Generative action and preference reversal in exploratory project management

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Generative action and preference reversal in exploratory project management

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ABSTRACT

Organisations trying to innovate, despite being naturally encouraged to use project management and associated rational theories of choice, will necessarily experiment in some way or another due to the high levels of uncertainty and the unknown to be discovered. Exploratory project management may face situations requiring a constant reconfiguration of beliefs and hypotheses as a reaction to external factors. In this paper, we propose to discuss the existence of a generative rationality breaking away from classical decision theory by deliberately reversing preferences and designing decisions.

Keywords: decision; design; project; innovation; preferences reversal; rationality; generative.

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INTRODUCTION

With the hope for innovation, firms launch projects facing high uncertainty and the unknown. They do it to a point where we can wonder how rational their decisions can be regarding the necessity of exploitation and availability of resources (March, 1991a, 1991b). The associated project management depending on the complexity and the well definition of the objectives, may not be fully adequate as it has been highlighted by several academics (Shenhar and Dyir, 2007, Lenfle, 2016, Lenfle, 2008, Elmquist et al., 2009). Experimentation appears crucial to test hypotheses about the ecosystem and technology development as in situations of double unknowns (Loch et al., 2006) or unforeseeable uncertainty (Loch et al., 2008) with trial-and-error approaches.

It is well known that project management is mainly influenced by decision theory specially for early stages (Söderlund, 2011) and the case of applying Stage-Gate like processes may not be as beneficial for radical innovation (Sethi and Iqbal, 2008, Jean et al., 2015) as is forecasting for large project management (Durand, 2003, Ansar et al., 2016).

Decision theory as practice (Cabantous et al., 2010, Cabantous and Gond, 2011) and its performativity within organisations raises important questions on the underlying rationality expected from exploratory project management. Experimentation in organisations and its *ex post facto* exploitation of project's history through the lens of decision theory is an occasion to question the axioms of expected utility theory (von Neumann and Morgenstern, 1944, Tsoukas, 2010).

During 20th century, key contributions and critics were made to the rational theories of choice with paradoxes, heuristics and biases (Allais, 1990), Schakle's unknowledge and its surprise potential (Frowen, 1990) and naturalistic decision-making (Kahneman and Klein, 2009). Axioms were challenged but remained untouched such as the transitivity of preferences (Regenwetter et al., 2011). Two types of inconsistency could occur: the first is a temporal one based on observed choices, and who has been extensively studied; the second questions rationality itself and related preferences ordering (ibid.). Here, we will only discuss the second.

In exploratory project management, potential surprises may occur, managers may take a certain course of action, and make decisions accordingly or not (Langley et al., 1995). So, preferences are evaluated in situation of high uncertainty, ambiguity and of gradual discovery of the unknown. They can be probably challenged in order to make the best decision according to a given performance criteria.

In this paper, we would like to discuss the phenomenon of preference reversal in project management as a signature of a manager's generative action to design and engineer a novel decision playground. We demonstrate that an experimental project management in the unknown cannot be fully explained by a classical decision-making process but rather by a generative decision process: action and decision design. We rely on a case study in a large aeronautical equipment manufacturer who had the incentive to break a monopoly whose offer was questioned by aircraft manufacturers and by aeronautical safety regulations.

The demonstration is supported by an *ex post* construction of Bayesian diagrams (beliefs in states of nature, their relationships, and utilities) to understand their preferences constructed from several interviews and extensive project documentations. The theoretical choice based on maximum expected utility derived from probabilities and preferences is then compared to the actual course of action.

THEORETICAL BACKGROUND

Decision theory from its beginning and throughout its evolution has evolved with a set of axioms which hold a certain view of rationality: transitivity, independence and completeness; hence leaving little room to expansive behaviours that one would expect from a manager in exploratory projects.

Decision theory and developments

A large stream of the economics literature puts the emphasis on deriving economic agents' behaviours from observed choices and by doing so introspection is avoided as much as possible (Samuleson, 1938). The works of Wald (1949), Von Neumann & Morgenstern (1944) and Savage (1954) are in line with this approach. Despite strong debates brought up by Ellsberg (1961) and Allais (1990), and breakthrough discoveries of prospect theory to embody psychology (Kahneman and Tversky, 1979), economics mostly rely on former theories except for the case of finance to some extent (Barberis, 2013).

