Journal of Sustainable Tourism
Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/rsus20

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Version of record first published: 03 Apr 2012.

To cite this article: John P. Moriarty (2012): Theorising scenario analysis to improve future perspective planning in tourism, Journal of Sustainable Tourism, 20:6, 779-800

To link to this article: http://dx.doi.org/10.1080/09669582.2012.673619

Journal of Sustainable Tourism
Vol. 20, No. 6, July 2012, 779–800

Routledge
Taylor & Francis Group

Theorising scenario analysis to improve future perspective planning in tourism

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(*Received 21 December 2010; final version received 28 February 2012*)

In contrast to its contribution to world affairs, tourism research diffuses and applies theoretical concepts and techniques more frequently than it generates them. The impact and complexity of tourism elevates the need for its future pathways to be sustainable and theoretically underpinned. A popular mechanism that might address this need is scenario analysis, but it relies upon broadly based praxis rather than theory. Scenario analysis seeks to contribute to sustainability by proposing hypothetical future environments that expose the structures and dependencies of current states of affairs, thus testing their ongoing resilience or appropriateness under different evolutionary pressures. This paper describes the nature of scenario analysis, its methodological necessities and articulated criticisms with reference to tourism and non-tourism exemplars. It explains the three broad methodologies used in establishing scenarios: "La Prospective", "Driving Forces" and "Extreme Worlds". It advances a platform for applying scenario analysis based upon the theories of cause and inference articulated by Charles Sanders Peirce (1839–1914). The outcome is a set of four theoretical criteria or benchmarks that improve the resilience of scenarios in tourism planning and policymaking. "Tourism 2023: Four scenarios, a vision and a strategy for UK outbound travel and tourism" is discussed and critically analysed.

Keywords: sustainability; scenarios; sensemaking; tourism futures; benchmarking; future planning

Introduction

Scenario analysis is a mature but praxis-based methodology that seeks to provide actionable insights under possible representations of the future. It is uncontroversial to note that the underlying reasons for scenario analysis are to pursue improvements or opportunities that might enhance survival or sustainability: the continuous satisfaction of dependencies relied upon for the supply and maintenance of resources (Pfeffer & Salancik, 2003).

This paper seeks to improve the theoretical foundations of scenario analysis by examining its purpose from the perspectives of the American metaphysicist, Charles Sanders Peirce (1839–1914). Peirce's contribution to the metaphysics of science has been profound as his theories on the nature of nature, causation, inference and development were revolutionary, often preceding "re-discovery" by others by as much as half a century.

There are broad views on the nature of scenario analysis, ranging from insistence on near-positivist underpinnings to the opposite: that it is subjective and more of an art form. However, nothing useful neglects the objectives of those who could benefit from it. The

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ISSN 0966-9582 print / ISSN 1747-7646 online

http://dx.doi.org/10.1080/09669582.2012.673619
http://www.tandfonline.com

foundations of such utility are coherency and cogency, necessary but often insufficient qualities that improve the reliability of any sustainable methodology.

Tourism's interest in improved theoretical constructions springs not only from an intrinsic quest for quality and continuity but also from its position as one of humanity's most universal and gregarious activities. Tourism's global economic impact might not exceed that of energy or agriculture but its activities influence the planet's social structures and its progress demonstrates sensitivity to natural and anthropogenic constraints. Peirce's theories on knowledge and reasoning suggest pragmatic ways to improve the quality and utility of tourism's future studies. Theory building within tourism also redresses the imbalance Pearce (2010, p. 4) observes to exist between tourism's historical consumption and diffusion of theoretical or methodological constructs rather than their production.

Praxis-based or a-theoretical organisational improvement methods such as scenario analysis, business excellence systems and benchmarking have made worthwhile contributions in all disciplines. Unfortunately, praxis-based methods seldom escape the criticism of lack of distinction between effective and ineffective practitioner efforts. For example, Wolfram Cox, Mann, and Samson (1997) and Francis and Holloway (2007) direct this criticism at organisational benchmarking practices and Martelli (2001) remains unrefuted in declaring scenario methodologies to be in a "chaotic" state. The technique of long-term forecasting using scenarios has also had its disappointments: the end of the cold war exemplifies social and political avalanches that can humiliate the practice of foresight. Such criticisms matter, as the consequences of ineffective efforts may threaten organisational viability through the establishment of critical dissatisfactions (Arrow et al., 2004; Ghoshal, 2005; Pfeffer & Salancik, 2003). Tourism organisations are no less vulnerable: visitor expenditure is highly discretionary and behaviours are susceptible to global and local phenomena.

It is certain that all improvement lies in the future, but how might we propose future states of affairs in an acceptable manner? Political and organisational leadership requires the critique of possibilities that might improve the trajectories of current states of affairs into the future. A sustainable trajectory can be defined in terms of its effects: achieving non-decreasing welfare for its dependants (Arrow et al., 2004). Unfortunately, this is not altogether helpful; trajectories need not be unique, efficient or optimal!

Scenario analysis has the objective of informing its users of behaviours and states of affairs that might plausibly occur in the future. The majority of applications lie outside the discipline of tourism and in all cases, too many to analyse in detail. Exemplars include Organisation for Economic Co-operation and Development (OECD; Greeuw et al., 2000), Shell Oil Corporate Strategy (van der Heijden, 1997; Van der Veer, 2005; Wack, 1985), Intergovernmental Panel on Climate Change (IPCC; Girod, Wiek, Mieg, & Hulme, 2009; Schiermeier, 2008), military strategy (Kahn & Jones, 2007), resource management (Elkington & Trisoglio, 1996; Stokke, Ralston, Boyce, & Wilson, 1990), institutional planning (Hodgkinson & Wright, 2002; Narayanan & Fahey, 2006) and the global financial crisis of 2008 (Ramirez, Selsky, & Van der Heijden, 2010).

Scenario usage within tourism is also diverse, and the meaning and methods of scenario analysis vary widely. Some studies rely upon the IPCC's essentially quantitative models, some adopt Shell Oil's method ([van der Heijden, 1997, 2005] – emphasising driving forces) and some refer to generic planning methods (Table 1). Where the method of scenario analysis is not cited, there is often evidence of methods discussed later – driving forces or extreme world.

