How managers' perceptions about dynamic complexity change: sensemaking catalyzed by shock and surprise

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Abstract

Purpose
This empirical study uncovers emotional sensemaking factors that cause changes in management perceptions about wicked strategic problems under dynamic complexity. These perception changes improve understanding of, and solutions to, the wicked problem.

Design/methodology/approach
Senior managers from three large organizations in different sectors participated in gaming simulation workshops. The strategic issues at stake were intractable and divisive. Qualitative methods captured participants' perceptions of the problems and the dynamic complexity that they faced and how they changed.

Findings
Flawed management perceptions were revised as sensemaking processes were catalyzed by emotions of shock/surprise that came from experiencing unexpected stakeholder conduct within a simulation. The plausibility of the conduct was strengthened because managers were role-playing stakeholders. The shock/surprise emotion uncoupled attachment to entrenched beliefs, leading to a willingness to revise the flawed perceptions. The changed perceptions created new insights for a solution to the wicked problem.

Originality
Our research extends theory on the role of emotions in sensemaking under dynamic complexity. We uncover how a hierarchy of managers' emotions used in sensemaking explains the catalytic effect of the shock and surprise of unexpected stakeholder conduct on revisions to their perceptions of the outcomes of the dynamic complexity.

Practical implications
How management practitioners can improve the tackling of wicked strategic problems through the use of shock and surprise in a gaming simulation.

1. Introduction

In this empirical study of the factors that influence changes in sensemaking under dynamic complexity, we are responding to calls from researchers asking for new approaches to solving wicked problems (e.g. Awati and Nikolova, 2022; Grint, 2022). Our synthesis of the many definitions of wicked problems is that they lack known solutions, whose decision inputs may be uncertain and/or changing, and where interdependence between factors complicates the solving of the problem.

Recent real-world examples of wicked problems (Bloomberg, 2023) include:
-GenZ consumer demand for fashion apparel flips from conventional stores to online, but the transition is driven by multiple, unknown, drivers;
-New entrant fintechs attack incumbent banks with innovative business models but with multiple competitive and regulatory barriers to overcome;
-Government and Central Bank economists struggle to design policies to defeat chronic escalating inflation following global socio-economic crises.

All these examples incorporate uncertainty in the conduct of stakeholders, including consumers, competitors, regulators, investors and employees. This conduct characterizes dynamic complexity, with various market metrics exhibiting a mix of virtuous growth, vicious decline, step changes and cyclicality (Morecroft, 2015; Sterman, 2010). For example, the market growth trajectory for a successful high-tech new product exhibits exponential growth and is driven by experience curves, network effects and the accumulation of complementors. Managers have many cognitive building blocks (Whittle, Vaara and Maitlis, 2023) i.e., perceptions, opinions, beliefs, mental models about the expected market growth rate and the timing and strength of multiple drivers that limit growth and direction. Such perceptions are major drivers of strategic decisions that impact organizational performance, including capacity investment, price and marketing spend (Figure 1). Similarly the conduct of multiple stakeholders, including the client organization, competitors, consumers and regulators influences these perceptions of

market growth. As the actual market growth is observed over time, then with some delay the feedback revises stakeholders' conduct and the whole cycle of decisions followed by observations continues.
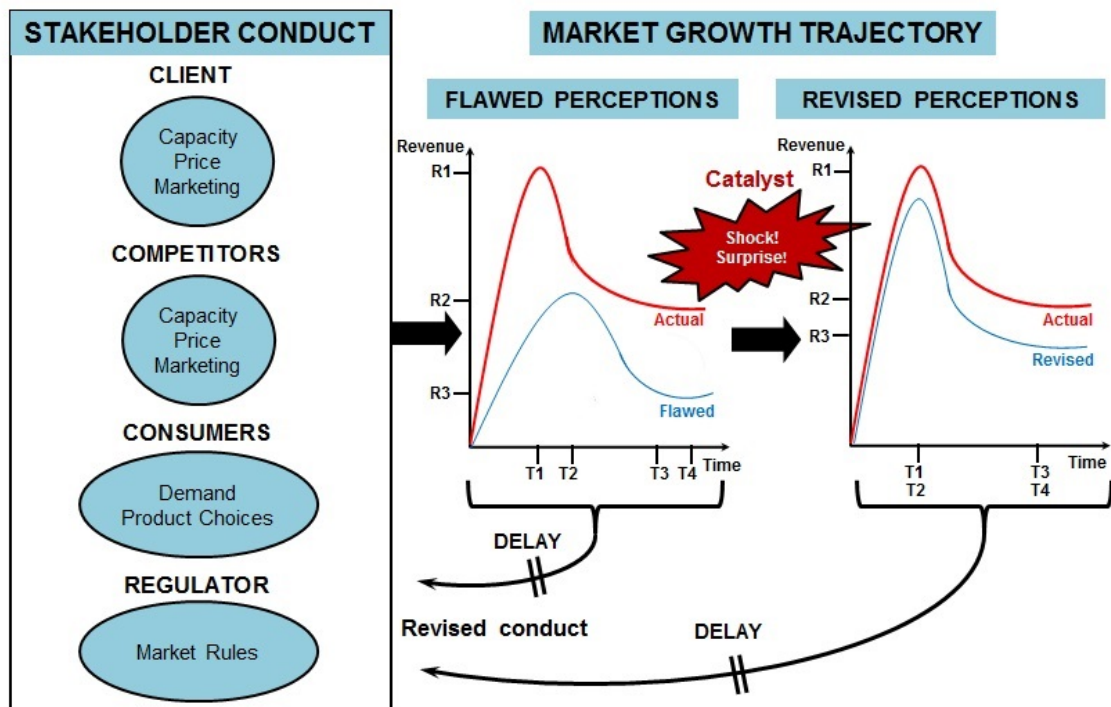

Figure 1. Flawed perceptions are revised by a shock/surprise catalyst

Dynamic complexity is difficult to manage (Torres, Kunc, and O'Brien, 2017). Empirical performance from real-world cases and experimental labs indicate that *flawed* management perceptions of dynamic complexity and its impact on performance is a major problem to solve. We use the term flawed perceptions to mean erroneous mental models that are not obvious to management decision makers without hindsight. Using the market growth trajectory for a high-tech new product example above (parameterized in Figure 1 by R1, R2, T1 and T3), flawed perceptions might include the expected market growth rate (too high or too low), the limits to growth (which factors and how strong they are), and the subsequent rate of market decline (too high or too low). Such flawed management perceptions are often entrenched and stubbornly resistant to change because of the bounding role of experience and industry recipes.