Consistency or transitivity of preferences can be discussed from a temporal perspective, considering that the decision-maker may not want the same things all the time, but this approach mainly relies on a methodology requiring deducing preferences from actual choices, with the support of mixture models for instance (Regenwetter et al., 2011). Without getting into this debate, we would prefer to challenge preferences with the construct of decision in organisations as seen from management (Cabantous and Gond, 2011, Tsoukas, 2010, Langley et al., 1995, Laroche, 1995). In other words, the manager in charge of his exploratory project actions makes decisions in a way that may differ from theoretical perspectives: the sets of alternatives may not be represented, courses of action may be taken and then crystallised into a decision for the organisation to make sense of the commitment (Weick, 1995).

In that perspective, the rationality expected from the decision-maker may be different from the normative and perspective one given by theories of rational theories of choice. This rationality and the circular relation between thinking, acting, and deciding may require more than 'satisficing' (March and Simon, 1958) as managers deal with unknowledge (Frowen, 1990) and unknown states of nature (Hey, 1983). For instance, discovery and challenging hypotheses through disconfirmation or counterfactual strategies (Wason, 1960, Feduzi et al., 2016), and naturalistic decision-making relying heavily on expert intuition and quick action (Kahneman and Klein, 2009, Klein, 1984) considerably question the notion of rationality and the link between acting and deciding.

Rational theories of choice may be insufficient to make a full account of experimental practices to manage projects in the unknown.

Innovative project management

Generative processes as observed by R. Epstein while studying creativity of pigeons (Epstein, 1990), or the notion of action generators in organisation (Starbuck, 1983) can be captured by an expandable rationality (Hatchuel, 2001) that integrates the role of action and design as means to grow one's body of knowledge and alternatives to validate and choose from; instead of optimizing and choosing from finite given sets according to available information.

Consequently, with generative behaviour, the very notion of uncertainty and expected utility need a constant update and can then be completely reconfigured in situations of ambiguity, complexity and unknown as already shown in several studies (Lenfle, 2016, Loch et al., 2006, Loch et al., 2008, Ansar et al., 2016).

In Fig 1, from the regime of objectivity and subjectivity, generativity introduces divergence, the possibility of exploration and experimentation. By doing so, generative behaviour in innovative project management can introduce *a priori* loose objectives due to the unforeseeable uncertainties (Loch et al., 2006, Loch et al., 2008) and potential surprises (Frowen, 1990, Shackle, 1952, 1955) to be tested. The management may require features varying from traditional uncertainty reduction project management (Shenhar, 2007, Lenfle, 2008, Takeuchi and Nonaka, 1986): inclusion of new parameters to avoid surprises and higher uncertainty, flexibility, learning, inquiry, value of *failed* projects (Elmquist and Le Masson, 2009), revealing interdependencies (Ben-Menahem et al., 2015). By generating new actions and new decisions, the decision-maker is challenging objective and subjective value of the available parameters, his understanding of the ecosystem's dynamics (Tidd, 2001) and preferences. It calls for a certain vigilance, constant update and inquiry, recalling features of naturalistic decision-making.

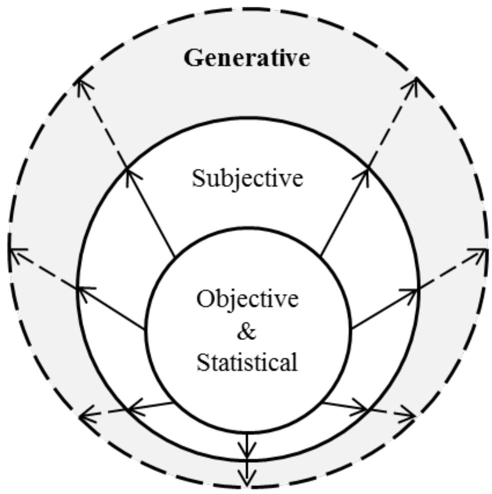

Fig. 1. Three fields of decision-making

Two complementary models

A generative model of decision-making extending rational theories of choice would then incorporate the possibility to reverse preferences and design decisions. By opposition to the classic rational model, if a deviation is observed for not committing to the maximised expected utility course of action, one could assume a psychological bias (subjectivity) or action to engineer the design (generative rationality).

Research questions

From our literature review, in situations of high uncertainty, unknown and experimentation in innovative project conduct, we may question the link between action and decision in exploration, and the associated rationality of the manager.

We propose to have a closer look at the issue of the order of preferences in exploratory project management with respect with generative behaviours:

(i) Can decision-making in exploratory project management be explained through rational theories of choice?
(ii) How generative behaviour relate to decision-making, beliefs and preferences?
(iii) How the generative model makes sense of the course of action?