Examples also highlight the diverse use of the term "scenario". Usage might refer to parametric options applied to quantitative models, constructed "world" views from panels

Table 1. Examples of scenario studies in tourism.

Examples of scenario studies in tourism	
Topic	Examples [Approach]
Tourism and climate change	Amelung and Viner (2006) [IPCC scenarios – no formal method]; Dubois and Ceron (2007) [IPCC]; Müller and Weber (2008) [No formal method cited, but their model emphasises driving forces]
Tourism resource management	Daconto and Sherpa (2010) [Cites Evans et al. (2006) using the driving forces model of Goodwin and Wright (2004)]
Tourism destination planning	Yeoman and Lederer (2005) [nominally Shell]; Taylor and McGlynn (2009) [No formal method cited, a driving forces approach is evident]; Formica and Kothari (2008) [driving forces approach]; Tourism 2023 (Draper et al., 2009) [driving forces approach]
Tourism planning	Haywood (1988) [Draws on numerous tourism planning and community participation frameworks; also cites Shell]; Badr, Zakareya, and Saleh (2009) [Systems dynamic model based on extremes]
Long-term tourism forecasting	van Doorn (1986) [Normative and descriptive approaches contrasted, cites Godet (1983) "not one method, but many techniques"]; Prideaux, Laws, and Faulkner (2003) [generic use of the term "scenario", cites examples of a learning-based approach (Senge, 1990) and Shell (van der Heijden, 1997)]
Tourist behaviours	Yeoman (2008) [nominally Shell]

of knowledgeable people or combinations of the two. The question under consideration here is what counts as an acceptable scenario for the portrayal of any future state of affairs? Do scenario writers, regardless of discipline, implicitly invoke some constructions or rules that might contribute to a theoretical basis for this future studies tool?

Definitions of a scenario, scenario planning and scenario analysis also vary. The etymology of the term "scenario" is Latin, describing *scœna*: "a stage or setting" (Kidd, 1957). Its organisational etymology dates to 1950's usage at RAND Corporation where Kahn, Wiener, and Bell (1967) define a scenario as "a hypothetical sequence of events constructed for the purpose of focussing attention on causal processes and decision points". Godet and Roubelat (1996) emphasise a "course of events that realise a future situation". van der Heijden (1997) and van der Heijden, Bradfield, Burt, Cairns, and Wright (2002) see scenarios as outcomes of an artful sensemaking process brought about by theory building and strategic conversation. In a similar vein, scenarios purport to assist sustainable practices through improved decision-making, assistance with planning and revealing valuable knowledge (Varum & Melo, 2010). In their most common form, scenarios are possible representations of future states of affairs. Although often disregarded, scenarios are neither forecasts nor predictions. Construction relies on praxis-based frameworks that seek to rationalise and challenge existing mental frames, admit surprises, avoid bias in estimating probabilities, address denial, treat the future with equanimity, exploit near-certainties about the nature of the future, distinguish the known from the unknown and identify uncertainties having the greatest potential impact (Wright & Goodwin, 2009).

Mathematical forecasting or modelling tools can propose future trajectories by extrapolating historical behaviours into the near future, often in combination with the magnitudes and timing of conjectured phenomena. However, as the time horizon lengthens, such methods struggle to accommodate combinations of complexity, inadequate nomology[1] and rapidly changing technologies that might motivate future states of affairs. Under such circumstances, credible sensemaking may result from pragmatism: ranges of scenarios encompassing possible extrema – including chance-like phenomena – that conceivably and traceably arise from the current operating environment.

Distinction between scenario analysis and scenario planning is also fine as epistemic usage is often interchangeable since both rely upon scenario methodologies (Godet & Roubelat, 1996; Postma & Liebl, 2005; Ringland, 2010). "Analysis" better describes a generic application of this praxis to the rational construction of sets of possible future operating environments. "Planning" better describes the implications for an industry, organisation, governance framework or resource progressing from its current to some possible future state of affairs within one or more future operating environments, as shown in Figure 1. Scenario analysis precedes scenario planning to distinguish between possible future operating environments and any contingent possibilities for states of affairs under consideration. This precedence also contrasts the tasks of describing current as well as future governing rules for the operating environment and states of affairs dependent upon it. The objective is to ground scenario analysis within a theoretical framework that offers tourism planners and policymakers a transparent perspective of possible trajectories from the present to the future and make the efforts in doing so effective (as possible).

Current methodologies

There are numerous processes for establishing scenarios. They may be classified under the three broad methodologies shown in Table 2: "La Prospective" (Godet, 1986), "Driving Forces" and "Extreme Worlds" (Goodwin & Wright, 2004). The objectives of each method

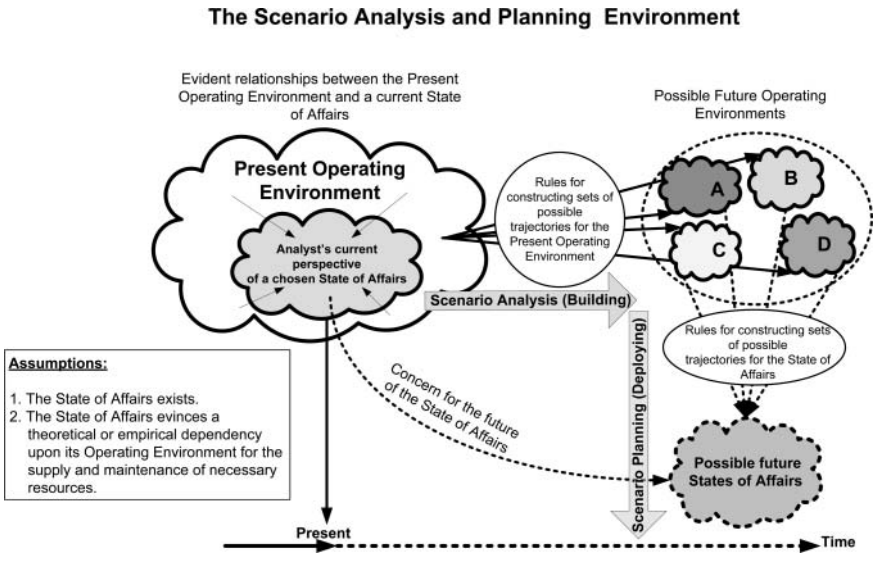

Figure 1. The scenario analysis and planning environment.

are the same, but approaches differ. La Prospective is also representative of scenario methods prioritising nomological relationships (e.g. statistical, system dynamics, economic) that portend impacts. The Driving Forces/Extreme Worlds are also representative of the opposite – scenario methods prioritising impacts that portend relationships. There are also examples where elements of each approach combine – as in the recent IPCC scenarios (Moss et al., 2010).

