Panel Symposium

The Nexus Between Artificial Intelligence and the Behavioral Theory of the Firm

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Division Sponsors: Technology and Innovation Management, Strategic Management,
Organization and Management Theory

Overview of the Panel Symposium

Management scholars are becoming increasingly interested in investigating the idea that artificial intelligence (AI) can replace humans in various roles as well as fundamentally remake existing organizational structures and processes (Brynjolfsson & McAfee, 2017; von Krogh, 2018). The primary promise of AI is that it may hold the ability to deliver higher quality, greater efficiency, and more innovative solutions as well as better decisions than those taken by human managers and experts (Agrawal et al., 2018; Bughin, Hazan, et al., 2018). Current analyses estimate that currently proven AI technologies may be able to take over up to half of all work activities done by humans – 60 percent of all occupations consist of around 30 percent automatable activities (Bughin et al., 2017). Thus, it is unsurprising that the widespread adoption of AI technologies by organizations will likely lead to significant organizational and economic changes. McKinsey (2018), for instance, estimates that by 2030 AI has the potential to incrementally add 16 percent or around \$13 trillion to current global economic output.

While AI has only recently started to gain momentum in the management literature (e.g., Adner et al., 2019; Bettis & Hu, 2018; Furman & Teodoridis, in press; Goldfarb et al., in press; Krakowski et al., 2019; Puranam et al., 2018; Raisch & Krakowski, in press), the phenomenon is of course not new: When the idea of artificially intelligent computer systems was first discussed by experts in that field in the mid-1950s, the potential impact of AI on organizations was already of interest to management scholars, especially among those at the Carnegie School like Richard Cyert, James March, and Herbert Simon. In particular, the Behavioral Theory of the Firm (BTF; Cyert & March, 1963) has, essentially since its inception, been intimately linked with AI (Augier & Prietula, 2007). Simon argued that “if computers are organized somewhat in the image of man, then the computer [is] an obvious device for exploring the consequences of alternative

organizational assumptions for human behavior” (Simon, 1996, p. 21). Since Simon’s and other behavioral theorists’ pioneering work on the importance of AI for our understanding of the functioning of organizations, great strides have been made in AI technologies. Specifically, while early research focused on symbolic AI systems, today AI technology is progressing primarily due to rapid advancements in machine learning applications, which was not viable until recently and has opened up new perspectives on the possibilities of applying AI in management. In light of this progress, it seems the time is ripe to reevaluate both the central assumptions of the behavioral theory of the firm and its key implications. Consequently, this panel symposium intends to open up a dialogue about whether and how our understanding of the BTF has changed and, perhaps, how it should still change in response to and in step with advancements in artificial intelligence.

The BTF has been acknowledged in organization theory and management as a main perspective for understanding decision-making and organizational behavior (Argote & Greve, 2007). In developing it, Cyert and March (1963) proposed a set of foundational concepts at the cognitive level built on the notion of bounded rationality that included the ideas of satisficing, search, and organizational routines. Further, the theory included a set of relational concepts serving as theoretical mechanisms explaining how cognitive concepts unfold in organizations. These concepts include the quasi-resolution of conflict, uncertainty avoidance, problemistic search, and organizational learning (Gavetti et al., 2012). Much research has already been conducted on the various concepts put forth by Cyert and March in “A Behavioral Theory of the Firm” (e.g., Bettis, 2017; Blettner et al., 2015; Clough & Piezunka, in press; Piezunka et al., 2019; Piezunka & Dahlander, 2015; Posen et al., 2018; Puranam et al., 2015) and they should now be reexamined in light of recent developments in the area of artificial intelligence. Our panel symposium intends to set an initial impetus for inquiries in this vein.

Each of the panelists' contributions initiates a discussion linking AI to key concepts in the BTF. **Hart E. Posen** will propose a Simon 2.0 approach and discuss the role of modern machine learning techniques for modeling organizational decision-making and behavior. **Sebastian Raisch** will speak about how humans and intelligent machine collaborate on complex learning tasks in organizations. **Phanish Puranam** will propose configurations for organizing human-algorithmic collaborative decision-making. **Florenta Teodoridis** will discuss human quality decision-making skills as complementary to the automated ones. Finally, **Henning Piezunka** will focus on the role of AI as a way to aid and improve human decision-making.