METHOD AND DATA

Our methodology consists in constructing *ex post facto* two *virtual* milestones and understanding the decision-making process in exploratory project management with Bayesian nets/Influence Diagrams, using Netica™ software. We position ourselves in the observer reconstructing strategic decision as reported by Tsoukas (2010): considering these as normative and performative features of project management in organisations (Cabantous and Gond, 2011).

Contrasting rational and generative decision models

The situations were recreated according to discussions with the project manager; decision models were elaborated on the base of the history of project management and interviews with several stakeholders, hence feeding the methodology as per mathematical theory (Koller and Friedman, 2009). The decision models were realised with the input of stakeholders and validation by project manager.

The diagrams represent states of nature with probabilities (yellow boxes) and costs/utilities (diamond boxes and expected utilities in purple boxes). They were evaluated from the interviews with ranked verbal judgments, and secondary material such as presentations and project statements, business cases and expenses in order to match Wald's approach of decision-making model. The maximum expected utilities were then computed.

With the two constructed rational decision diagrams and suggested optimal decisions, we can oppose these to the actual course of action of the project.

Research Data

We conducted a case study of the Icing Detection project carried over 15 years at Zodiac Aerospace (Z) business unit dedicated to sensing and system management and making its strategy to enter a monopolistic market.

The original situation consisted in tackling the safety issues related to the icing phenomena, which implied ice removal by any means or its detection. Regulations had then evolved to enhance safety. Aircraft manufacturers were considering a potential upgrade of their anti-ice systems and ice detectors, thus reconsidering the monopoly. At the group level, Z could provide anti-ice systems with another business unit (Za), or internally (Zi) could work on sensing systems in line with their own core business. In addition, Z has a long history of mergers and acquisitions, so an acquisition of a business in the ice detection market was considered.

Overall, 8 interviewees were solicited with semi-structured interviews to trace the history of the project, the different initiatives, beliefs, preferences and actual decisions taken at different stages. Full access to the project documentation including expenses was granted. Interviewees were consulted twice, except for the manager who was consulted six times to fine tune the decision diagrams based on the input collected from the other interviewees (20 interviews in total).

RESULTS

Situation 1 – discovering and understanding

The first situation projected the team at the early stages of the project: the aim was to break a monopoly whose technology was criticized for not being sufficient and not meeting the evolving requirements of icing conditions detection due to the understanding that the phenomenon was more complex and causing aircraft to crash.

With the support of public funding and interest from an aircraft manufacturer, Zi did a first study to detect ice on wings before take-off (critical phase) with available internal competencies. Technical difficulties in terms of equipment integration left however the project on a dead-end. Consequently, a wide technical survey was conducted to evaluate ice detection alternatives (patents, laboratories, businesses), and synergies with Za for anti-ice systems to answer to a request for proposals from an aircraft manufacturer. Moreover, an acquisition was considered to enter the market and provide similar technology to the established monopoly. This is reflected in the interviews and project documentation (SWOT analyses, scenario planning etc.).

The diagram (Fig.2) reflects the beliefs and preferences for the project after the first failed study, and considering a wide range of scenarios to break the monopoly with a given technology and strategy for icing phenomena.

Not following the optimal choice

In the absence of on-the-shelf mature alternatives, it is interesting to highlight the ecosystem's solution was to offer a service of chemical spray at the airport, before take-off, to avoid ice formation on wings and partially satisfying regulation evolutions (FAR 25 App C). This reinforced the dead-end of the first developed technology.

Despite having commercial incentives, synergies, an envisioned acquisition to go to market quickly and match with maximised expected utility, the project took another course of action. A foreign business offered a patented technology for ice detection and, instead of buying it, the manager consulted his expert engineer who told him he could come up with a solution bypassing the patent and build up competences internally.

Generative rationality – inconsistency and engineering the decision

Consequently, what is constructed as a strategic decision by the project (anti-ice system) in accordance with available capabilities, beliefs and utility maximisation, it turned out to be discarded for less profitable decision (ice detection). The course of action reveals inconsistency as the decision was to keep opened alternatives instead on jumping on the optimal.

Situation 2 – engineering an *irrational* decision

The second situation at a later stage (Fig.3), we find Zi's project into the field of icing conditions detection as the likelihood of detection appears higher than the removal, and more utility is expected from choosing keeping this option.

Rational theory of choice lacks in explanations

The action of the manager with his expert engineer that appeared as an out of scope opportunity changed the decision situation. This generative action becomes an irrational decision considering the preferences and beliefs presented by the project manager and his team.