La Prospective is an early scenario methodology that arose from the French nuclear power programme. It combines structured nomological and subjective processes describing current states of affairs that evolve into the future under scenarios based on perceived likelihoods. La Prospective's nomological structure is explicit and Delphi processes assign subjective probabilities to key variables (Duperrin & Godet, 1973, 1975; Godet, 1986, 2001; Godet & Roubelat, 1996). Mathematical programming techniques may also minimise the difference between (relationship) probabilities assigned by Delphi contributions and those that would arise from deductive interrelationships between key variables. A technique known as SMIC-74 (Duperrin & Godet, 1975) ranks scenarios based on a mathematical cross-impact analysis. Causality is implicit in La Prospective, bounded by the extent key variables are formalised within a nomological framework. Whilst there is no limitation on the scenario horizon, articulating the complexity of inter-relationships between key variables becomes the principal practical limitation to this approach.

La Prospective prioritises analytical relationships (impacts arise from analysis of relationships). Prioritisation of analytical relationships is also found in simulation models such as the historical IPCC scenarios (Girod et al., 2009), the RAND Wonderland "LXMR" approach (Lempert, Popper, & Bankes, 2003), system dynamics models (Maani & Cavana, 2000; Sterman, 2000) and complexity/chaos models of behaviour (Smith, 2002). Qualitative factors may also be incorporated into this scenario class – e.g. Moss et al.'s (2010) new

Table 2. Scenario construction methodologies.

Scenario construction methodologies		
La Prospective	Extreme Worlds scenario	Driving Forces scenario
Governing ideas (1) Classification of present actions in light of the future. (2) Exploration of multiple factors contributing to present actions. (3) Adoption of a global and systematic approach. (4) Incorporation of qualitative factors and strategies of actors. (5) Information and forecasts are never neutral: strive to eliminate bias. (6) Give preference to plurality and complementarity of approaches. (7) Preconceptions should be identified and questioned. *Basic methodology* (1) Determine and relate internal variables for the phenomenon under study to external variables in the general environment. (2) Create a structural (nomological) framework for key variables. (3) Establish the roles of key actors and develop an actor strategy that relates to this structure. (4) Perform " expert" surveys and perform a cross-impact analysis on key variables. (5) Scenarios are formed from a selection of the most probable evolutionary paths of the key variables. (6) Create storylines for each scenario.	*Basic methodology* (1) Identify issues of concern and the horizon year which will be captured. (2) Identify predetermined trends that impact on the issues. (3) Isolate the critical uncertainties which when resolved (one way or another) impact the issue of concern. (4) Isolate the trends and resolved uncertainties into positive or negative impacts on the issue of concern. (5) Create extreme worlds by placing all positively resolved uncertainties into one scenario and the negatives in another. (6) Combine pre-determined trends to both scenarios. (7) Check for coherence and plausibility. Could the trends and resolved uncertainties coexist in a *plausible* future scenario? (8) Combine the actions of the actors who will be impacted by the future scenario and consider what actions they will take to satisfy their own interests.	*Basic methodology* (1) Identify the issue of concern and the horizon year which will be captured. (2) Identify elements that appear related to the issue of concern. (3) Cluster the elements into the categories of (more/less) predictability and (more/less) impact. (4) Examine the high impact/low predictability cluster to determine inter-relationships by further clustering those evidently related to each. (5) Search for underlying driving forces that link uncertainties within the high impact/low predictability clusters and prioritise these forces by the level of impact. The top two driving force priorities are the base scenarios. (6) For each driving force, identify the range of outcomes by two extremes. (7) Combine elements in other three quadrant clusters if they could fit into any of the scenarios. (8) Create storylines for each scenario, ensuring that there is coherence between the elements in the clusters associated with the selected driving forces.

IPCC scenarios integrate behavioural adaptation, climatic, radiative and human systems' usage factors.

Driving Forces and Extreme World approaches emphasise the priority of impacts perceived to arise from key properties (relationships arise from impacts). There is consensus that all valid approaches must demonstrate coherency and cogency between the present operating environment and that conjectured for the future.

The Extreme World and Driving Forces approaches are more commonly deployed than La Prospective and generally more reliant on subjective analyses. The Extreme World approach examines the viability or survival of a state of affairs by polarising future choices into totally positive or totally negative outcomes. This approach is useful for highlighting behaviours but risks the criticism of implausibility if perceived contrary to human experience. In contrast, the Driving Forces approach hinges on degrees of uncertainty surrounding the future progression of important forces believed to influence a future operating environment. In this case, clusters of forces positioned within a 2 by 2 predictability/impact matrix provide the basis for future operating environments and subsequent scenario narratives describing particular future states of affairs. Unlike La Prospective, the attributes of causality (cogency) and coherence are not structurally implicit in either of these two methods. Practitioners must specifically demonstrate these attributes during the clustering processes and subsequent storylines. The effective horizon is where the balance between analytical and interpretive support collapses due to a lack of either causality or coherence. To proceed further provokes the criticism of guesswork.

