

Strategic Decision Analytics

So we completed extensive data analysis on every conceivable scenario we could imagine. We have inferences prioritized, socialized among various stakeholders, revised views and options. The explanations, plausibilities are at the least consistent with the qualitative and quantitative data we had available. We even made plans and resourced a team to revise our expectations as new data arrives. We know that the job is barely half done! Now what do we do? Do we simply extend whatever models we built, more data, more variables, more structure? Do we tweak with how we manage unobserved anything like missing observations and missing variables?

Yes, of course! Some of this is hardly a tweak. We cannot avoid any further how the learnings, the inferences, can be incorporated explicitly in our strategic decisions. We pose a table-top exercise to help us understand the components of such an undertaking. We do know, in our probabilistic hearts, that we should use posterior predictive probability intervals throughout our understanding of the impact on the outcomes of decisions. We already know how to build our current beliefs into prior predictive probabilities, at least we think we do. In going forward we also know that our preferences are given by the model as much as they are built into our models. Not only all of this, we need to evaluate the impact of how other actors in our markets will act and react. We are not islands in the stream, but we are in a vast interconnected ecosystem of other producers and consumers. Some of these we cooperate with, like suppliers, customers, investors, employees, joint venturists. Others we go head to head with competitively vying for those same suppliers, customers, investors, employees, joint venturists.

How can we pull all of this, and perhaps more, off? A workbench with insight inciting tools can help us.

- Risk-to-performance ontologies which link together networks of risk and performance metrics, value chains, organizational hierarchies, markets, and agents to decisions will help us pinpoint ensembles of related decision alternatives.
- Generative simulation models, again from probabilistic reasoning, to help us model the many time, space, agent interactions in our decisions.
- Predictive inference models from probabilistic reasoning with hierarchical models can help us learn and understand with a backward-looking view so we can progress forward.¹ These too can help us infer time and space impacts on our decision alternatives.
- Bayesian discrete choice decision models will help us map decision alternatives as if they were hypotheses about the generation of decision outcomes. Here we can use the generative simulation and predictive inference models coupled with the value functions a decision maker might hold to assess the outcomes of a decision, even the process of coming to the decision at all.
- Goal programming models will help us model the hard and soft constraints of preferences, technologies, timing, and location of our decision alternatives. This is another step in the right direction of impounding agent preferences into the evaluation of decisions.
- Two stage contingent programming models can elucidate the impact of uncertainty on our decision alternatives.
- Game theoretic models will help us with rationality, signaling, cooperation and competition among multiple actors. Using a Bayesian-Nash approach we can solve these models for optimal decision trajectories. All games can be set in linear programming models. This will allow us to consider more extensive agent and decision spaces under states of uncertainty.
- R and spreadsheet computing, documentation and visualization platforms will help us implement our ideas, analyses, analogies, dialectics and syntheses into artifacts consumable by decision makers.

This book is a course in probabilistic decision analytics with a focus on strategic decisions.

Strategic decisions

By a strategic decision we mean the following:

- A decision which substantially affects the achievement of the vision, mission, and purpose of the

¹Soren Kierkegaard, Journals and Notebooks, Volume IV.

organization. Such a decision would often be deferred to the Board of Directors or Trustees of the organization with regard for the delegation of authority from the Board to Management.

- A materially substantive decision such as the acquisition of a competitor in a new market, representing a 20% change in potential revenues, numerous legal, tax, environmental, political, and even cultural changes in the organization.
- A decision for which there is anticipated a strong and persistent reaction, possibly retaliatory, possible and new entrant or even an exit by a competitor, including the competitor's supply chain.
- A decision, whose prosecution requires a major restructuring of the organization, including culture, commitments, resourcing, legal and compliance requirements, hierarchies, networks, and markets.

A decision is a compound of the organizational, and individuals within an organization, experience, understanding, judgments, in a word knowledge, coupled with action, namely the decision. Typical strategic decisions include investment, financing, partnering, pricing, market selection, production and distribution location, insurance, innovation, joint ventures and any number of portfolio alternatives such as product and sales mix, talent hierarchies, market mix, partner mix, incentives.

Analytics

By analytics we mean the process and product of developing the understanding we need to develop decision alternatives for an agent's discrete choice.

Analytical techniques and products consumable by strategic decision makers will be comprised of combinations of these elements.

- Data engineering and ontology reasoning to identify decision alternatives, their sources in the organizational ecosystem, metrics and the data to compute metrics and generate reports.
- Probabilistic reasoning provides the contingent logic we will need to make both-and and either-or assessments of our prior views of decision alternatives as well as deduce with data our posterior predictions of the outcomes of decision alternatives.
- Judgment of *is it? (plausibly)* and *what is it? (plausibly)* require criteria beyond the pale of specifically statistical understanding and models.
- Optimization models with hard and soft decision constraints will allow us to incorporate probabilistic reasoning about decision alternatives.
- Models of interactive agents combined with probabilistic reasoning and optimizing choices will cap the extremes of the high rationality we impose on decision making.
- Behavioral, cultural, and moral interpretations and models will help us relate rational choices to the wider human condition decisions affect.

The analytical process will follow these broad steps.

1. Pose strategic question.
2. Form decision alternatives across stakeholders as conjectures.
3. Collect data to calculate stakeholder payoffs and constraints.
4. Simulate, optimize, and produce probabilistic range of decision alternatives.
5. Decide consistent with what has been inferred.