Generative rationality: ability to engineer the decision

The generative behaviour then consisted in opening a new space they had to design and in managing the suboptimal decision construction. They took the lead of a EUROCAE working group; a consortium tasked to "update the In-Flight Ice Detection System (FIDS) Minimum Operational Specification ED-103-2016, and provide recommendations on the feasibility to standardize In-Flight Ice Crystals Weather Radar Long Range Awareness Function - 2016" (EUROCAE website). The aviation industry ecosystem concerned by icing conditions, could gradually build their own path and collectively uncover the unknown (Sydow et al., 2012, Lange et al., 2013). Moreover, public funding campaigns supported the ecosystem effort to understand the icing phenomenon and associated technologies.

Making sense of the situation with the generative model

Constructing the decision reveals the inconsistency in the decision-making process as preferences are reversed. This reversal occurs because an action was taken to generate a new decision playground. It is only then that the decision is engineered and sustained by an active role played in the ecosystem to endogenise new parameters (Loch et al., 2006). The generative action looks at reducing uncertainty by projecting the decision on a larger state to manage, as seen by comparison of the two diagrams.

The manager who presents beliefs, preferences and scenarios to take a decision and commit to it, is also capable to act and design the decision *a posteriori*. A feature discussed in the literature questioning the theoretical rationality of the decision-maker as the tension between acting and deciding may challenge transitivity of preferences.

We have shown the decision model fails to grasp the subtleties of a generative action, exploring the expanded decisional context, provoking a reconfiguration of preferences and value networks.

Furthermore, the traditional objective of maximising the expected utility does not match the actual dynamics of the exploratory project management as action can be taken to generate new decision situations and to recompute expected utility. The generative behaviour is driven by another sort of criteria than optimizing and uncertainty reduction.

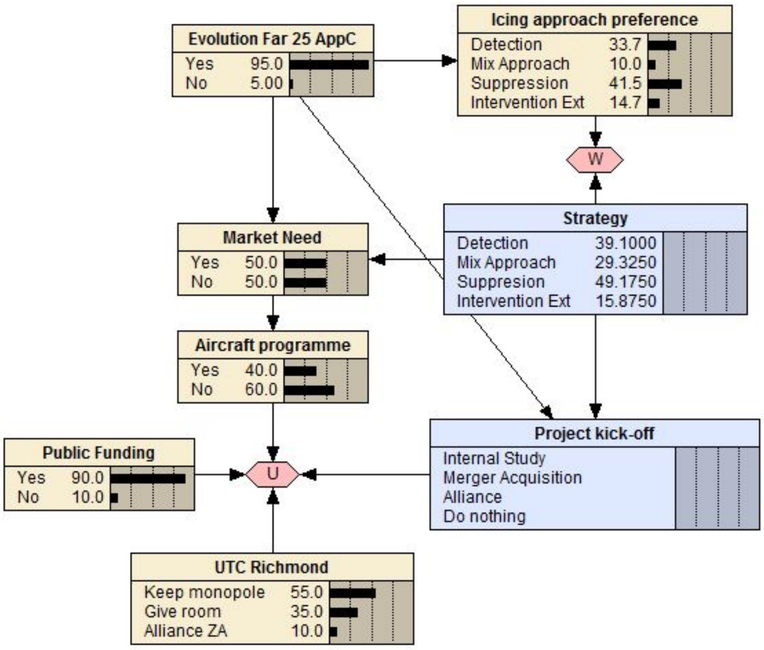

Fig. 2. First decisional setting: Beginning the exploration and challenging rational decision