And there is much "value at risk" as a consequence of these flawed perceptions driving multiple strategic decisions, including those relating to capacity, pricing and marketing. The "boom-bust" dynamic illustrated in Figure 1 fits many product growth cover stories. For example, a typical pharmaceutical "blockbuster" drug might have lifetime revenues of US$200 billion (Bloomberg, 2023). Flawed perceptions could affect multiple dynamics of the drug's revenue trajectory, including market growth and decline rates, market size, price elasticity, timing of competitor product launches and their efficacy, post-patent generic new entrants and regulatory safety interventions. Given such flawed perceptions, the value at risk could be anywhere from 20% to 80% of these lifetime revenues, some US$40-160 billion.

The challenge is how these flawed perceptions can be improved. This question can be examined in depth in gaming simulation workshops, which allow participant reflection on simulated organizational performance over many years. A poor simulated performance by a management team in a gaming simulation generates the hindsight that elements of the perception of the dynamic complexity are flawed.

Our empirical study builds on a gap in existing research on solving wicked problems under conditions of dynamic complexity (Gary *et al.*, 2008; Kampmann and Sterman, 2014) by exploring which factors influence changes in management perceptions of the outcomes of dynamic complexity, within gaming simulation workshops. Senior managers from three large organizations attempted to solve intractable and divisive strategic issues. Qualitative methods captured participants' perceptions of the problems and dynamic complexity they faced, and how these perceptions changed before, during and after the workshops. Methods included observation of participants' discussions; written and verbal feedback from participants on their thoughts before, in-between rounds and after the workshop; documentation in the form of participant-completed logs on strategy design; completion of written questionnaires by participants on their understanding. We discuss this in detail in the Methodology section below.

We found that a major factor in changing these flawed perceptions was the effect on the sensemaking process as a result of the emotions[1] of shock and surprise that resulted from experiencing unexpected, but plausible, stakeholder conduct. This catalyzed revisions to perceptions about the dynamic complexity and hence the likely success or failure of the strategy under consideration (Schoemaker, 2020). For example, in Figure 1, a competitor stakeholder making marketing spend decisions much higher than historical norms could

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[1] In the interests of accessibility and readability by practitioners and non-specialists, we use the word *emotion* instead of the more precise term *affect*, which is the word that is most commonly used in the psychology literature

be the shock and surprise catalyst, generating revised perceptions of the market growth trajectory. The flawed perceptions (in the graph on the left) about the trajectory of product market growth are revised (in the graph on the left). And in turn, the observed market growth trajectory which unfolds over time then drives revised stakeholder conduct.

The emotion of shock and surprise uncoupled attachment to entrenched beliefs, leading to a willingness to revise the flawed perceptions (Maitlis and Sonenshein, 2010; Maitlis and Christianson, 2014). The changed perceptions created new insights for a solution to the wicked problem. We also show that the credibility of the unexpected stakeholder conduct is strengthened using managers to role-play specific scenarios involving shock and surprise (as opposed to model-generated shocks).

Our research contributes to theory on sensemaking as it relates to solving dynamically complex problems, by uncovering how a hierarchy of managers' emotions used in sensemaking explain the catalytic effect of shock and surprise of unexpected stakeholder conduct on revisions to their perceptions of the outcomes of the dynamic complexity. Our findings are also important for practitioners because dynamic complexity is pervasive and can result in counter-intuitive outcomes across many organizational settings. Under dynamic complexity, cause and effect can be distant in time and space, making problem-solving difficult for managers who look to explain events through short-term or 'bounded' lenses, resulting in flawed decisions (Acciarini, Brunetta and Boccardelli, 2021). Organizations can address wicked strategy problems under conditions of dynamic complexity, using dynamic gaming simulation workshops.

We next review the theoretical background to the study, followed by our methodology and results. Then we present a discussion and synthesis of our contribution to theory and management practice. Finally we conclude together with limitations and recommendations for future research.

2. Theoretical Background

Our paper focuses on the factors that changed flawed management perceptions about dynamic complexity. It is interdisciplinary, building on two main themes from the various fields of behavioral decision theory, system dynamics, dynamically-complex systems and emotions in sensemaking. First, the challenges facing management learning and performance under dynamic complexity and the impact of gaming simulation tools to improve performance. Second, the role of shock and surprise in sensemaking and why flawed management perceptions are changed.

2.1 Management Learning In and About Dynamic Complexity

Dynamic complexity is a known problem for managers making strategic decisions. An example is an organization that initiates an action in response to a market or competitor signal, only to find that the performance outcome is not only less than expected, but also in the opposite direction. This is typically the situation in dynamically-complex environments (Morecroft, 2015; Sterman, 2010) where there are long time lags between action and results and also numerous side effects (often unintended consequences) of a particular decision. The recent digitization trends in rapidly evolving technologies, consumer preferences and new business models have significantly increased the speed and magnitude of change to generate sector discontinuities and multiple challenges for organizations to respond effectively (Langley and Rieple, 2021).

There are many examples of dynamic complexity that are common to different industries. These situations are often difficult to manage well mainly because they appear to be deceptively easy to cope with (*misperceptions of feedback*, Sterman, 1989). Due to incomplete understanding of the dynamics, managers often place emphasis on the wrong and/or less important managerial levers resulting in sub-optimal initiatives and sub-optimal performance. Also, managers underestimate the impact of internally generated dynamics on their business and tend to attribute wide variations in business performance to external factors beyond their control (for example, exchange rate fluctuations or competitor activities).

One recent view is that a "systems thinking" approach is needed to understand wicked problems that are characterized by dynamic complexity (Grewatsch, Kennedy and Bansal, 2021). System dynamics model simulations can be used to investigate how certain strategic decisions drive positive reinforcing, or counter-balancing, feedback loops. The dynamic simulation models can then be explored effectively in gaming simulation workshops, which introduce "doing" into strategy discussions in a fast, effective and risk-free way (Gary and Wood, 2011). They act as a catalyst to help managers focus, reflect and hence change their mental models (perceptions) and subsequently their decision-making behavior). Thus, gaming simulations are powerful devices for communicating and internalizing strategy across an entire senior management team, dramatically accelerating learning about a shared vision of the firm's future (Langley, 2023).

