Exaptation and Organizational Adaptation

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Abstract. Organizational responses to environmental changes can have significant effects on long-term performance and goal attainment. For over 30 years, scholars and practitioners have used the exploration-exploitation model to consider trade-offs between refinement of existing and development of new capabilities. Despite its many strengths, the exploration-exploitation model is diminished because it inadequately conceptualizes intermediate forms of adaptation and the affordances of modern information and communication. This paper proposes an updated model—the exploration-exaptation-exploitation model—that incorporates exaptation and information foraging theory, offering scholars and practitioners a more differentiated model to guide understanding of organizational adaptation. Exaptation captures the intentional repurposing of existing capabilities in new organizational designs, while information foraging theory highlights search behaviors that are consistent with the middle space between exploitation and exploration. This paper also compares the proposed model to effectuation and bricolage theories and recommends future studies corroborate exaptation as a distinct adaptation technique, characterize underlying search behaviors, and explore the dynamic nature of identified solutions.

Keywords: Organizational Design, Group Performance, Innovation, Exploitation, Exploration, Exaptation

1 Introduction

Organizational responsiveness to significant environmental changes is generally key to long-term goal attainment. In the modern school of organization theory, organizations are modeled as purposefully designed sociotechnical systems and their performance is driven by the extent to which their designs fit environmental demands [1]–[4]. Environmental changes, such as new competitors, regulation shifts, and resource constraints, can disrupt the fit between an organization and its environment, significantly impacting performance [1,] [2], [5]. Substantial research affirms that organizational performance is contingent on the degree of fit between its design and environment, especially during periods of significant environmental change [5], [6]. An organization's ability to purposefully adapt is thus central to its long-term performance and viability.

Organizational adaptation refers to an organization's ability to learn from internal and external sources and subsequently modify its structure and behaviors, accordingly. Foundational scholarship identifies exploitation and exploration as two primary modes of organizational learning and change [7]–[9]. Exploitation emphasizes refinement of existing capabilities, whereas exploration focuses on experimentation and the development of new capabilities. These modes represent opposing poles, but the exploration-exploitation model gives less attention to adaptation behaviors that fall between them. Organizations need adaptive strategies that can offer strengths of exploitation and exploration, while mitigating their weaknesses.

Organizations adapt to strengthen near-term performance and long-term viability. Increasingly, these adaptations incorporate modern information and communication technologies (ICTs), which can reshape organizational capabilities and ability to adapt. Yet, adaptation that involves repurposing or reconfiguring existing capabilities, particularly when enabled by modern ICTs, is not explicitly represented in canonical organizational adaptation models. March's (1991) influential model focuses on two approaches to organizational adaptation: exploitation, which refines existing capabilities, and exploration, which transforms them [7], [10], [11]. Adaptation, however, often falls between these two poles, relying on the repurposing or reconfiguring of existing capabilities in innovative or adjacent ways [7], [10]–[12]. Additionally, modern ICTs enable new, cost-effective forms of searching for information, opportunities, and solutions [13], supporting these intermediate forms of adaptation. Although such adaptations do not align specifically with either exploitation or exploration, they are increasingly central to how organizations respond to environmental change [14], [15]. By incorporating these ICT-enabled, reconfiguration adaptation processes, we clarify the underexplored middle space in March's (1991) exploration-exploitation model and strengthen its relevance for modern contexts [7].

