BIG
BUSINESS INTERACTIVE GAMES

Computational Strategy:
Using Games for Better Decision Making

Summary

Making the right decisions is key to the success of individuals and organizations in today's complex, connected, globalized, and rapidly-changing world. Strategy is the art of decision making and is essential in all areas of business. It is the cross-functional glue that unifies and gives direction to an organization. We believe that human-driven technology is the key to enhance strategic decision making capabilities and business performance in the Digital Era. We are architects of a new field designed to guide CEOs and executives through the Digital Transformation, and we call it Computational Strategy. This new discipline looks at business as a game, and we therefore believe Decision Games are the next-generation strategy and management tools needed for success. Our Decision Games combine the computational power of Artificial Intelligence with the reasoning power of Human Intelligence to create complex and data-rich environments where users can simulate decisions and strategies. They can be designed as single-player games for individuals to improve their skills on an ongoing basis, or as multi-player games for group training and executive seminars.

Pioneering Computational Strategy

Making the right decisions is key to the success of individuals and organizations in today's complex, connected, globalized, and rapidly-changing world. Strategy is the art of decision making. It is about setting ambitious yet feasible goals, and deciding on the best course of action to achieve them given available resources. Effective strategies are essential for success and growth in all areas of business.

The increasing sophistication of business in a globalized and digital world has led to more compartmentalization within organizations. While it is necessary for companies to develop a wide range of competencies, the spe-cialization of organizations must be accompanied by a common, big-picture vision to result in business success. Strategy is the cross-functional glue that unifies and gives direction to an organization.

At the same time, the Digital Revolution is exponentially increasing the quantity of data available to businesses. While this has the promise of greater insights, in practice decision makers often struggle to understand and extract valuable information from all the data they have. The only solution is to leverage computing power to enhance the human ability to analyze information. We believe that human-driven technology is the key to enhance human decision making capabilities and consequently, business performance in the Digital Era.

In this new era, the field of strategy needs to evolve into a new way of thinking and doing strategy. It requires new ideas and global frameworks, new technology and tools, new training and implementation methods to help organizations and individuals adopt the new mindsets and behaviors required for success. We are architects of this new field designed to guide CEOs and executives through the Digital Transformation, and call it Computational Strategy.

By definition, Computational Strategy arises from the combination of different disciplines. It is founded on principles of Computer Science (AI, Machine Learning, SMT solving), International Business Strategy, and disciplines related to human Decision Making (Economics, Psychology, Cognitive Science, Consumer Behavior). Moreover, as strategies come to life only when they are executed, computational strategy also involves principles of Education and Teaching to develop innovative training and implementation methods for transformation and strategy execution.

While a strategic mindset is needed at all levels of an organization, Computational Strategy is particularly relevant at the CEO and executive levels, where big-picture vision is critical. We therefore believe that Computational Strategy will become a key pillar of executive advising and consulting in the Digital Era.

A fundamental principle of Computational Strategy is to approach business as a game

Fig. 1: *Foundational paradigm of Computational Strategy*

(Fig. 1). By definition, a game is a goal-driven competitive activity conducted under defined rules, where success is contingent on good skills and strategy. We believe that Decision Games are the next generation strategy and management tools needed to succeed in a digital world, after Data Management and (Big) Data Analytics (Fig. 2).

Innovations in Computational Economics

Since the playing fields of all businesses are markets in which they serve customers (be it consumers or other businesses), Decision Games need to model the preferences of customers in a given market. Traditionally, this has been done with classical economics theory using global simplified models, such as elasticity. We propose a new approach to quantitative business models based on Computational Economics, which represents the choices of each individual in a market, to derive the overall market state. For example, to estimate the impact of a price increase, it models the responses of individual consumers to the price change, instead of using an aggregate price elasticity estimate.

Our Computational Economics approach is built on two pillars: Agent-Based Models and Satisfiability Modulo Theories

(SMT). Agent-Based Models de-average to the individual agent and aggregate the behaviors of all agents to simulate a complex environment. Our proprietary SMT solving approach combines search with deduction (pruning very large search spaces quickly) to solve millions of utility optimization problems in seconds. Computational Economics is therefore another addition to the list of disciplines transformed by massive computing, such as Computational Biology, Computational Linguistics, or Computational Chemistry.

In addition, to model individual preferences in Decision Games, one needs to understand what they are in the first place. This is the field of Consumer Insights, which can also advance with human-driven technology. We offer new techniques to collect and understand consumer preferences more efficiently, such as Dynamic Survey Design, Automatic Free-Text Analysis, and Human-Driven Artificial Intelligence (HD-AI) Consumer Analytics.