Methodological factors

Scenario analysis is criticised, not solely for its lack of theoretical provenance or reproducibility, but because the consequences arising from its basic methodologies and their numerous variants often produce unacceptable outcomes. Acceptability, according to Popper (1987), rests with those who are affected by its consequences. Ghoshal (2005) amplifies the converse: bad organisational theories, or fads, can also result in unacceptable outcomes because, unlike the physical sciences, their implementation can construct new realities. Reliance on known nomological relationships might safely describe simple states of affairs that incrementally transition from the present to a near future, but a distant future is altogether different. Early contributors emphasised strict nomological trajectories from the present to the future, evidenced by factors such as "causal, coherent, disciplined and transparent". Such factors suggested a highly discursive approach, omitting what later contributors also identified as necessary: inclusion of mental, social and teleological factors that are more difficult to encompass with nomological rigour. Unfortunately, improving the efficacy of praxis-based constructions usually includes increased methodological detail: the assembly of increasingly "necessary" criteria to such an extent that deployment becomes unwieldy, thus provoking even more criticism. This phenomenon was evident in organisational benchmarking, another praxis-based methodology (Anand & Kodali, 2008; Moriarty & Smallman, 2009) and it is also apparent in scenario analysis. The earliest publication dates in Table 3 suggest that increased numbers of methodological factors have been found necessary over time to improve the effectiveness of scenario analysis. Even so, this is helpful since, in lieu of underlying theory, these "Methodological Factors" form a set of necessary criteria for acceptable scenario analysis. Similarly, the "Approach" in Table 3 reflects the underlying analytical framework. Both of which should be evident in any theory of scenario analysis.

Table 3. Necessary methodological factors for scenario analysis.

Necessary methodological factors for scenario analysis		
Methodological factors	Approach	Epistemology
Causal	Logical	Burt, Wright, Bradfield, Cairns, and van der Heijden (2006), Godet and Roubelat (1996), Kahn et al. (1967), Schoemaker (1995), van der Heijden et al. (2002)
Nomological (probability)	Logical	Bradfield, Wright, Burt, Cairns, and Van Der Heijden (2005), Schoemaker (1995), Tversky and Kahneman (1983)
Coherence (internal consistency)	Logical	Godet and Roubelat (1996), Goodwin and Wright (2004), Porter (1985), van der Heijden et al. (2002), Wright, Cairns, and Goodwin (2009)
Disciplined	Logical	Haywood (1988)
Transparent	Logical	Greeuw et al. (2000)
Mental	Psychological/social	Börjeson, Höjer, Dreborg, Ekvall, and Finnveden (2006), Martelli (2001), Ringland (2010)
Nomological (morphology)	Logical	Lempert et al. (2003), Lempert, Groves, Popper, and Bankes (2006), Martelli (2001)
Purpose/purposeful	Teleological	Burt et al. (2006), Goodwin and Wright (2004), Ringland (2010), van der Heijden et al. (2002)
Rational	Logical	van der Heijden et al. (2002)
Diverse	Social	Slaughter (2002)
Interpretive	Social	Burt et al. (2006), O'Brien (2004)

Early criticisms of scenario analysis also centred on the unlikelihood of the future simply being a linear extension of the present. Assignment of probability ranges to phenomena might attempt to bridge this divide, but this is problematic. Tversky and Kahneman (1983) remind us that whatever the likelihoods of A *or* B, A *and* B cannot be more likely. Thus, pathways leading to future states of affairs become less likely as the number of conjunctions increase. Similarly, what may appear as collectively random behaviour may be perfectly rational and purposeful at elemental levels (Ehrenberg, 1988): very little is truly random (Williams, 1997). Social factors also contribute to present and future states of affairs, but their inclusion introduces complexities not easily expressed as convenient mathematical constructions. Instead, multiple social theories, some incommensurate with others, may be relied upon (Burrell & Morgan, 1979; Gioia & Pitre, 1990; Weaver & Gioia, 1994). Two recent factors have also arisen: the purposeful nature of scenarios and the need to accommodate societal complexity. van der Heijden et al. (2002) identify the role of scenario analysis as a "strategic conversation" producing "purposeful stories about how the contextual environment could unfold in time". Within this context, "purposeful" appears to emphasise improved utility rather than teleology (actions supporting purpose). Greater enlightenment about future possibilities or challenges to current perspectives is desirable but the role of scenarios in sustaining an organisation's teleological trajectory also involves social and mental processes that require greater description if they are to be useful. In a similar vein, Slaughter (2002) and O'Brien (2004) advocate inclusion of realism – an ontology that, as Burrell and Morgan (1979) suggest, recognises distinction between "what it is" and "what it seems to be". Gioia and Pitre (1990) claim that where social theories are developed under different paradigms, such as those of Burrell and Morgan, greater acceptability accrues to those admitting multiple perspectives (i.e. multi-paradigmatic) rather than from those that do not.

These observations add to the advantages of moving scenario analysis away from its praxis roots towards a theoretical base that is both broad and simple. A sound starting point for this journey is objective criticism. Critics of scenario analysis receive ample fuel from the challenges of combining social, teleological, psychological and logical constituents into coherent trajectories describing the transition from current to future states of affairs.

Criticisms of scenario analysis

The purpose and the scope of the three principal scenario analysis techniques described in Table 2 are sufficiently broad in their objectives as organisational improvement tools and do not exclude methodological convergence. Yet the practices and preferences of practitioners pursuing these techniques are subject to a very basic criticism: defiance of Ockham's well-known heuristic – the "unnecessary multiplication of entities". Are all of these different practices necessary? Would a better codification of scenario analysis reduce their number?

Criticisms of scenario analysis cite factors commonly associated with criticisms applied to "normal" theory construction. Table 4 cites a range of criticisms that attend current scenario analysis practices and reveals an overriding criticism, not one of purpose or potential utility, but what Martelli (2001) colourfully terms "methodological chaos".

These criticisms also suggest circularity. Where scenario analysis relies on discursive techniques, its processes may be criticised as wooden, lacking richness or failing to admit evident subjective or intuitional behaviours typifying organisational endeavour over time. The contrary perspective attracts the criticism of an altogether subjective technique seemingly reliant upon sophisticated guesswork to elucidate future states of affairs – amelioration of which leads to the circular argument requiring traceable, nomological constructions. Failure

Table 4. Necessary methodological factors for scenario analysis.