The purpose of this paper is twofold. Stimulating discussion about how to conceptualize organizational adaptation when organizations respond to environmental change by repurposing existing capabilities rather than largely refining existing (exploitation) or developing new (exploration) capabilities is first. Proposing an updated model—the exploration-exaptation-exploitation (E3) model—that enhances the exploration-exploitation model by elaborating the underdeveloped middle space between the two poles of exploration and exploitation is second. This paper addresses the following research question: *How can exaptation extend the exploitation-exploration framework to better account for organizational adaptation through the repurposing of existing capabilities?*

Although March's (1991) original model acknowledges the middle space, it receives little attention [7]–[11]. Prior research has examined exaptation in organizational and innovation contexts, but its relationship to the exploration-exploitation framework and the information search behaviors that support repurposing remain less clearly specified. We incorporate information foraging theory from library and information sciences to better conceptualize this space. The resulting E3 model connects exaptation with exploration and exploitation and provides a more differentiated account of how organizations search for and identify adaptation solutions This paper begins by summarizing relevant theoretical background, then describes the proposed, model and its

relationships to effectuation and bricolage theories. Recommendations for future studies are also offered.

2 Theoretical Background

Organizations are multi-agent systems that provide members with resources needed to attain shared goals. In the modern school of organization theory, *organizational technology* refers not to tools and technical systems, but to the configuration of people, roles, routines, methods, and tools that enable task performance [16]–[18]. Organizational technology describes how work is accomplished, expertise is organized, methods are applied, and tools are used to accomplish organizational objectives. Crucially, organizational performance depends on the degree to which the configuration fits the environment [1]–[3], [5], [6]. Major environmental changes can alter the fit such that organizations need to modify the organizational technology to tighten the fit, strengthening performance.

Organizational adaptation refers to modifying organizational technology in response to environmental change. Building on March's (1991) foundational work, researchers argue that organizations adapt by modifying their search strategies, search competences, and aspirations [7], [9]. Modifying search strategies involves changing how likely group members are to engage in exploration versus exploitation, and how they direct their search efforts toward alternative structural configurations. Modifying search competences entails improving organizational efficiency in identifying and evaluating possible solutions. Modifying aspirations and aspiration levels adjusts expectations about the value of possible changes to organizational technology. Previous experiences influence both the approaches selected and their efficacy [7]–[9].

2.1 Exploitation and Exploration

Exploitation and exploration are two common approaches to organizational learning and adaptation. Exploitation sacrifices what might be in favor of what is known. *Exploitation* describes organizational behaviors that take advantage of existing capabilities without significantly modifying organizational technology [7], [12]. Exploitation, therefore, represents a proximate search for expertise, information, and solutions [7], [9], [11], [12].

Long-term performance gains from exploitation are usually limited, and so are the resources (funding, time, etc.) consumed searching for solutions and uncertainty and ambiguity of search outcomes [7]. Fig. 1 illustrates notional relationships between exploitation and the relative amounts of resources consumed for search, uncertainty and ambiguity of search outcomes, and degree of anticipated gains in long-term performance and goal attainment. Increasing productivity and efficiency and making more optimal use of existing capabilities exemplify exploitation [7], [10], [11].

Exploration, in contrast, sacrifices certainty for possibility. *Exploration* describes behaviors that transform organizational technology [7]. Performing fundamental research and developing new markets are common forms of exploration [7], [10], [11]. Exploration, therefore, represents more distant search for expertise, information, and

solutions [7], [12]. Long-term performance gains from exploration tend to be greater than from exploitation, but the resources consumed for search, as well as the uncertainty and ambiguity of search outcomes, also tend to be greater (see Fig. 1).

Organizations must balance exploitation and exploration while responding to environmental change. Focusing too much on exploitation can result in organizations efficiently losing relevance—just doing the status quo "better" can effectively exclude development of new expertise, skills, and outputs [7], [9], [19]. Concentrating overly on exploration can result in organizations trapping themselves in more costly research and new market development phases without adequate revenue and other resources needed for viability. Generally underspecified in the exploration-exploitation model is how organizational members search for possible solutions when exploitation is inadequate, but the organization lacks the funding, time, and other resources for exploration.