A number of experimental studies have been conducted in "managerial labs" (typically with MBA students or executive short course participants) in the fields of system dynamics and behavioral decision theory, examining decision making in complex

dynamic systems (Torres *et al*., 2017). Results consistently found that decisions made are far from optimal and often poor relative to normative benchmarks or simple decision rules. All these experiments seem to pass an important test for external validity – that the outcomes resemble real world performance. For example, oil industry investment and demand/supply balances (Langley and Morecroft, 2004); asset management under resource depletion in a fisheries fleet (Kunc and Morecroft, 2010); and production and pricing in a commodity market with inventory management (Kampmann and Sterman, 2014).

In many studies, subjects do not improve performance, or appear to adjust their perceptions about dynamic complexity, following experience (over repeated trials). But in just a few cases performance is improved after receiving insights about systemic (feedback) structure, a notion that learning to improve performance is indeed possible (Langley and Morecroft, 2004; Leemkuil and De Jong, 2012). Learning about dynamic complexity during the process of building simulation models is often most effective when managers have experienced relevant cause and effect relationships in far-from-the-equilibrium extreme conditions (Sterman, 2010). There is also some evidence from this body of research on gaming simulation workshops of changes in participant perceptions of dynamic complexity following a shock or surprise (Augier, Dew, Knudsen, and Stieglitz, 2018). However prior studies have not explained how perceptions change, or are not reliable and consistent across contexts. We seek to better understand this process with the objective of creating a replicable gaming simulation toolset to help solve wicked problems.

2.2 The Role of Shock and Surprise in Sensemaking

The extensive sensemaking literature provides some explanation for how shock and surprise can change perceptions and subsequently management decision-making. This is especially so under conditions of crisis or change, and in dynamic and unpredictable environments (Dwyer, Hardy, and Tsoukas, 2023). Maitlis and Sonenshein (2010) argue that emotions play a key role in the process of sensemaking in such conditions. Maitlis and Christianson (2014) further suggest that emotion first of all signals the need for new sensemaking and provides the energy to drive any necessary changes. However, despite Maitlis and Sonsenshein's (2010) plea, only a few recent studies (for example Dionne, Gooty, Yammarino and Sayama, 2018; Kataria, Kreiner, Hollensbe, Sheep and Stambaugh, 2018; Cristofaro, 2022) have explicitly addressed the role of emotion in sensemaking, or the interplay between emotions and cognition, and still leaves under-theorized the likely impact of emotion on sensemaking in chaotic contexts.

Crises or dynamic environments are situations where previous sensemaking becomes unsuitable. Previously, Weick (1995) argued that an unexpected interruption in an ongoing flow of activity triggers arousal of the autonomic nervous system, and that this arousal serves as a warning that there is a stimulus to which attention must be paid. Conceptually related to sensemaking is sensebreaking "the destruction or breaking down of meaning. Individuals use sensebreaking to question existing understandings of themselves or their situation (Maitlis and Lawrence, 2007; Vlaar, Fenema and Tiwari, 2008). Comparatively little research has focused on the role that emotion plays in either sensemaking or sensebreaking activities (Kataria *et al.*, 2018).

The literature on the respective role of positive or negative emotions is equivocal. On the one hand the intense, negative felt emotions typically found in crisis and change contexts can impede sensemaking. Threat engenders rigid reactions, such that individuals enact well-learned, habituated responses that are often inappropriate to the changing situation (Maitlis and Sonenshein, 2010; Sarkar and Osiyevskyy, 2018). More recently Dwyer *et al*. (2023) showed that under the context of extreme incidents, practitioners experience emotions that can inhibit sensemaking, for example fear of senior management, sadness, anger and apathy.

On the other hand some forms of anxiety can facilitate change. Doubt is an essential component for adaptive sensemaking, and fear may be necessary to overcome the strength of entrenched beliefs or "stickiness" that is the consequence of previously negotiated shared meanings, for example about the nature of competition (Strike and Rerup, 2016). Such commitment to established norms and group identity is where danger can lie – as individuals grasp tenaciously onto familiar meanings. Thus strong emotions of fear and urgency may be necessary to uncouple attachment to entrenched beliefs.

But the literature is scant on how to significantly change management perceptions and hence improve management learning and performance under dynamic complexity. For example, although Johnsen (2021) found that construction entrepreneurs, in an attempt to change the mindset that prevails in the construction industry, challenged the dominant perception of sustainability and thus created a space for new understandings of green architecture, he did not focus on the process whereby these entrenched perceptions were changed. Nor did he suggest how this might happen in different contexts. And although Klarin and Sharmelly (2021) examined sensemaking in unstable emerging markets, they did not specifically examine emotions.

Recent papers add further to the understanding of individual versus team sensemaking and the interplay of multiple emotions on sensemaking. Cristofaro (2022) reviews research on organizational sensemaking, and proposes an updated and holistic revisitation

of the original (Weick) sensemaking model according to a co-evolutionary lens. A key part of this model examines the transition from initial individual sensemaking to team collective sensemaking. Cristofaro's (2020) Affect Cognitive Theory explains how decision-making processes occur, by considering the interplay between emotions and cognition. This work considers the role of mixed emotions in sensemaking to understand what are the implications of multiple emotions in sensemaking activity. Emotional power or strength varies. So the impact on sensemaking efficacy (i.e., the ability to solve a problem) depends on the number of emotions in play, and how strong they are.

Because they so rarely occur, real-world shock and surprise events, including high market fluctuations, economic crises and bankruptcies, are difficult for managers to gain experience in how best to manage them (Allal-Chérif and Makhlouf, 2016). In parallel, there are few empirical studies about changes in perception of dynamic complexity as a result of shock and surprise. One rare example is Rahmandad and Repenning (2016) who report on a turnaround success by a software company, attributed by a senior manager to the organization's learning from a previous "shocking" failure, a sales boom curtailed by fast acting limits to growth which then flipped to a vicious decline to a bust. However, they were looking from the perspective of the erosion of capabilities and did not examine the role of emotions on sensemaking or changes to the way that information was processed and interpreted.

Fortunately real-world studies are not the only avenue for understanding the impact of shock and surprise on understanding dynamic complexity. Gaming simulation workshops can be designed so that they catalyze a change in perceptions about the dynamic complexity and how it drives organizational performance (Lawrence and Haasnoot, 2017). The catalyst is the ability to experiment risk-free in multiple trials until an improvement is discovered - almost by trial and error. Empirical studies in different fields report encouraging impact on learning following simulated extreme or unexpected conditions. For example, using aircraft flight simulators with unpredictability and variability in scenarios coupled with cascading equipment failures and hazardous weather (Landman, van Oorschot, van Paassen, Groen, Bronkhorst and Mulder, 2018). Superior "understanding and performance" in a shock and surprise test was found in treatment groups who had previously undergone unpredictable outcomes training (in comparison to control groups who had not). But neither of these two studies explained how the shock/surprise affected perceptions as a result of the role of emotions on sensemaking.