Necessary methodological factors for scenario analysis		
Critical factors	Criticism	Citation
Naïve realism	Accepting current social realities as simple extant structures complete with dysfunctions and inequities.	Beck (1999), Slaughter (2002)
Solely empirically driven	Non-empirical factors precluded – an extension of naïve realism.	Beck (1999), Slaughter (2002)
Silo-based/consultant capture	Practitioners seldom venture beyond their chosen framework or deem "experience" a necessary condition for methodological acceptability.	Bishop, Hines, and Collins (2007), Bradfield et al. (2005) Martelli (2001), Selsky et al. (2010)
Definitional variation	The interchangeable use of terms such as "Scenario [Analysis, Planning, Building, Thinking]" and "Alternative Future". Conflation of terms, methods and techniques.	Bishop et al. (2007), Bradfield et al. (2005), Varum and Melo (2010)
Misattributions of causality	Inappropriate attribution of causality limits scope. Causal properties may be numerous with a poorly understood relational framework.	Tversky and Kahneman (1983), Wright and Goodwin (2009)
Cognitive/motivational bias	Incrementalism, optimism, judgemental vacuum, hindsight-driven foresight.	Fischhoff (2003), Wright and Goodwin (2009)
Entertainment or "pop futurism"	Relevance, coherence, likelihood and transparency are claimed to be necessary conditions for the scenario method.	Godet and Roubelat (1996), Slaughter (2002)
Lack of standardised process	Basic structures exhibit some commonality, but there is no cohesive rationale for these structures.	Postma and Liebl (2005)

to surmount these criticisms also undermines respect for scenario analysis as a valid organisational improvement tool. For instance, Godet and Roubelat (1996) cite Orwell's *1984* and Toffler's *Future Shock* as examples of fiction: an "honourable literary genre rarely containing relevant, coherent or even likely uses for decision makers". Slaughter (2002, p. 29) also excoriates "pop futurism", claiming it to be exemplified by "futurist" publications or in scenarios ignoring "the rights, freedoms and capacities of self-constitution in social contexts".

A symptom of praxis-based improvement mechanisms, including scenario analysis, is over-reliance on practitioner "experience" for their efficacy: criticisms of "capture by consultants" or "silo-thinking" reflect this. Selsky, van der Heijden, and Ramirez (2010, p. 286) observe that experienced practitioners, "such as van der Heijden", possess "skills behind the curtain" that preclude novices from replicating some of the claimed successes of scenario analysis as the knowledge outcomes might be "artful" rather than "replicable". Selsky et al.'s remedy of this and other criticisms is increased attention to "the causal texture of the environment". Benchmarking also laboured under this thrall for decades, where its efficacy demanded increasing reliance on practitioner experience and methodological detail. A coherent theory of benchmarking can be constructed and novices possessed of it can expect to distinguish between successful and unsuccessful effort at the outset (Moriarty, 2011; Moriarty & Smallman, 2009). Debate between the "artful" and the "replicable" components of scenario analysis provides further evidence that there are important theoretical depths yet unplumbed. In the meantime, praxis rules, because the outcomes of scenario analysis are frequently acceptable enough to avoid its rejection as another "fad". Critics do not deny the utility of scenario analysis if pursued within serious and focused organisational contexts, but they question its quality. For both the critics and the suitability of scenario analysis as a technique that might improve tourism's sustainability, "good" is nowhere "good enough".

Quality improvement is more likely to arise from theory than from more detailed praxis. The scope of such a theory requires breadth and an inferential framework that explains current behaviours and the future purpose of natural and human states of affairs. Charles Peirce's metaphysical approach to these issues provides a starting point for addressing the nature of scenario analysis. The structure of this approach is divided into three parts. The first part is a presentation of a general state of affairs in terms of its properties (relata) and rules (nomology) that establish it within an operating environment. The second examines the process of scenario analysis in terms of Peirce's theories of purpose, cause and inference. The concluding part examines the extent to which Peirce's theories entail the necessary methodological factors that address current criticisms and improve the effectiveness of scenario analysis.

Describing a scenario's state of affairs

If there were a theory of scenario analysis, we would expect that theory to describe the relationships and dependencies entailing the basic properties of states of affairs under consideration. Even if there was a satisfactory knowledge of the basic properties of a state of affairs, how might we treat their relationships and dependencies? The concept of supervenience addresses this dilemma as it refers to a type of relationship where phenomena depend on properties and changes in properties result in changes in phenomena. For example, we may hold that the world's financial system supervenes or depends on environmental properties as changes in these properties (e.g. climate, resources, etc.) certainly result in changes to financial and economic phenomena. However, the rules associated with environmental properties (principally those of physics) are not

necessarily appropriate for financial analysis. Moreover, the reverse might not be the case: changes in financial phenomena might not change environmental properties.

In summary, under a theory of scenario analysis, a scenario narrative would entail the properties of a possible future operating environment and this operating environment would supervene upon that scenario narrative. Entailment reflects commonality between sets of properties and supervenience reflects commonality between sets of rules.

"Entailment" is not solely a deterministic concept as it may also describe probabilistic (Hawthorne, 2004) and dispositional properties (Fara, 2006; Rozeboom, 1973). Properties may have a less than conclusive basis over time (e.g. thermodynamic disorder in materials) or may be described in terms of propensities (e.g. fragility, agility).

A "supervenient" relationship is an unspecified law-like dependence of one state of affairs, B, upon another, A. We can test for "what" occurs, but the underlying mechanisms of exactly "how" it occurs are immaterial as supervenience reflects a "covarying" relationship amongst B's properties and those of A (Davidson, 1970/2001; Kim, 1984; Mandik, 2004; McLaughlin & Bennett, 2010; Stalnaker, 1996). The existence of a supervenient relationship is verifiable through formal logic tests that examine indiscernability between properties in different states of affairs (Kim, 1984). That is to say a set of properties B supervenes upon another set A where nothing can differ with respect to B-properties without also differing with respect to their A-properties (McLaughlin & Bennett, 2010). The extent of a supervenient relationship is also important. There are three common strengths: global (applicable within a world), strong (within a broad domain) and weak (within a narrow domain; Kim, 1984).

Supervenience is applicable to theory-building: if changes in perceived reality mirror changes posited by some theory, then perceived reality supervenes upon that theory (e.g. the observed reality of light deflected by mass supervenes upon Einstein's theory of relativity).

The combination of supervenience and entailment forms a necessary, but clearly insufficient, condition for positing a theory. Theoretical properties should always entail perceived reality and perceived reality should supervene upon the theoretical behaviour of these properties.

For the scenario analysis and planning environment shown in Figure 1, conjectured possibilities of any sort are inconsistent if they fail entailment and supervenience tests between any operating environment and dependent states of affairs. The properties of possible future states of affairs should entail the properties of their respective future operating environments. The possible future operating environments should supervene upon any dependent states of affairs explained through their narratives.