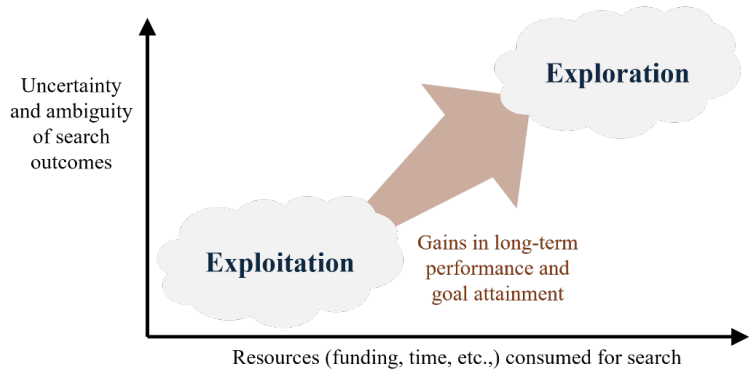

Fig. 1. This figure illustrates notional relationships between exploitation, exploration, resources consumed, uncertainty and ambiguity, and anticipated effects on long-term performance. The grey areas represent, albeit simply, the scope of exploitation and exploration behaviors.

2.2 Exaptation

Exaptation originated in evolutionary biology and describes a characteristic that performs a function different from the function for which it originally developed [20]. Research in organization and innovation studies has extended the concept beyond biological systems to explain how existing technologies, resources, and capabilities can be repurposed for new uses [21], [22]. This work demonstrates that exaptation can contribute to innovation, search, and problem solving by allowing organizations to identify new applications for capabilities that already exist. Applied to organizations, exaptation captures adaptation behaviors that intentionally repurpose existing capabilities to address new problems. Exaptation involves an existing capability, a prior function or application, and the use of that capability for a different function or problem. This distinguishes exaptation from exploitation and exploration, as exaptation retains an existing capability but changes how or where that capability is applied.

Prior research has established exaptation as a relevant process in organizational and innovation settings, but its relationship to the exploitation-exploration framework remains less clearly specified. Research has also given less attention to the information search behaviors through which organizational members identify existing capabilities that may be useful for different problems. These issues are important because exaptation depends not just on the availability of an existing capability but also on recognizing that the capability may have value outside its original application. The E3 model builds on this prior research by positioning exaptation relative to exploitation and exploration and by using information foraging theory to help explain the search behaviors that support capability repurposing.

2.3 Information Foraging

Information search behavior (ISB) and, more specifically, information foraging theory (IFT) offer useful perspectives for conceptualizing organizational adaptation behaviors that fall in the space between exploitation and exploration. In library and information sciences, ISB refers to the generalized processes by which individuals locate, assess, and use relevant information [23]–[26]. ISB also highlights the role of modern ICTs, which increasingly enable broader and more efficient capabilities for locating and retrieving information [27], [28]. These enhanced search capabilities likely influence information search behavior vertically and laterally within and across organizational boundaries [4], [13], [29]. In other words, modern ICTs can enable broader search for relevant expertise, information, and solutions, yielding exploration-like alternatives, without necessarily incurring exploration-like resource consumption for search.

IFT provides a behavioral model of searching for information that helps illuminate organizational adaptation behaviors that lie between exploitation and exploration. IFT conceptualizes the information environment as a landscape of multiple, loosely connected information patches [30], [31]. Organizational members choose an information patch to forage for information, based upon their objectives and intuition. Search continues within a patch until foragers have exhausted locally available sources or think needed information exists in another patch [30]–[32]. Continuing to forage within an information patch reflects exploitation, efficient but potentially limited in scope: it can result in locating and using less comprehensive information—limiting long-term performance gains—but also limiting the resources consumed while foraging and the uncertainty and ambiguity of foraging outcomes.

Shifting to a new information patch resembles exploration: it can lead to more comprehensive expertise and information—contributing to stronger long-term performance—but consumes more resources while foraging and the outcomes are more uncertain and ambiguous. Notably, searching additional patches, including those outside organizational boundaries, is inherent to information foraging. Exaptive search extends this logic by searching across information patches for existing capabilities developed or used for other problems that may be repurposed for the current problem. Information scent can guide this search by providing cues that connect an existing capability to a new application [30], [31].