Our empirical study is of the factors that influence changes in sensemaking under dynamic complexity. It fills a gap in the literature by identifying how perceptions are catalyzed to change by the shock and surprise of unexpected stakeholder conduct within a gaming simulation. Within this we focus on understanding the role of emotions in changing managers' perceptions of how they can deal with the problems they face as a

result of the dynamic complexity. And further, we seek to explain how these perception changes modify managers' strategic insights about the intended strategy or business model.

The next section describes the methodology used to investigate this research question.

3. Methodology

Our empirical study involves managers from three large organizations who were trying to solve intractable problems under conditions of dynamic complexity within gaming simulation workshops. We seek to understand the factors that led to changes in their perceptions of dynamic complexity.

At the time that data gathering took place one of the authors was a specialist advisor to a large management consulting firm undertaking workshops for clients. This paper focuses on three such workshops which included gaming simulations, developed and run over a period of one year with three different large commercial organizations. The workshops were part of longer-term strategy interventions which could last for several months or longer, depending on the client organization's needs and preferences.

The three organizations that we examine in this study were all facing divisive issues, within a difficult environment characterized by dynamic complexity. They had all decided to engage with a gaming simulation workshop in order to help develop a deeper understanding of the intractable issue that they faced. The organizations were selected for analysis because an initial review of the participants' discussions indicated that something interesting was going on in terms of their sensemaking processes, as a result of their experiences in the simulation. Each organization differed by sector/industry and the dynamically-complex issue that they faced (Table 1).

Table 1.
Three organizations, workshops delivered, business situation, complication(s) and the key dynamic complexity of the wicked problem

Organization	Gaming simulation workshops delivered and timescale	Business situation	Complication(s)	Dynamic complexity
1 Global Pharmaceutical	Two with senior managers including the CEO, then ten more with 200 middle managers over six months	A history of being early to market and achieving dominant positions They had developed a launch strategy for a potential "blockbuster" product	For the first time, they were facing very early and aggressive competition not only from traditional pharma players, but also from consumer goods companies (with potentially huge marketing budgets)	Reinforcing virtuous growth of the market could be much higher or lower than expected, creating challenges for capacity growth and value capture
2 UK Financial Services	One with the senior team (20) including the CEO. Six follow-ups with 120 middle managers over two months	A top European pensions and investments company was in need of a new strategy because of future regulatory and competitive discontinuities	Within the board there were several quite disparate views on expected future performance, from complacency to fear	Virtuous growth trajectory of sales could rapidly slow and flip to a vicious decline

3 French Consumer Goods Conglomerate	One with senior team including the CEO then roll-out of 40 workshops to 120 senior and 600 functional managers over one year	Implementation of a multi-product growth strategy in new territories Needed organization-wide adoption of key management principles on the way that resources were allocated to existing and new products	How to internalize the new paradigm across management teams Independent-minded managers need to be influenced with realistic tools and methods	Recognizing and overcoming the limits to growth

The gaming simulation design was specific to the dynamically-complex issue under consideration and did not attempt to model the whole organization. The simulation models were developed over a number of weeks and converted to a gaming simulation user interface for use in the workshop. It is outside the scope of this paper to describe the underlying simulation model building process (documented extensively elsewhere, for example Morecroft, 2015; Sterman, 2010). The gaming simulations were an interface to the simulation model, suitable for use in a one day workshop and by the senior management teams involved (i.e., number of decisions, number of output reports, task objectives and performance metrics). Our workshops incorporated best-practice aspects of gaming simulation design (Rumore, Schenk and Susskind, 2016; Augier *et al.*, 2018; Torres *et al.*, 2017).

In this research, the three organizations had been engaged with the consulting firm in a long-term trust-based relationship. The gaming simulation activity (over multiple workshops with senior and middle management) formed part of a much wider engagement with the client. Workshop participants in all three organizations were of a similar mix for age, gender, ethnicity, education and job responsibilities.

There were a number of elements to the data collection: observation of participants' discussions by consultant facilitators; written and verbal feedback from participants on their thoughts before, in-between rounds and after the workshop; documentation in the form of participant-completed logs on strategy design; completion of written questionnaires by participants on their understanding; videos and synthesis of the strategic problems/issues under investigation and how these may have changed during the course of the workshop (Baird, Plummer, Haug and Huitem, 2014).

In this research, the gaming simulation workshops were all conducted with organizations involved in a paid consulting relationship. The major methodological issue is if consultant facilitator choices, such as what briefings they were given as to their expected actions, influence outcomes (Susskind and Cruikshank, 2006; Franco and Nielsen, 2018). We believe that any biases in the consulting relationship did not affect our findings, because, although there was desire on both sides for the intervention to work, only afterwards when the transcripts were analyzed inductively, did the role of shock and surprise emerge as a factor in changing behaviors and decisions. We reviewed participant and observation debriefing notes with client leaders to check that the recordings were accurate; and we had discussions of the data analysis protocol and implications of the findings between the two co-authors.

The data from transcripts of videos and interviews, together with participant-completed questionnaires, were analyzed using standard thematic qualitative coding techniques (Américo, Clegg, and Tureta, 2023; Flick, 2014). This method was deemed appropriate as it can highlight similarities and differences across the data set and can generate unanticipated insights. Data analysis was accomplished in three phases. The first phase consisted of multiple readings of the transcripts to identify the most common and/or important themes relating to perceptions of stakeholder conduct and market uncertainties under dynamic complexity. These were coded factually without applying any theoretical frameworks. The coding was based deductively on prior literature, and inductively on new insights emerging from the data, in a retroductive stance. The second phase involved refining our interpretation of the coding, revisiting the literature, and refining and re-organizing the themes that had emerged from the first phase of our analysis. During the second phase we began to be able to identify dynamic complexity theory-informed explanations for what we saw in our data. The final phase in our analysis comprised a further refining of the data focused on identifying theory-informed causal or explanatory links between variables, including the role of emotions on sensemaking in this context.

This type of exercise was useful in helping to understand and document how management perceptions had changed (Sousa and Rocha, 2019). For example, "market growth is much higher than we had expected due to direct-to-consumer word-of-mouth network effects" implies a perception change on the strength of a driver of virtuous growth. It was at this stage that the role of emotions emerged as relevant and further reading around the theoretical fields of emotions and sensemaking was undertaken.