Scenarios contain both conjectured operating environments and explanations for states of affairs dependent upon them. How might the rigour of supervenience and entailment apply? What inferential processes confer this rigour? Are scenarios subject to further constraint? The next sections examine these questions from Peirce's theories of "Purpose", "Cause" and "Inference".

Purpose

Does purpose supervene upon action and, if so, what does this entail? Peirce addressed this question from the perspective of behaviour. Expressions of human behaviour develop over time through the establishment of generalised ideas, habits or tendencies arising from deductive and inductive inferences which become actualised via communication between the "person" and the environment for the purpose of growth and survival (Peirce, 1935a, VI, p. 144ff; Trout, 2010). Peirce observed that the processes behind this pursuit might not

even be conscious of it because human personality implies a teleological harmony of ideas. Through communication with other states of affairs, this personality imbues a trajectory of growth and improvement into the future, which represents a developmental teleological trajectory in pursuit of survival (Peirce, 1935a, VI, p. 156). Growth and development occur in the future, which would otherwise be the case if constrained by a pre-determined end.

A pragmatic starting position for the teleology of human (or living) states of affairs is that the pursuit of survival (sustainability) is *sine qua non.* Pfeffer (1997) also argues that survival or sustainability is a rational organisational purpose responsible for driving present and future action as "its pursuit is continuous and attainment is never assured". An organisation may be set up with a plan not-to-survive but this would be a rational action for a purpose, otherwise no advantage accrues.

Scenario analysis must also account for both order and disorder. Even if the governing principle of sustainability applies to living (including organisational) states of affairs, there is little evidence to suggest that it applies to nature itself. Peirce held that in the natural world, it was inevitable that states of affairs reached some final state. He acknowledged that the word "teleology" might be too strong a word to apply to these natural laws and coined the use of "*finious*" to express the empirical tendency of such natural laws towards a final state (Peirce, 1935b, VII, p. 471). Peirce's philosophical view echoed Clausius' 1854 exposition of the second law of thermodynamics: disorder (entropy) increases inexorably and a closed system declines to a final state. Peirce also recognised the metaphysical implications of Poincare's 1887 discovery that chaotic outcomes could proceed from deterministic laws, depending on the initial states of their properties. To Peirce, time was an irreversible continuum where disorder and chance also gave rise to orderly, albeit temporary, states of affairs, about which we might know very little in detail of their antecedent history or future (1935a, VI, pp. 554–556).

Chance provides the opportunity for orderly states of affairs to arise amongst universal disorder. For living states of affairs, this is the teleology of growth and survival. Our planetary environment seems, to us, an "orderly" state of affairs that arose from cosmic chaos, yet it will almost certainly become disordered in the future through natural phenomena that may also threaten human continuance. Human endeavour also instigates states of affairs that remain evidently capable of producing chaotic outcomes, even if contrived according to "understood" laws. Chaotic outcomes defy reliable prediction as complexities increase and detailed knowledge of constituent properties declines. In natural states of affairs, determinism is thwarted by chance and "finious" purpose. However, in a social or organisational state of affairs, the basis of its developmental teleology is survival but actions in pursuit of survival are subject to chance. A pragmatic theory of scenario analysis encompasses not only purely natural states of affairs but also purely living (social or organisational) states of affairs, as well as combinations of them.

Cause

Would the quality of scenario analysis be improved if the theoretical basis of causation was explicit? Evidence of causality is an important methodological factor supporting the integrity of scenario analysis. A theoretical approach to scenario analysis would be helpful if it addressed the application of causation and described how future states of affairs might arise from the present. As we have seen, some practitioners hold that scenario analysis is a more "artful" than "replicable" practice, but others say it is essential to understand the casual texture of the operating environment (Emery & Trist, 1965; Selsky et al., 2010; van de Ven & Poole, 1995). But first, what does causation mean? Causation is the evidence of an effect

arising from antecedence or simultaneity of particular properties, although the mechanism might not be evident (Aristotle, 350BCE/1984; Diogenes Laertius, 220CE/1853; Hulswit, 2002; Hume, 1748/2000; Mill, 1872/1973; Plato, 400BCE/1793). However, not everything requires attribution to some cause. For example, only changes to a state of rest or uniform motion (effects) require causal attribution.

A so-called causal relationship may also be a supervenient relationship if antecedent properties "covary" with their effects. An example of this is a management theory that affects subsequent management practices. However, distinction between the necessity and the sufficiency of antecedents may prove challenging. Statistical correlation may confer no proof of causal relationships as, unlike supervenience, it relies on hypothecated mathematical relationships linking antecedents and effects. An ancient but eminently useful perspective of causation is that of Aristotle (Physics II, 194b16, p. 332) who contended that understanding "why something was so?" could be exhausted by independent knowledge of its properties, governing laws, actions and purpose: known respectively as *material*, *formal*, *efficient* and *final* causes. Peirce's perspective was different: causation is a triad of action, purpose and chance; actions are always driven by purpose and actions are always subject to chance (Hulswit, 2002; Peirce, 1935a, VI, p. 101.f). In Peirce's theory of causation, the Aristotelian concepts of *material*, *formal* and *efficient* cause combine as "action". Peirce's chance is a natural characteristic, "acting always and everywhere, restrained within narrow bounds by natural laws that produce infinitesimal departures from law always and great departures with infinite infrequency" (1893/1998a, V1, p. 308). This is also Peirce's metaphysical underpinning of modern chaos theory.

Peirce argues that purpose governs action (1935a, I, p. 220), readily observed in human states of affairs (i.e. motive) and exemplified in his description of the application of law and order. If the law reflects community's purpose, it is ineffective without the Sheriff's enforcing action. The reverse is evident: chaos is action without purpose. Peirce also described "chaos" itself as purposeful, provided it was subject to nature's "finiousness" as the term is otherwise utterly without meaning.