Creating Decision Games

To support Computational Strategy, using Computational Economics, we create Decision Games. For example, in our BIG Airlines Game, participants play the role of competitor airlines and set the prices and capacity allocation for different booking classes on a set of routes. In our BIG Consumer Retail Game, participants play competitor retailers and set prices for key categories in a market. In our BIG Cyber Security Game, participants learn about the key components
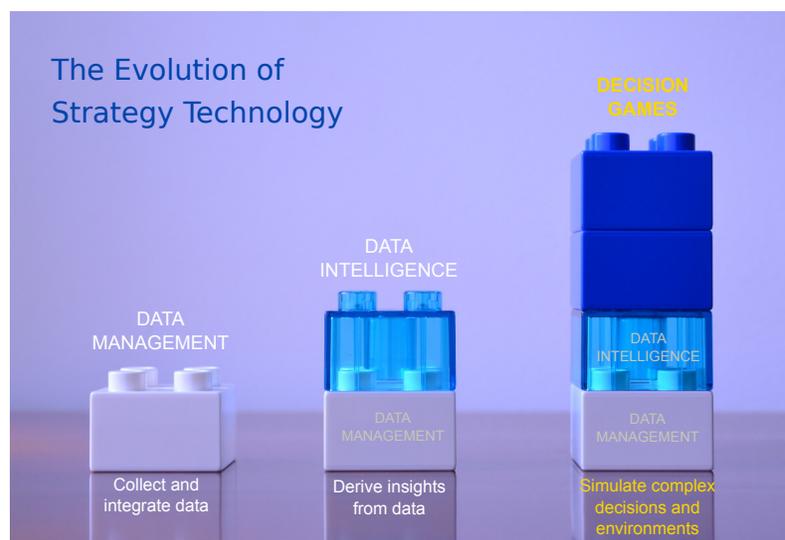
The Evolution of Strategy Technology

DECISION GAMES

DATA INTELLIGENCE

DATA MANAGEMENT

DATA INTELLIGENCE

DATA MANAGEMENT

DATA MANAGEMENT

Collect and integrate data

Derive insights from data

Simulate complex decisions and environments

Fig. 2: *The evolution of strategy technology*

> Our technology combines the computational power of Artificial Intelligence with the reasoning power of Human Intelligence for better decision making.

of cyber security and test security strategies against threat scenarios. Players actively shape the game outputs with their decisions and observe instantly the results on the simulated environment, such as changes in demand, market shares, and revenues. In essence, Decision Games combine the computational power of Artificial Intelligence with the reasoning power of Human Intelligence to create complex and data-rich environments where users can simulate decisions and strategies (Fig. 3).

Decision Games offer the following benefits to organizations:

Strategic Thinking: Develop strategic mindset to guide individual and collective decisions

Vision & Coordination: Foster big-picture thinking and coordination across the organization

Strategy & Scenario Testing: Test and refine strategies, simulate market disruptions

Skills Training: Learn and practice new skills for better performance

Market Insights: Improve understanding of market and competitor dynamics

Risk Planning: Assess potential risks and expectations for success

Our Decision Games are deployed on (private) cloud for access on all devices: private networks, desktops, mobile devices. They can easily be integrated or linked to existing systems, and require no installation from users.

They can be designed as single-player games for individuals to improve their skills on an ongoing basis, or as multi-player games for group training and executive seminars. They can enhance strategy and decision making capabilities in all areas of an organization, across functions and hierarchy levels, from senior executives to junior team members.

Since every business is different, we create our Decision Games on demand and customize them to fit specific business needs and objectives. In addition, we also provide support for game workshop design and facilitation.

Looking ahead, Computational Strategy and Decision Games offer exciting potential to help individuals and organizations become better at decision making, across industries, functions, and regions.

Authors

Aurélie Mei-Hoa Beaumel *is the CEO of BIG. She has BA/MS degrees from Stanford University in Economics and Cognitive Science, and has multi-year experience in International Business Strategy.*

Thomas Dillig *is the President of BIG. He has a PhD from Stanford University in Computer Science, and has a decade of experience in cutting-edge Computer Science research at top academic institutions.*

For more information, visit our website at `www.bi-games.com` and contact us at `info@bi-games.com`.
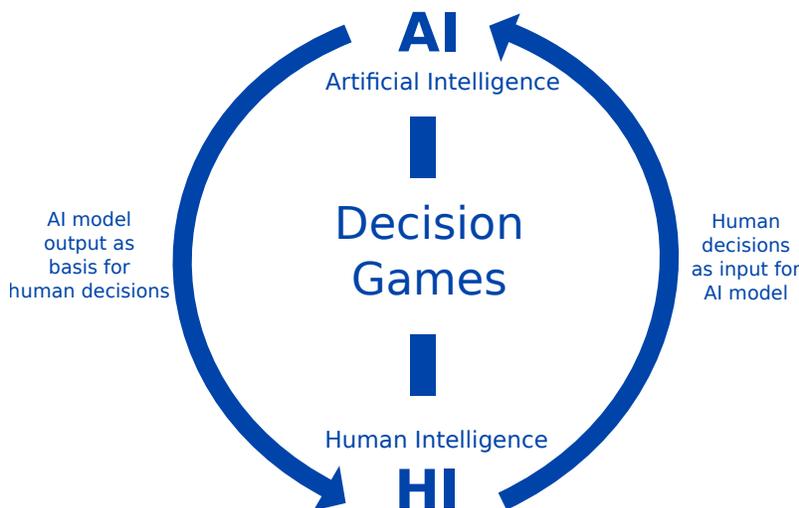

Fig. 3: *AI-HI technology for Decision Games*