Fig. 2 illustrates notional relationships between information foraging and the relative amounts of resources consumed for search, uncertainty and ambiguity of search outcomes, and degree of anticipated effects on long-term performance and goal attainment.

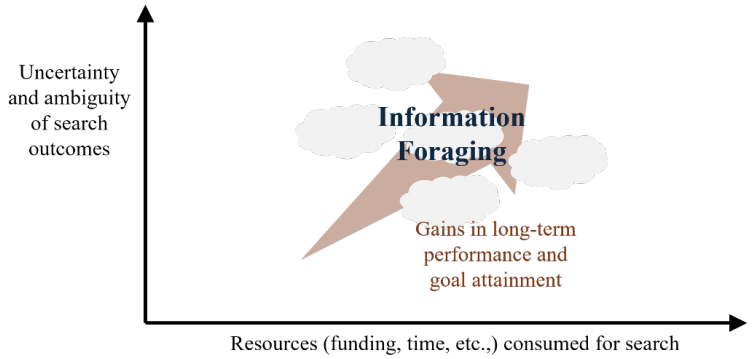

Fig. 2. This figure illustrates notional relationships between exploitation, exploration, resources consumed, uncertainty and ambiguity, and anticipated effects on long-term performance. The grey areas represent, albeit simply, the patch-based scope of information foraging behaviors.

IFT is consistent with modern school of organization theory, especially behavioral decision-making, making it well-suited to describe adaptation behaviors that fall between exploitation and exploration. Decision-making is generally rational within bounds, searches for expertise and information are often proximate, and organizational members satisfice [12], [33]–[36]. IFT reflects similar patterns: organizational members tend to limit search and make decisions that are rational based upon the information patches, if aspiration levels are met [30], [31]. By describing search behaviors that are wholly exploitative nor explorative, IFT offers insights that can help clarify the dynamics of organizational adaptation in this increasingly relevant middle space. While prior exaptation research has primarily examined innovation outcomes, technological recombination, and problem solving, less attention has been given to how exaptation functions as an organizational adaptation mechanism and how information search behaviors enable the identification and repurposing of existing capabilities. The E3 model addresses this gap.

3 The E3 Model

We propose an updated model for organizational adaptation that extends March's (1991) exploration-exploitation model by introducing a third mode – exaptation [7]. Applied to organizations, exaptation captures adaptation behaviors that intentionally repurpose existing capabilities to address new problems. Exaptation therefore involves existing capability, a prior function or application, and the repurposing of that capability for a different function or problem. Intentionality underlies solution repurposing,

making adaptation more meaningful. Exaptation describes organizational adaptation behavior that lies between exploration and exploitation, highlighting how search behaviors enable organizations to repurpose or reconfigure existing capabilities.

Repurposing capabilities developed for different purposes distinguishes exaptation from exploitation and exploration. In organizations, capabilities are combined into configurations to address problems. A configuration, or organizational technology, functions as a solution to organizational challenges, such as how to structure organizational networks for more optimal performance and goal attainment. When environmental change disrupts the fit between existing organizational technology and the environment, performance declines, prompting the search for alternate solutions. The sub-optimal performance represents an organizational problem, and its severity motivates organizations to search for new expertise, information, and capabilities. Exploitation involves proximate search; in this mode, organizations attempt to find solutions to problems within existing organizational technology. Exaptation, in comparison, draws on capabilities developed for problems external to the current configuration and adapts them to meet the new problem. Exaptation offers a distinct form of adaptation that is based on existing capabilities but is not constrained by current configurations.