The main purpose of this Symposium is to engage a group of panelists in a moderated and interactive discussion on the questions pertaining to the nexus between AI and the BTF. More specifically, the panelists will (1) discuss how – in the light of the technological advances of AI – the BTF has changed and should be further reevaluated, (2) identify challenges and opportunities researchers face in linking AI to behavioral theory, and (3) discuss ways forward. Moreover, this symposium aims to build a network of scholars from different career stages and divisions who share an interest in this topic. As such, this symposium intends to connect scholars in order to engage in a joint effort to expand research on the nexus between AI and the BTF.

Panelists

A prominent group of researchers has confirmed their willingness to participate as panelists:

Richard Bettis is Professor of Strategy and Entrepreneurship at University of North Carolina at Chapel Hill (USA). His research interests lie in the fields of corporate strategy, global business strategy, strategic management, and technology management. He is currently working on how AI can improve theorizing in behavioral strategy. Rich's work has appeared in *Strategic Management*

Journal, Organization Science, Academy of Management Review, and Academy of Management Journal, among many others.

Henning Piezunka is an Assistant Professor of Entrepreneurship and Family Enterprise at INSEAD (France). Henning is an accomplished researcher in the areas of competition and innovation. His current research interests focus on the role of AI in fostering human skill development. He has published his work in leading academic journals including *Administrative Science Quarterly, Academy of Management Journal, Research Policy*, and *Strategic Entrepreneurship Journal*.

Hart E. Posen is a Professor of Management and Human Resources at the University of Wisconsin (USA). In studying strategy, Hart's research focuses on the learning processes through which firms innovate, build capabilities, and sustain competitive advantage when there is uncertainty (e.g., technological change). Currently, he is working on modeling the firm with modern machine learning-based techniques to gain insights on firm behavior. His research is regularly published in leading management journals such as *Strategic Management Journal, Organization Science, Academy of Management Review*, and *Administrative Science Quarterly*.

Phanish Puranam is a Professor of Strategy and Organization Design at INSEAD (Singapore). Phanish's research in organizational science focuses on how organizations work, and how we can make them work better. His current interests include non-hierarchical organizations, the design of informal organization, and organizational architectures that support self-assembling teams. He is currently working on the role of AI in collaborative decision-making and directs the AI for Business program at INSEAD. Besides publishing his research extensively in peer reviewed journals such as *Strategic Management Journal, Organization Science*, and *Academy of Management Review*, Phanish has also written several books.

Sebastian Raisch is a Professor of Strategic Management at University of Geneva (Switzerland). His research focuses on how large firms cope with the tensions between stability and change in their corporate development. Currently, he is very much interested in the “digital revolution” and how the emerging human-machine collaboration on managerial tasks affects organizations and society at large. He has recently received a large research grant to expand his research team on AI-related topics and challenges. Sebastian's work has been published in journals such as the *Academy of Management Journal*, *Academy of Management Annals*, *Journal of Management*, and *Organization Science*.

Florenta Teodoridis is an Assistant Professor of Strategy at the University of Southern California (USA). Florenta's main areas of interest are the economics of innovation, creativity and the impact of technology on society. Her current interests focus on factors that influence the development and adoption of AI technologies and how AI technologies affect information processing in organizations. She has published her work in leading academic journals including the *Administrative Science Quarterly*, *Organization Science*, *Strategic Management Journal* and *Management Science*.

Symposium Format

The 90-minutes session will be highly integrative and interactive. The organizers will start with a brief overview of the main topic and will present the framework of the symposium (3 minutes). This will be followed by *individual presentations* by the six panelists (6-8 minutes each). While sharing their recent research each presenter will explain how their presentation is positioned in relation to the symposium theme and reflect on how their research complements and expands the discussion on AI and the BTF. These presentations serve as a primer for the moderated *panel discussion*, in which the panelists will discuss a series of questions that present opportunities and

challenges for current research (20-30 minutes). The panel discussion is followed by a *Q&A session*, in which the audience will have the opportunity to ask questions (15-20 minutes). The session will end with a summary and wrap up by the organizers (1 minute).