From our inductive analysis we were able to formulate a research question, namely *how* managers' perceptions about wicked strategic problems under dynamic complexity are

catalyzed to change within the sensemaking process by the emotions of shock and surprise of unexpected stakeholder conduct.

4. Results

Our results are structured around the wicked problems facing each of the three organizations. Table 2 summarizes the three gaming workshop interventions, the main perceptions changed and the potential strategic impact from these perception changes.

Table 2.

The key dynamic complexity for three wicked problems, before and after catalyzed perception changes and the potential strategic impact

Dynamic complexity	Dominant perception	Shock and surprise catalyst	Change in perception	Potential Strategic impact
1. Reinforcing virtuous growth of the market could be much higher or lower than expected, creating challenges for capacity growth and value capture	"Consumer goods new entrant won't execute a big direct-to-consumer (DTC) marketing spend – it's just not economically viable"	Observing the unexpected competitor conduct role-played by client managers DTC spend 10 times or more larger than expected, but still profitable	"Not that it won't happen, but when?" Consider counter-measures to strong consumer goods DTC marketing spend"	How to think like the competition and identify shortcomings in their own strategy How to shape the market trajectory, by investing in market growth and creatively encouraging competitors to do the same

2. Virtuous growth trajectory of sales could rapidly slow and flip to a vicious decline	"The past three years' tremendous profit growth is sustainable for several more years"	Various unexpected changes in consumer demand (e.g., lower prices preferred in direct channels), coupled with unexpected competitor and regulator conduct	"When could the flip happen and what drives the flip" "We're in deep trouble here if we don't do something about the entry of strong consumer brands"	"We must modify our positioning on price/brand" "The simulation workshop is outstanding - we should get the mid-tier sales managers to play this in order to better understand the competition"
3. Recognizing and overcoming the limits to growth	"Our brands with price premiums are sustainable and lower-price competitors can't beat them" "The reinforcing network effects are very strong and will continue to drive sustainable virtuous growth"	Observing competitor (big) winners and (big) losers in managing a product portfolio strategy Experimentation was allowed to challenge current best practice, which turned out to be a long way from best	"Limits to our product growth are much stronger than we thought, e.g., competitor price changes" "We can only enjoy a price premium if we advertise and invest in product quality…but needs a sustained investment and don't give in to pressure to cut price"	Sharing a new vision and approach for focusing on fewer products and use leading indicators to quickly eliminate duds Redesign strategy communication with middle managers

4.1 Wicked problem 1
Key dynamic complexity: reinforcing virtuous market growth could be much higher or lower than expected, creating challenges for capacity growth and value capture

In a leading global pharmaceutical company the consulting team was investigating the launch strategy of a potential "blockbuster" product. The company had a history of being early to market and achieving dominant positions. However, in this instance it was facing very early aggressive competition not only from traditional pharma players, but also from new entry consumer goods players. It was not clear what unilateral preemptive actions, if any, the organization could take to shape potential attacker entry strategies.

A real-time (as opposed to batch-processed) gaming simulation was developed allowing three teams (client, pharma competitor and consumer goods competitor) to compete against each other over a simulated five-year period. Decisions included price, discounts and marketing spend split between segments and channels, sales detailing versus direct-to-consumer (DTC), plus spending on other initiatives (e.g., new formulations). On-screen reports and graphs included financial and market indicators as well as market research data (e.g., stakeholders' product perceptions).

Managers learned how to shape the market growth trajectory. They invested in growing the market (as opposed to simply winning share) and also found creative ways to encourage competitors to invest in market growth. The client managers role-played a consumer goods competitor and learned to make high marketing investments in the context of the gaming simulation, something that was culturally very difficult for them to do in their real-world jobs. They also sustained the investments to achieve profitable returns, hence demonstrating a credible competitor strategy.

In one workshop, the market had grown much faster than the managers had expected, under an aggressive DTC marketing spend. A lively discussion took place during the debriefing when some participants suggested that although it was contrary to their existing experiences, the market *could* possibly grow at the faster rate and if it were to do so, then their current marketing strategy was somewhat inadequate.

Participant1:   *The market growth rate is too high – much higher than we've previously seen.*
Participant2:   *It's driven by high DTC spend which catalyzes word-of-mouth effects to a significantly higher rate than physician [sales rep] detailing.*
Participant1:   *Our current marketing spending levels are likely to be out-stripped by the competitor-drug in both DTC and physician detailing.*

Participant2: *Competitor has previous experience in building an image o mythology around a product [competitor's earlier blockbuster-drugs] which it will use to its advantage with competitor-drug.*

Participant1: *We have limited experience in competing against image or mythology, focusing instead on science.*

Participant2: *So just how bad will these competitor-drug messages be for us, coupled with this consumer word-of-mouth escalation?*

The mood of the meeting changed to thinking about alternative futures. Experiencing this high market growth scenario for themselves in the gaming simulation raised the level of the debate in the debriefing discussion. Perceptions were changing on how strongly the new entry consumer-goods competitor could drive a high market growth rate through a large DTC spend, possibly then triggering a virtuous reinforcing growth word-of-mouth effect.

The main dynamic complexity was unexpected competitor conduct driving very high reinforcing market growth, much higher than initially expected and prepared for, in terms of manufacturing and sales capacity building. The perception change was the size of likely rates of virtuous growth driven by reinforcing network effects. The shock and surprise catalyst shaping this perception change came from observing the competitor conduct with client managers role-playing the competitor, creating unexpected but plausible outcomes. The strategic insights were modified by considering counter-measures to strong consumer goods marketing spend to best capture the higher value creation.

4.2 Wicked problem 2
Key dynamic complexity: virtuous growth trajectory could rapidly slow and flip to a vicious decline

A UK pensions and investments company (one of the top ten players) needed help with thinking about its future. Within the board, there were several quite disparate views on expected future performance, ranging from complacency:

> *The past three years' tremendous profit growth is sustainable for several more years.*

…to fear:

> *We're in deep trouble here if we don't do something about the entry of strong consumer brands.*

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The board split was understandable, given that the industry was undergoing a number of transformations brought about by regulatory and market discontinuities (telephone and internet channel replacing the direct sales-force channel, new government pension schemes and so on). They asked the consulting team to help them build internal consistency within their assumptions about industry trends and uncertainties driving future scenarios.

A gaming simulation workshop was designed for just the Board (a total of 20 Executives and Non-Executives), based around four competitors (one of which was the client company itself) played by four participant teams and the rest of the industry was played by the simulation model. The competitive market was simplified to two products in just two channels. Yearly decisions included price and investments in service and advertising, over a ten year period. Decisions and performance indicators were recorded and communicated using paper-based media.