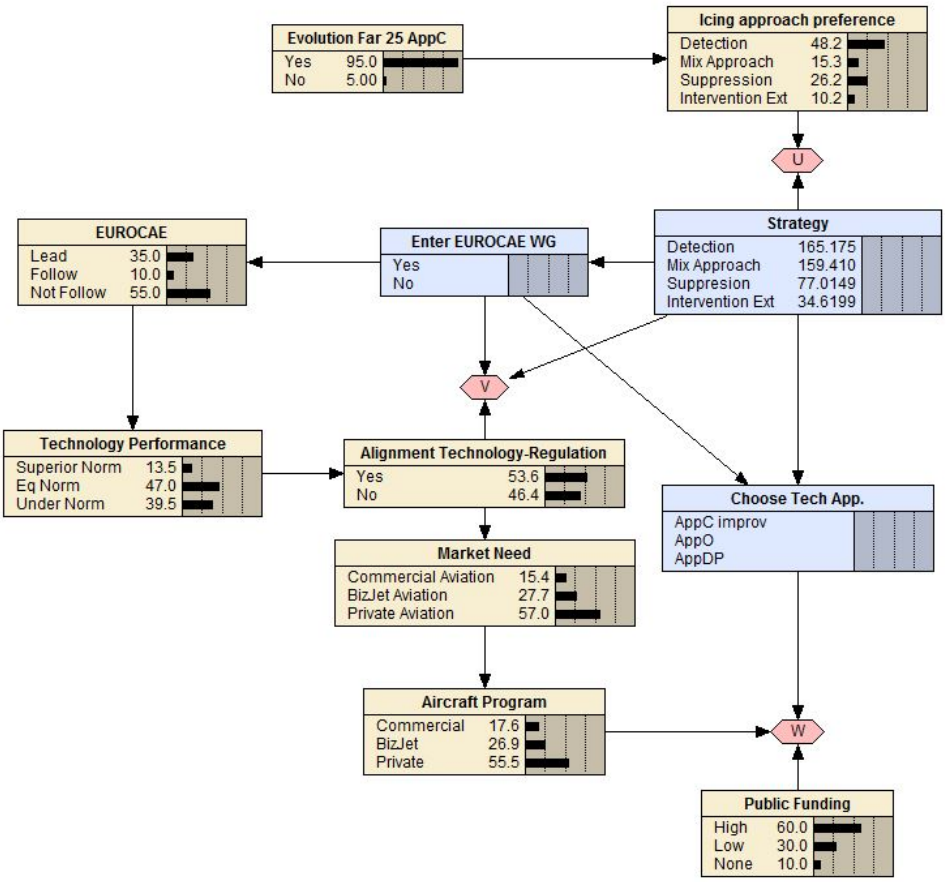

Fig. 3. Second decisional space: Expanded and reconfigured decisional space following an irrational decision

DISCUSSION AND CONCLUSIONS

First, we have shown that rational theories of choice are not fully appropriate to explain exploratory project management as its need for inquiry reveals the possibility to re-order preferences. This discrepancy appears as the construct of decision diagrams, reflecting the normativity and performativity of its underlying theories for project management cannot grasp the importance of generative action to engineer a reconfigured and expanded decision playground. The origin of this generative action is not fully understood. Further research should be conducted to fully understand why and how this occurs, and how it is linked to the level of uncertainty, ambiguity and the unknowledge.

Second, we have also identified that generative behaviour challenges preferences and underlying hypotheses as it is triggered by a criteria different from maximising expected utility based on available knowledge.

Third, the generative action that interferes with the expected continuity of the two decision situations reveals the engineering of the second decision situation as an inquiry process to endogenise the unknown, and reduce uncertainty. This pattern can only be explained by a generative rationality.

We relate to the result that exploration or at least generative patterns are of another kind (Lenfle, 2016) and must be managed in a different way as it has been demonstrated by studies on ambidexterity (Raisch et al., 2009, O'Reilly and Tushman, 2013).

Generative action which triggers the engineering of new decision situations with potential preferences and beliefs interference differs from the works of Feduzi *et.al* whose purpose is about comprehensiveness of a decision situation with different inquiry methods (Feduzi et al., 2016) or the exploration of state space in double unknown configurations (Feduzi and Runde, 2014). Experimental studies within an engineering and user-driven environment such as IdeaSquare@CERN could be conducted to provide further confirmation of this phenomenon.

Deriving from Wason's (1960) inference matching bias (Houdé and Moutier, 1996), simple experiments could be designed mixing orthogonal protocols from creativity theories (generation) and decision theories (selection) to highlight the capacity of participants to trigger the need to generate novel value spaces (abduction) differing from given utilitarian and biased reasoning. The implications for scientific management where the distribution/coordination of decisions/actions are crucial, as the effort to manage generativity for decision-making would endogenise the prospective twist of scientific discovery into society's challenges (a given objective). This behaviour has, at its own scale, proven rather efficient for novelty-search algorithms in robotics (Mouret and Clune, 2015, Stanley and Lehman, 2015) as they avoid the dead-ends of traditional performance criteria.

The management of the tension between decision (optimization) and design (generation), calls for a certain reflexivity of the decision-maker and we propose to call it decisional ambidexterity. The role leadership (Schneider et al., 2012, Ezzat et al., 2017) to generate and engineer extended decision situations for potential greater benefits and risk mitigation as observed by Henri Fayol (1916) and Burns & Stalker (1961).

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