Relevance to Sponsoring Divisions

Technology and Innovation Management (TIM): This symposium reflects the TIM Division's focus on the management of innovation and technological change from a behavioral perspective. Specifically, this symposium helps to understand—given the advances in AI technologies—how key concepts and mechanisms of the BTF have changed and should be further reevaluated. Moreover, this symposium also reflects the TIM Division's focus on cross-disciplinary topics as questions pertaining to AI and the behavioral theory are relevant to various disciplines such as strategy, organization theory, and innovation.

Strategic Management (STR): This symposium contributes to the STR Division by focusing on understanding how AI impacts organizational behavior and decision-making. As such, this symposium touches upon a number of central topics for the STR Division, including behavioral strategy, strategic decision-making processes, internal resources and capabilities, firm/competitive heterogeneity.

Organization and Management Theory (OMT): This symposium speaks directly to the OMT Division as it discusses a classic work in organization theory and management: the BTF. Specifically, this symposium connects the existing theoretical base of the behavioral theory to the emerging organizational phenomenon of AI. As AI is gaining momentum in management, it is imperative for scholars and practitioners alike to understand how AI contributes to solving the most fundamental problems of organizing.

Summaries of the Panelists' Discussions

AI Research Metaphors for Studying Organizational Adaptation and Learning – Rich Bettis

and Deborah Anderson

Computer science generally and especially artificial intelligence and computational complexity are examining many issues of relevance to organizational adaptation/learning. Artificial intelligence has also raised successful challenges to the optimization and equilibrium logics of economics by incorporating concepts, developments, and techniques rooted in computer science. In other words, computer science has equipped scholars with tools to challenge the optimization logic that has dominated intellectual discourse and thinking in Business for decades. For example, recent work in Algorithmic Game Theory has overturned the idea of any form of lasting equilibrium in game theory in addition to giving us a useful tool for the realistic study of competition in complex situations.

What has been left behind in Strategic Management and other management disciplines are the many relevant lessons learned in Artificial Intelligence that apply with minor revision to organizations, managers, and industrial ecosystems. Illustratively, the problem spaces of many seemingly simple problems cannot be searched in finite time to find an optimal solution. As a result, heuristics must be used to get close to solutions in AI. Search heuristics are the primary technique available for approximately solving many problems in the BTOF. Furthermore, AI scholars have developed much more rigorous definitions of the term “heuristic” that can intellectually rationalize applications in firms. The presentation reviews relevant theory, research, definitions, and techniques from Artificial Intelligence that can productively improve our theorizing in Behavioral Strategy.

Where AI is a Game Changer: Evidence from Chess Computers – Henning Piezunka

Prior debates on artificial intelligence (AI) focus on its potential to either support (Acemoglu & Restrepo, 2018; Autor & Salomons, 2018; Frey & Osborne, 2018), or supersede humans in performing particular tasks (Agrawal et al., 2019; Brynjolfsson & McAfee, 2012; Choudhury et al., 2018). We suggest that AI has an additional role: it can foster human skill development. While technology has done so before in the form of learning tools, the specific advantage of AI is that it can emulate a human with whom the focal human can interact. By doing so the AI provides unlimited private training opportunities in interactive tasks. We consider this as a particular manifestation of the role of AI as prediction machine (Agrawal, Gans, Goldfarb, 2018; Agrawal, McHale, Oettl, 2019) as the AI allows the focal actor to understand what outcome a particular action would lead to.

Simon 2.0: Modeling Firm Decision-Making and Behavior via a Neural Network – Hart E.

Posen

We develop a Simon 2.0 approach to understanding organizations by modeling decision-making and behavior using modern machine learning. Over 50 years ago, Simon stated that "it is no longer necessary to argue that computers can be used to simulate human thinking" (Simon & Newell, 1962). He posited that we could better understand human and organizational problem-solving as general information processing systems modeled via simple computational "if-then" algorithms that were at the core of artificial intelligence at that time (Feigenbaum, 1961). The logic of thinking about the organization as a simple algorithm is deeply embodied in the Behavioral Theory of the Firm (Cyert & March, 1963). For instance, problemistic search theory considers organizations as simple problem-solvers, modeling the organization as a thermostat-like "if-then" type algorithm in which behavior is relatively static unless performance is below aspiration, in

which case search is triggered. We think of the "if-then" algorithmic logic of understanding organizations as Simon 1.0. Our Simon 2.0 approach is built on recent developments in artificial intelligence, and in particular, neural networks. Simon's efforts to use artificial intelligence techniques to model human and organizational behavior in the mid-1950s was constrained, in part, by limits in the understanding of how to construct artificial intelligence — machines that learn. We develop new insights into firm behavior by modeling an organization using topology-evolving neural networks (Stanley & Miikkulainen, 2002).