The gaming simulation helped the Board to recognize signals from the competitor or the market environment, possibly about an unfamiliar future which could not be easily related to the past experiences of the Board. For example, in the direct channel (phone and internet) scale is very important and margins are likely to be thin. Strongly branded distribution, heavy advertising and extremely competitive pricing are the key to gaining market share and loyalty. However, in the workshop players priced over-aggressively and made very large advertising spends, as a result of competitive pressures to win share. Much value was consequently eroded.

As the intended strategies and actual performance of each team were replayed during the post-game debriefing session, there was initially utter disbelief in the value that had been destroyed, through their competitive dynamics. In most cases embedded value decayed. This would translate with a lag into lower dividend payments. Then the participants came to terms with the pressures they had faced in the simulation (just like those that they might experience in the real-world) and talked frankly about how to avoid a disastrous response. The executive board members were engaged in a debate with non-executives:

Exec1:   *Our strategy can be summarized as a virtuous circle - starting with*
                strong sales growth we generate profit growth and shareholder value.
Non-Exec1: *But only if the growth in profits is sustainable. If your cost base is too high*
                then your margins will be insufficient to generate the profit growth - you'll
                get the volume share but not the margins. There are a number of
                counteracting pressures that may make it difficult to sustain the virtuous

circle. In fact, if you are not careful then everything could work in reverse and the virtuous circle becomes a vicious decline!

Exec2: *How can that be? The worst that can happen is that we grow profit a little slower than expectations.*

Looks of incredulity within the room prompts Non-Exec1 to elaborate:

Non-Exec1: *To generate the value required we might cut marketing spend or service costs or product investment costs. Or, we might decide to raise prices which would increase the unit margin but won't represent the good value products which our customers associate with the brand. Either way, under sustained competitive pressure on our value proposition, we can't generate the volume and the sales growth declines further and so on.*

Exec3: *Isn't this all a bit far-fetched?*

Non-Exec1: *Maybe, but it will happen very quickly – months rather than years. So we need to be prepared and understand the leading indicators of a possible decline.*

The main dynamic complexity was how a slower profit growth performance could unexpectedly and quickly flip to a vicious decline in profits. The perception change was just how rapidly this could happen and what was driving the flip. The shock and surprise catalyst shaping this perception change was various unexpected changes in consumer demand (e.g., lower prices preferred in direct channels) coupled with unexpected competitor and regulator conduct which were role-played for client managers to engage with. The strategic insights were modified by discussing their positioning on price/brand. Senior managers were somewhat less complacent about their future success, raising their level of debate about "what to do if…". The "do it all" approach was seen as at risk from attack from more focused players.

4.3 Wicked problem 3
Key dynamic complexity: recognizing and overcoming the limits to growth
A French conglomerate food company had developed a corporate-wide program to boost growth, by adopting a new approach to product portfolio management and branding strategy. The project deployed a gaming simulation to help business unit managers understand the complex dynamics of tradeoffs between multiple products and various product development, sales and the marketing levers to manage these products.

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As part of a corporate-wide effort to boost growth, the consulting team reviewed the strategies of a number of business units at this client. It soon became apparent that some general lessons could be derived for all other business units in this diversified corporation. For example, these lessons had to do with the way resources were allocated to existing and new products, the marketing measures that were tracked with more or less attention and the time that new initiatives were given to succeed.

Using the gaming simulation, teams of client managers played against competitors (either model-driven or client role-playing), in which they tried to create and capture as much value as possible. The simulation allowed players to sacrifice short-term profit for long-term brand equity that will drive future growth. This dialogue between client team members captured this trade-off:

Participant1: *I only reduced the price by 5% to match the competitor's cut and hold our market share.*

Participant2: *But that was enough to destroy our revenue and profit growth!*

Participan3: *Managing the brand involves building and maintaining several intangibles in tandem. If we build consumer awareness through advertising and improve perceived product quality through a product re-launch, then we can capture value by increasing price – but there is a delay before we can benefit from the investment.*

The participants were changing their perception here on the timing delay of the impact of the intangible drivers on brand reputation. Significantly, when asked in debriefing sessions to reflect on what they had learned in the game, the insights they had gained were exactly those intended and were not rejected as "obvious", or as specific to one business. For example, the lesson that resources should be focused on key products rather than spread thinly was clearly understood in a much more vivid way than when simply stated. Management perceptions changed on this issue, but also on the surprising impact of (more) capable competitors who were more proactive in this respect.

The main dynamic complexity was that successful brand building (price premium and advertising spend) needs sustained investment and multiple limits to growth must be recognized and overcome. The perception change was the much increased strength of impact of limiting factors on virtuous growth. Furthermore, understanding the importance of using the correct leading indicators of success or failure to aggressively invest resources in products, or quickly cull them. The shock and surprise catalyst shaping this perception change was observing the contrast between competitor (big) winners and (big)

losers in managing a product portfolio strategy. The strategic insights were modified by sharing a new vision and approach for focusing on fewer products, while quickly eliminating duds.

5. Discussion

In this study, we captured rich qualitative data on perception changes about the dynamic complexity of wicked (intractable) strategy problems, using gaming simulation workshops with senior managers in three large organizations. The research uncovered how emotions in sensemaking explain the catalytic effect of shock and surprise of unexpected stakeholder conduct on perception changes concerning the efficacy of their intended strategy, under conditions of dynamic complexity.

Our results go beyond previous studies (including Rahmandad and Repenning, 2016; Lawrence and Haasnoot, 2017; Landman *et al*., 2018) in explaining *how* the shock and surprise catalyzes perception changes. We look more closely at the emotions of senior management participants (Maitlis and Christianson, 2014). We note that they were very familiar with each other's preferences/mindsets as part of a close-knit senior management team (Strese, Keller, Flatten and Brettel, 2018). The stakes were high. Tackling wicked problems which were divisive for the team (Hopson and Cram, 2020), and winning or losing in simulated performance had reputation risks for the participants - no-one wanted to be seen to perform poorly, even in a simulation workshop (Bernerth, Carter and Cole, 2021). A combination of a less risky environment (than the real boardroom) and the urgency of the situation stimulated an "end-goal" focus - a willingness to try something different in order to find a solution, and a more positive attitude - "if we've got this wrong then let's try something new that might work better".

