for future research could be the development of modelling tools designed to assist in the
dynamic elements of systemic cognition. This paper presented patterns of systemic cognition that arose independently and then intertwined to become defining factors in the global financial crisis. The paper does not explore the links between the modes of cognition presented because it would be difficult to summarise all of the links. A modelling tool that developed and explored these links would be helpful for a variety of applications.

Future research could explore the differences and connections between a reductionist epistemology and systemic cognition. Traditionally these two modes of interpretation have been seen as mutually exclusive. There could be a lot gained for future research if we explored the connections between individual thought and systemic cognition. This research would also feed into the cognitive aspects of systems thinking which haven’t been developed as yet. Especially, this research could build a better understanding between the dynamic elements of social cognition with the static and non-linear elements. While this last one is ambitious, the right combination of behavioural research and systemic cognition could provide useful insights.

Conclusion

This paper used the illustration of the GFC to highlight how cognitive engagement impacts on complex problem solving and decision-making. The paper highlighted how particular cognitive models shaped and informed the practices noticed during the GFC by key actors. It is believed that the GFC rested on assumptions that at the time were largely held as rational and shared by many actors. Further research and debate could show how in complex situations, commonly held cognitive models, the kind that uphold an economy for example, need further perspective and analysis to be considered valid. The paper also suggested that dominant models should be reframed and discussed, instead of simply accepted as par for the course.
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