Our first application is to the question of why different organizational structures evolve. Following Cyert & March (1956), we model two organizations that compete in an oligopoly market. We examine how organizational complexity emerges and evolves over time. Prior research has argued that organizational complexity is an important driver of performance and its heterogeneity (e.g., Levinthal, 1997). However, current work takes organizational complexity as given or considers it to be a design choice. Our model shows how organizational complexity endogenously adapts in a competitive context. We show how this “complexification” process varies across alternative competitive regimes and exhibits rich time-series properties. For instance, organizations endogenously pass through alternating periods of complexification (structural change of increasing internal complexity) and optimization (in which the organizational structure is somewhat fixed, but undergoes fine-tuning), and we consider conditions under which rivals’ organizational structures become synchronized in terms of their complexity.

Human-Algorithmic Collaborative Decision Making – Phanish Puranam

AI, in particular machine learning based algorithms have the potential to aid and possibly improve human decision making. I consider human-algorithm collaboration for decision making as a problem in organization design, and outline a micro-structural approach to its analysis. I show

that there are only a few basic configurations for organizing human-algorithmic collaborative decision making, and describe some preliminary results from research my collaborators and I have been doing that outlines the distinct advantages and challenges of each configuration. In particular, I highlight the fact that unlike human use of any other tools or automation technology in general, human-AI collaboration entails mutual adjustment. This gives rise to some unique dynamics of learning that are fairly well understood in organizational science, and may be of use in understanding human-AI collaboration.

Augmented Learning Theory: A Relational View of Humans and Machines in Organizations

– Sebastian Raisch

This research expands and updates organizational learning theory by exploring the increasingly pervasive use of machine learning in organizations. Machine learning is an application of artificial intelligence (AI) that allows machines to learn from experience without being explicitly programmed. Organizational learning theory has thus far focused on human learning, while largely ignoring the role of intelligent machines and their interactions with humans on organizational learning tasks. To overcome this human bias, I integrate insights from augmented learning theory, which has emerged in computer science at the intersection of the machine learning and human-computer interaction research streams. This theoretical expansion leads to a perspective of organizational learning, which integrates human and machine actions and considers the complementarities and dynamics arising from their interaction. My research makes three interrelated contributions: First, it conceptualizes augmented learning in organizations and differentiates it from the established learning perspectives. Second, it applies the augmented learning concept to explore the implications for the central organizational processes of adaptation,

control, and decision making. Third, it outlines a future research agenda on augmented learning's organizational antecedents, consequences, boundary conditions, and application contexts.

The Advent of AI and Decision-making Skills – Florenta Teodoridis

The concept of bounded rationality is rooted in the observation that decision-making is limited by the information processing capacity of individuals. More precisely, in the process of decision-making, humans face two broad constraints: (1) informational limits – costs associated with gathering and analyzing information, and (2) computational limits – the complexity of reality often exceeds the human capacity to process information. Artificial intelligence (AI) has the promise to overcome these limitations due to machines' capabilities to retrieve and process a large amount of information. How would these technologies influence humans' decision-making process, and, by extension that of organizations? A dive into AI's history and its technological details suggests that the advancement of AI algorithms will likely place an increasing emphasis on human quality decision-making skills, where quality is relative to AI's performance. This remark is motivated by the observation that AI task automation (1) reduces the cost of performing such tasks and (2) it does so incrementally, thus places a premium on complementary tasks along the production chain of the automated ones. Decision-making is a main such complementary task. In a study exploiting the advancements in chess AI, I evaluate the role of experience – intensity, difficulty, and diversity – in developing quality decision-making skills, evaluated as such relative to the performance of the AI algorithm as a benchmark. Given that these benefits are motivated by an incremental advancement of AI, I also discuss the role of such skill benefits in the short and long-run, and the consequent follow-up research questions.

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