Maitlis and Christianson (2014) argued that emotions signal the need for sensemaking and then provide the energy to drive it. Our managers' need was a sense of urgency to solve divisive problems coupled with a fear of a failed reputation in the simulation. Their energy was fueled by competitiveness and a strong desire to learn to improve organizational performance. Finally, their emotions were based on the confidence in role-playing colleagues' credibility as competent decision makers, thus impacting the plausibility of unexpected stakeholder conduct when this came from their colleagues.

Weick (1995) showed how unexpected interruption in an ongoing flow of activity triggers arousal of the autonomic nervous system, thus the shock/surprise emotion (the catalyst of unexpected stakeholder conduct, e.g., a competitor new entrant with a very high marketing spend) stimulated a new insight - the so-called "ah-ah moment of truth"

(Kounios and Beeman, 2009). This insight was a self-realization of an inadequate performance outcome (e.g., "our strategy for value-capture from the growth of the market is just NOT robust to the unexpected competitor's decisions") hence uncoupled an attachment to entrenched beliefs and a willingness to revise flawed perceptions.

We had six emotions in play (fear of loss of reputation with peers, competitive spirit, end-goal focus, sense of urgency, fear of failure and confidence in the plausibility of colleagues' decisions). But to catalyze the managers' team collective buy-in to a revision in perceptions (of the dynamic complexity), the additional shock/surprise emotion was needed. Each of the six emotions impacted variously on individual managers' sensemaking. But the much "stronger" shock/surprise emotion affected all the manager team members and hence impacted the team's sensemaking of the wicked problem solution (Cristofaro, 2020, 2022). This shock/surprise emotion appeared to have a stronger effect because it superseded other emotions which divided opinions, rather than uniting.

We suggest that the senior manager participants experienced the six emotions in the workshop, as indeed they did so in real life. Each emotion was likely to have affected each manager in different ways. Hence opinions on strategic decisions were divided rather than united. The shock/surprise acted as a unifying emotion because it was a large step change from expectation norms on stakeholder conduct, experienced by everyone in the same way. The surprise was an intense experience. Our findings suggest that there were two elements to the shock and surprise that were particularly material to the changes brought to sensemaking: first the intensity of the emotion and second the surprise element, which together brought about an embodied, physical, reaction (Whittle et al., 2023) and loosened attachment to previous beliefs.

The senior managers' recognition of their perceptions as being flawed was based on the hindsight that came from simulated performance over several years and repeated rounds experimenting with different strategic decisions. They understood more deeply the implications of the conduct of stakeholders (including competitors, consumers and regulators) on the success of their strategy. The perception changes experienced by senior managers stimulated further thought and discussion on strategic insights through escaping an entrenched perception and implementing a mind-set different from the old one (Grint, 2022).

Previous experimental studies conducted in "managerial labs" have found that improvement in managerial learning and simulated performance after repeated trials is poor (see Torres *et al.*, 2017 for a review). In contrast, we did find that management perceptions about dynamic complexity were changed and consequently strategic insights.

Figure 2 shows the emotions discussed above influencing managers' sensemaking such that their flawed perceptions of dynamic complexity (from Figure 1) were revised.
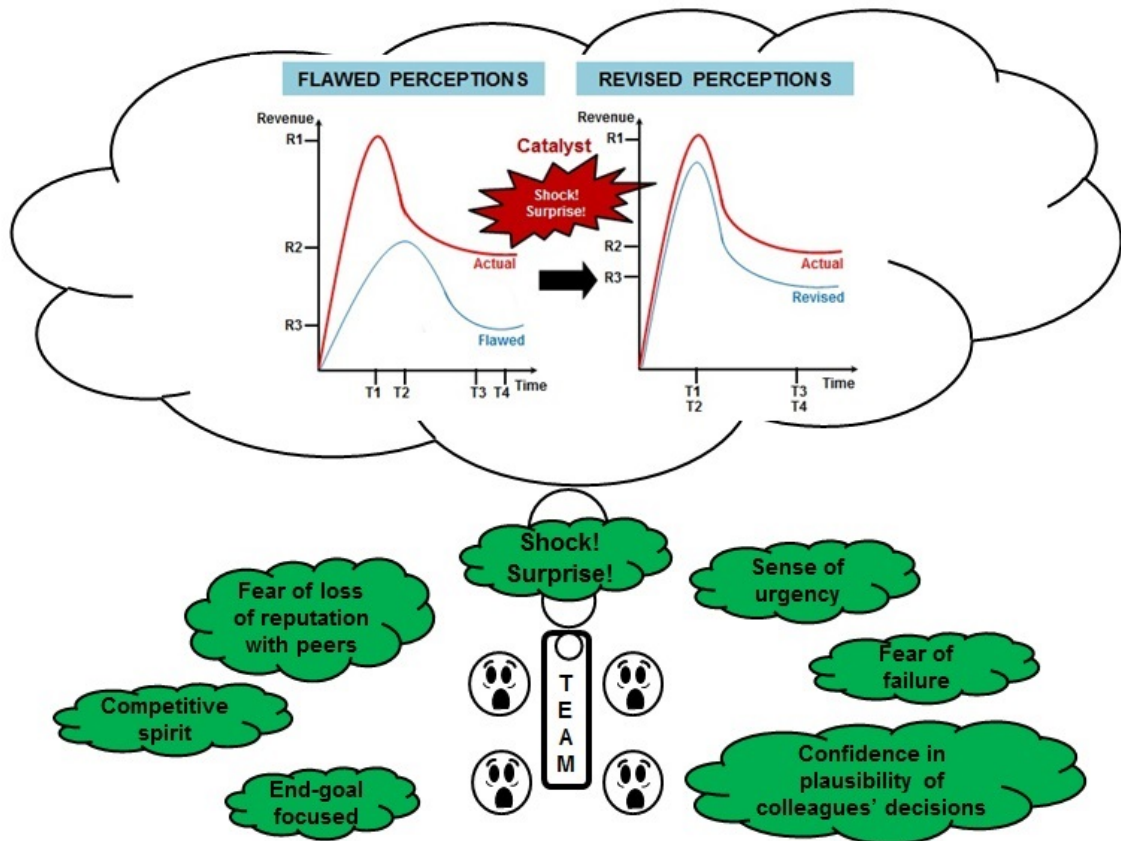

Figure 2. The team experiences various emotional pressures, but the shock/surprise unifies team sensemaking and catalyzes revised perceptions

The shock and surprise catalyst shaping our three cases of perception changes came from unexpected conduct (decisions) from stakeholders, including competitors (capacity variations, price variations, marketing/positioning variations), consumers (demand variations) and regulators (variations in rule-making and meddling). Hence a departure from "normal" based on past experience or current planned expectations. Furthermore the shock and surprise could be from an unexpected or counterintuitive performance outcome. For example, the client team performance is not even close to planned targets or is outperformed by a competitor (role-played by client managers).