Exploration, like exaptation, involves adaptation, but differs in intent and scope. Exploration involves distant search and the development of new solutions to solve problems. In organizations, exploration often results in the design of a new organizational technology – a new configuration specific to the changed environment. Exaptation, in contrast, does not develop wholly new capabilities; rather, it locates and repurposes existing ones developed to address another problem, but adequate for the new one. While both exploration and exaptation transform the current organizational technology, exploration emphasizes novelty, whereas exaptation emphasizes reuse. Therefore, exaptation represents an intermediate adaptation approach that is more expansive than exploitation but more limited than exploration. These distinctions suggest several testable expectations about the conditions and search behaviors associated with exaptation: (1) Organizations are more likely to engage in exaptation when exploitation is inadequate and resources constrain exploration; (2) Exaptation involves search across information patches for existing capabilities that can be repurposed to address an organizational problem; and (3) Information scent that indicates the relevance of an existing capability to a new organizational problem increases the likelihood of exaptive search.

Fig. 3 illustrates the proposed organizational adaptation model, which includes exaptation in the middle space between exploitation and exploration. By explicitly recognizing exaptation, this updated model captures organizational search behaviors focused on repurposing existing capabilities and more comprehensively reflects how modern organizations adapt, strengthening model relevance to modern organizational contexts. The explicit inclusion of exaptation as an approach to organizational adaptation also addresses the long-standing “problem of dealing with innovations” [12, p. 188], which often do not arise from pure exploration or exploitation.

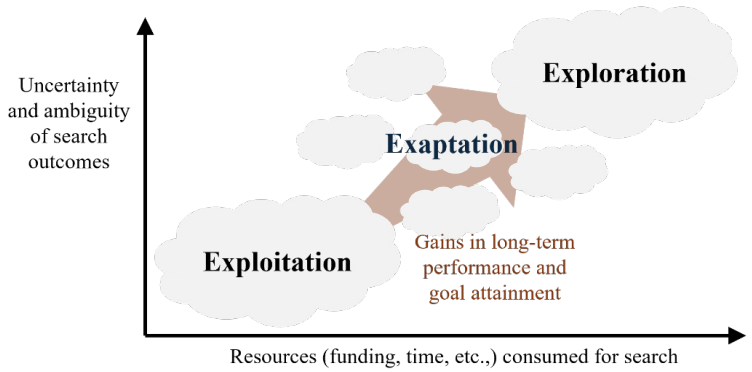

Fig. 3. This figure illustrates notional relationships between exploitation, exaptation, exploration, resources consumed, uncertainty and ambiguity, and anticipated effects on long-term performance. The grey areas represent, albeit simply, the scope of associated search techniques.

4 Discussion

The proposed model supplements effectuation and bricolage theories. Effectuation theory describes entrepreneurial decision-making that takes advantage of already known expertise, information, and capabilities [37]. In short, effectuation theory characterizes entrepreneurial decision-making as a control technique in which entrepreneurs play to their strengths. Bricolage theory describes the social integration of differentiated knowledge to find solutions [38] and may overlap with exploitation or exaptation. Exaptation differs by specifically repurposing an existing capability for a new function or problem.

The proposed, updated model provides a framework that explicitly incorporates exaptation into the exploitation-exploration model. The updated model addresses a common form of organizational adaptation technique that is underexplored in March's (1991) exploitation-exploration framework, as well as effectuation and bricolage theories [7], [29], [39]. Notably, the proposed model supplements effectuation and bricolage theories with exploration.

Corroborating exaptation as a distinct organizational adaptation technique, refining its boundaries, characterizing underlying search behaviors, and exploring the dynamic nature of exaptation should be the focus of future empirical studies. Researchers could examine organizational adaptation episodes to identify the capabilities considered, their prior applications, the information patches searched, and whether capabilities were refined, repurposed, or newly developed. Organizational investment decision-making usually involves group members searching for and choosing between proposals that vary in the scope of possible organizational technology impacts. Exploring decision-making by investment program managers seems especially relevant for further exploration of the proposed organizational adaptation model.

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