A strong basis for testing the plausibility of a future scenario is whether organisational states of affairs are driven by a survival teleology (whether altruistic or at the expense of others) via the interactions of people who are dependent upon resources and subject to the laws of nature. Even so, consequential actions that pursue this purpose will remain subject to the intrinsic uncertainty of nature. Is determinacy of a future state of affairs possible where there is knowledge of its governing rules, their properties (over all time) and likewise those of its dependencies? In practice, the irreversibility of time precludes such determinism. Even possession of the exact governing rules of an existing complex state of affairs is insufficient as all antecedent property information is inaccessible. The best we should expect from a state of affairs are acceptable departures from predicted behaviours to occur frequently with larger, perhaps even chaotic, departures occurring infrequently due to resonant effects arising from chance-like combinations of its properties and laws over time.

Our experience of visitor flows, weather patterns, financial markets and seismic activity recognises chance-like components due to insufficient knowledge of either or both of any governing dependencies and the status of their properties over time. Historical experience often suggests the likelihood of chaotic behaviours and conjectures their occurrence in the future for the purpose of general preparedness, ongoing growth and survival.

Chance also reflects a fundamental facet of nature where the knowledge of atomic structures is only probabilistic, the limits of which are represented by Heisenberg's uncertainty principle. Uncertainties at atomic levels diminish as scale increases and the pragmatic outcome is an acceptable certainty for a great many states of affairs on which society depends

for its continuance. Even so, the attainment of conjectured states of affairs might be impossible if reliant on exploiting nature beyond fundamental limits. This may be the case with rapidly evolving electronic technology, on which societies are increasingly dependent. Solar energy conversion, information transfer speeds, miniaturisation and processing speeds are examples of technologies where the fundamentals of nature impose ultimate limits on their efficiency and density.

Inference

Scenario analysis and scenario planning infer possible states of affairs that depend upon a conjectured operating environment. Peirce subdivides inference into the categories of deduction, induction and abduction (1935a, VI, pp. 469–473).

Deduction is a formal logical process that progresses from truth (or axiom) to truth, guaranteeing the validity of subsequent conclusions. The application of deduction to a future state of affairs is appropriate for invariant relationships between properties, formal definitions, the consistent application of quantitative techniques or other logical relationships. Scenarios containing inconsistent deductive constructions are invalid.

Induction is the foundation of normal science. It is the deductive inference that cogent reasons exist for a probationary hypothesis. In such cases, we should expect that the properties of the hypothesis also entail the domain in which the hypothesis applies. Similarly, we should expect that this domain supervenes upon the hypothesis – namely changes in the domain portend corresponding changes in the hypothesis' outcomes. Induction also seeks generalisation from the specific. A hypothesis that maintains its entailment and supervenient relationships with other similar properties attracts greater interest than the one that does not. Although deduction is an attempt at truth, it may more reliably called sensemaking. This is especially so if outcomes reflect good sense (Peirce, 1935a, VI, pp. 469, 556), plausibility, good processes, correspondence with accepted realities and narrative rationality (Popper, 1996; Sutton & Staw, 1995; Weick, 1989, 2005). Induction in scenario analysis makes the pragmatic inference that what makes sense today may do so in the future. Induction may also explain why conjectured departures from current sense might not make sense in the future. However, Peirce's pragmatism only confers probationary status on inductive inference. It is on this basis that scenario analysis can legitimately question the sense of current, key assumptions under different hypothetical constructs. For example, the analogous technique of thought experimentation helped displace classical mechanics with relativistic mechanics. In a similar vein, inductive scenario analysis that identifies a state of affair's dependent relationships and challenges their future appropriateness under changing circumstances supports a teleological trajectory of improvement, growth and survival.

Peircean abduction (he also called it "hypothesising") describes inferential processes associated with positing future or unknown scenarios. This is the deduction of a set of relationships and properties supporting a conjecture, also, less charitably, known as guesswork. Abduction is the reverse of normal science but firmly based on cogency. A conjectured state of affairs is the abductive inference of antecedent combinations of plausible relationships and properties. "Fault-finding" is a common application of abduction, particularly where the antecedents of a faulty state of affairs are constrained by bounded sets of relationships and properties. More generally, rational abductive construction of a future scenario will be coherent and cogent if it remains subject to deductive rules, even though their application cannot assure "truth". Abductive inference is therefore subject to the deductive tests of entailment and supervenience.

In Figure 1, scenario analysis conjectures possible future operating environments arising from present states of affairs via an ensemble of properties and behaviours. Scenario planning conjectures future states of affairs arising from these future operating environments via narratives.

We can say that if P is a present state of affairs with properties {P}, F is a future operating environment with properties {F} and S is a future state of affairs with properties {S}, then the rules of abductive inference give tests for coherence and cogency.

Scenarios are coherent if {S} entails {F} and {F} entails {P}. Scenarios are cogent if P supervenes upon F and F supervenes upon S.

Peirce (1903/1998b, V2, p. 434) notes that whilst there may be an infinite set of relationships satisfying an abductive inference, Ockham's principles of economy should apply: the pragmatic and cogent choice being the simplest and most economical explanation of a future state of affairs. The time horizon of any scenario is also subject to this test. There is little point in proceeding beyond a time where explanations degenerate to pure fiction. Probabilities offered in support of abductive inferences on conjectured states of affairs warrant circumspection. If we can deduce current phenomena from historical frequencies, as these once were and appear now, they might sensibly continue into the future. Use of probabilities or frequencies adds nothing to plausibility where inferences entail behavioural and natural properties having neither a cogent nor a coherent explanation. Tversky and Kahneman (1983) also echo Ockham: a conjectured state of affairs cannot be more likely than its least likely dependent.

In summary, criteria C1–C4 establish benchmarks for the formation of effective scenario analysis and planning:

C1: A supervenient relationship extends from the present into the future (cogency).
C2: The future entails the present (coherency).
C3: Actions that extend from the present into the future are subordinate to purpose and subject to chance. The nature of "Purpose" is the pursuit of continuance (sustainability or survival) in anthropogenic states of affairs and "finiousness" in natural states of affairs.
C4: Ockham's principles of economy should apply (pragmatism).

Discussion

If criticisms of scenario analysis are rooted in poor methodological quality, to what extent does Peirce's perspective dispel them? If criteria C1–C4 characterise good methodological practice for scenario analysis, they should assist with construction and criticism of existing scenarios.