All three wicked strategy problems in this study were similar in that the organizations were large and the issues were both intractable and divisive at senior management level. But each was from a different sector/industry and more importantly the key dynamic complexity issue varied in each case. The results demonstrate that management perceptions were changed in all three cases through a shock and surprise catalyst, despite variations in the dynamic complexity driving the intractable strategic issues. In the global pharma company, strategic insights were modified as client managers shifted from "the consumer goods new entrant conduct (a very high consumer advertising spend) is not plausible" to "but what if it does happen - how can we respond? What's the win-win solution rather than a battle for share?" In the UK financial services organization, strategic insights were modified as client managers discussed changing their positioning on price/brand and were somewhat less complacent about their future success, raising their level of debate about "what to do if…". In the French food company, modified strategic insights included sharing a new vision and approach for focusing on fewer products, while quickly eliminating duds.

6. Conclusions

In this study, our focus has been on using a gaming simulation toolset to help solve a class of wicked (intractable) strategic problems characterized by dynamic complexity. This motivation for this work is in response to calls from researchers in this journal and elsewhere (e.g. Awati and Nikolova, 2022; Grewatsch *et al.*, 2021; Grint, 2022). Following empirical studies from real-world cases and experimental labs (see Torres, Kunc, and O'Brien, 2017 for a summary) we introduce the notion of *flawed* management perceptions of the dynamic complexity. These flawed perceptions drive systemic errors in sensemaking, hence poor performance. We argue that revising these flawed perceptions improves understanding of the dynamic complexity, hence improving solutions to the wicked problem.

We suggest our findings will help managers better tackle wicked problems by using shock and surprise to uncouple attachment to entrenched beliefs, leading to a willingness to revise assumptions that had created the flawed perceptions. Little prior research has explained how the changes in participant perceptions of the dynamic complexity, following a shock or surprise in a simulation, actually work. Our study fills this gap in the literature by identifying how the perceptions are catalyzed to change by the shock and surprise of unexpected stakeholder conduct. We contribute to theory by focusing on improving our understanding of the role of emotions in changing managers' perceptions of dynamically complex wicked problems. We propose an emotional hierarchy where a much stronger shock/surprise emotion supersedes six other emotions, thus unifying team sensemaking on solving the dynamically complex wicked problem.

We contribute to the equivocal debate within the sensemaking field on the respective role of positive or negative emotions. On the one hand the intense, negative felt emotions typically found in crisis and change contexts can impede sensemaking (Maitlis and Sonenshein, 2010; Sarkar and Osiyevskyy, 2018; Dwyer *et al.*, 2023). On the other hand some forms of anxiety can facilitate change in perceptions and adaptive sensemaking, to overcome the strength of entrenched beliefs (Johnsen, 2021; Strike and Rerup, 2016). Our findings support the latter perspective.

This research also makes a contribution to revising and improving practitioners' perceptions of dynamic complexity through the use of gaming simulation toolsets. Exposing practitioners to simulated conditions that produce shock and surprise from unexpected stakeholder conduct can help to expose flawed perceptions of the dynamic complexity. Hence improve strategic insights about the wicked problem they are trying to solve.

6.1 Limitations

Because this was a single study we are not able to say what aspect of the gaming simulation workshop design produces the most impactful shock and surprise. Our three cases focused on the conduct of competitors, but other possible stakeholder conduct includes consumers, investors and regulators. There is also uncertainty and discontinuities in the market environment (externalities) that could generate shock and surprise.

Strategic decisions driving performance outcomes could be "workshop biased" reflecting the relatively risk-free environment. The gaming workshop protocols outlined in the methodology helped to mitigate such behavior.

Another practical challenge for developing a new approach to solving wicked problems is the feasibility of modeling the scope and depth of the particular wicked problem. Clearly many wicked problems are so-called because they have no obvious analytical solutions. For example, it is likely impossible to solve an equation to optimize policies to achieve both a minimum inflation rate and say a 2-3% gdp growth rate. But a simulation model could be built to capture the key macroeconomic elements and policy levers to test (by trial and error) various policy choices to achieve the targets above. It would just take a long time to complete many simulation runs. Similarly for many wicked problems - the market/economic environment that hosts the problem could be modeled in a simulation.

In this research, the gaming simulation workshops were all conducted with organizations involved in a paid consulting relationship. We've already discussed in the methodology section various approaches taken to minimize bias from data collection with participants. However despite these precautions we should acknowledge the possible errors in data reliability. Specifically the extent to which the shock and surprise catalyst drives changing perceptions of the dynamic complexity, which improves understanding of, and solutions to, the wicked problem under consideration.

6.2 Recommendations for Further Research

Further investigation is needed on our proposal that it was the unifying effect of the shock/surprise emotion that acted as the catalyst to solve the wicked problem. Whether other types of emotion would have the same effect would be an interesting avenue to explore. Our findings suggest that there were two elements to the shock and surprise that were particularly material to the changes brought to sensemaking: first the intensity of the emotion and second the surprise element, which together brought about an embodied, physical, reaction (Whittle et al., 2023) and loosened attachment to previous beliefs. Whether this is to be found in other types of intense emotions or whether they need to be experienced together is an interesting avenue for further research. As Whittle et al. (2023) suggest, cognitive and psychological interests in emotions, with recent research on emotions as embodied phenomena, represent an important direction for future research.
Another interesting avenue to explore would be what emotions (or other factors) are best able to solve divisive problems; wicked problems having no known solutions are likely to be some of the most divisive encountered by management teams. Our results suggest that intense and surprising emotions can stimulate reconsideration of solutions. Are there other factors that could achieve similar effects (Hopson and Cram, 2020; Bernerth et al., 2021).

A different strand of research would consider the impact of strategy workshops, with or without gaming simulations, on organization performance, given the cost of developing and implementing them. To understand if senior managers leave these workshops with changed mindsets and perceptions. Do workshops without inbuilt shock and surprise elements also lead to changed perceptions, and if so, how. These are challenging questions which would likely need a longitudinal study over an extended time period, potentially with multiple organizations.

In all three organizations described in this paper, the main role-play for client participants was the conduct of competitor(s). Further studies could extend the role-playing to other stakeholders, including customers, regulators and investors. This would enable various pervasive elements of dynamically-complex markets to be investigated further.

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