Examination of Tourism 2023 (Draper, Goodman, Hardyment, & Murray, 2009), the Forum for the Future's recently published scenarios on UK outbound travel and tourism, illustrates how these benchmarks can critically test their methodology.

Tourism 2023 claims to "set out a clear vision of a profitable, successful future in which the travel and tourism industry recognise its wider responsibilities to society" (C3). The stated purpose of Tourism 2023 is to provide its signatories (seven substantial UK outbound tourism organisations) with a "sustainable future" through "integration of this vision into their business strategies" (C3). Scenario construction employs the "driving forces" approach where cogency (C1) and coherence (C2) require explicit consideration. Accumulated expert interviews provided insight into a panorama of behavioural properties (business, travel, tourism, legislative, economic, environmental and social), which encompassed key

uncertainties within the two dimensions of "at home" and "overseas" (C2). "At home" represents the spectrum of enabling or inhibiting forces affecting consumers' propensity to travel. "Overseas" represents the spectrum of forces that make outbound travel more or less attractive. Tourism 2023's driving forces approach establishes an abductive framework, inferring four possible worlds from combinations of behavioural dimensions "at home" and "overseas" whilst also admitting "chance" (chance-like disturbances such as militancy, storms, floods, pandemics, resource shocks, economic shocks, etc.) (C3). This is a further application of C3 to Tourism 2023 but for completeness, each of its narratives should also illustrate that actions are purpose-driven. Tourism 2023's scenarios use the mechanisms of a timeline ("How we got there") and four narratives, each describing the world, UK outbound travel, destinations and a holiday in 2023 for solo, family and retirees, to hypothesise a trajectory from the present and the future. In particular, timelines present as plausible political, economic, technological and chance-like annual milestones proceeding from the present (2010) to the scenario horizon (2023). There is good evidence of entailment (C2) since milestones that are more recent appear as subsets of the behavioural properties of those in the future. Similarly, there is also broad entailment between global properties and narrative properties depicting destinations and the UK outbound travel industry (C2).

Cogency (C1), however, is selective. Entailment (C2) without supervenience (C1) was earlier criticised by Slaughter (2002) as lacking academic rigour: overtly phenomena-orientated but devoid of underlying behaviours. For example, Tourism 2023's Scenario 2 presents travel conditions for UK citizens as appealing but outbound travel as unappealing due to inhibiting political, environmental and technological phenomena at popular UK travel destinations (C3). Readers may only ponder why a greater propensity to travel arose in the first place (C1). Moreover, the UK internal criteria of appealing travel conditions apply to both Scenarios 1 and 2 but their outbound propensities are the opposite. It presumes rather a lot to hold that UK's internal states of affairs are independent of polarised changes in overseas states of affairs. This example of nomological parsimony, also repeated between Scenarios 3 and 4, reduces Tourism 2023's utility to its users since underlying rules (C1) lie unaddressed in each situation. Even if adjacent quadrants share common properties (C2) within a driving forces framework, rules (C1) governing these properties require explanation for each inference or scenario narrative. The practical value of this to users, when asked "what if", is an accessible rules and properties framework to support their response.

A final observation is the difficult application of C4 – Ockham's economy. Scenario narratives rightly seek to dissuade users from linear thinking. However, where plausible options are numerous, simple seldom predominates over complex. Tourism 2023's depiction of retirees attracted to "simulated white water rafting" in a Scandinavian hotel pool exemplifies the challenge of applying C4 and raises a more general issue. Scenario narratives that subordinate cogent and coherent depictions of a state of affairs' governing behaviours to phenomenal extremes attract the attention of C4 and heighten the risk of invalid abductive inference (C1 *and* C2 *and* C3). Inferential formality and a sober reflection on complexity are important attributes for professional users (policymakers, major utilities, airlines, etc.) of scenario analysis since their dependents expect quality decision-making.

In summary, "driving forces" scenarios require considerable attention to cogency (C1) and Tourism 2023 is no exception. Apart from the purpose of satisfying the signatories' needs to envision profitable futures, Tourism 2023's particular emphasis on possible future phenomena (C2 *or* C3) at the expense of possible future behaviours (C1 *and* C3) reduces its strategic utility. Just as scenario analysis' depiction as a "strategic conversation" (van der Heijden et al., 2002) cannot be decomposed into "strategic" *or* "conversation", it likewise cannot be decomposed into C1 *or* C2 *or* C3 *or* C4.

To generalise, tourism scenarios are generally reliant upon a synthesis of quantitative (economic and environmental modelling) and qualitative (behavioural) relationships and properties. In cases where there is a greater emphasis on qualitative than quantitative approaches (Yeoman, 2008), there is heightened danger that causal and nomological relationships may lapse (Godet & Roubelat, 1996). For example, those using van der Heijden's (1997) popularisation of the Shell Oil exemplar might improve the cogency and coherency of their qualitative assumptions by identifying underlying supervenience and entailment relationships. Global or strong supervenient relationships are much more compelling, and useful, than those exhibiting weak supervenience (e.g. highly localised relationships).

Conclusion

Peircean theories on causation, inference and pragmatism provide a set of criteria or benchmarks for coherent and cogent scenario analysis. Nothing forbids the inclusion of richness, introspection, chaos, incrementalism or even extremism in any scenario, so long as these possibilities are justified according to the criteria C1–C4. These benchmarks serve the role of Peirce's Sheriff (action without governing laws of purpose is chaos) on scenario constructors and address a great many of the criticisms directed at the technique of scenario analysis.

This theoretical approach offers more illumination to its tourism novices and end-users than that available from current, much-criticised praxis-based methodologies. Encompassing tourism's complexities within Peirce's theories also makes sustainability or survival a *sine qua non* of scholarly enquiry, ensuring that conjectured actions, policies or scenarios are coherent and cogent. Theoretical constructions also improve the quality of sensemaking if they are subject to explanatory, a-paradigmatic tests such as supervenience and entailment. Tests arising from these constructions help practitioners understand the limitations of the scenario analysis technique with the prospect of achieving a more satisfactory outcome for their users. These benefits are particularly applicable to the future of tourism: it is a very complex subject. A-theoretical scenarios risk unreliability and the dissatisfaction of those we hope would use them.

Note

1. Relating to or expressing basic physical laws or rules of reasoning.

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