Renewing Research on Problemistic Search – A Review and Research Agenda

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ABSTRACT

Problemistic search, search triggered by a performance shortfall relative to an aspiration, has become a central feature of many important organizational theories. It is an integral part of explanations of a wide variety of organizational behaviors and outcomes including strategic change and reorientation, risk-taking, organizational adaptation, knowledge generation, organizational learning, new resource creation, and innovation. While the concept of problemistic search has diffused broadly in the management literature, development of the theory underlying the concept has not kept pace with the breadth of the unfolding literature. In our review of the literature, we identify six critical issues with extant theory that can be traced back to a continued reliance on the initial conceptualization of the process. To address these issues and to revitalize research on problemistic search, we propose a research agenda that is premised on a more central role for cognition in the theory and suggests new emphasis on a process perspective of problemistic search.
1. INTRODUCTION

Problemistic search, search for behavioral alternatives triggered by a performance shortfall relative to an aspiration, is a central concept in a broad variety of organizational theories, and an important explanation of a wide variety of organizational behaviors and outcomes. While the concept of problemistic search has diffused broadly in the management literature over the past half-century, development of the theory underlying the concept has not kept pace with the breadth of the unfolding literature. Most studies that use the theoretical apparatus of problemistic search match quite closely to its early conception in Cyert and March’s (1963) seminal work on the behavioral theory of the firm. The refinements and challenges to the conceptualization that have arisen from research on problemistic search, as well as from adjacent streams of work, have not been sufficiently integrated into the conceptualization of problemistic search. Given this lack of integration, the literature remains fragmented.

In this paper, our goal is to review the extant research on problemistic search, identify gaps and problems with the conceptualization and research on problemistic search, and develop a research agenda to address these. Following the conceptualization of problemistic search in the behavioral theory of the firm (Cyert & March, 1963), our review focuses on research at the firm level of analysis. We take stock of the large literature on problemistic search via a literature review that takes a process oriented perspective. In doing so, we identified an initial sample of 2440 papers that invoke problemistic search, although our main analysis focuses on the subset of 205 papers that form the backbone of the literature.
Based on our review, we identify six critical issues with the current conceptualization that have held back theoretical and empirical progress. First, problemistic search is conceptualized as overly routinized, assuming a high degree of automaticity, with a rather limited role for cognition. Second, research has focused primarily on solution search, and has therefore ignored an important element of problemistic search, namely the need to identify (search for) the problem itself (e.g. Nickerson & Zenger, 2004). Third, the empirical research, due to inherent data challenges, tends to conjoin distinct elements of problemistic search (search, outcomes, and stopping of search), limiting our understanding of the process. Indeed, the empirical literature on search triggered by performance below an aspiration rarely examines search itself, black-boxing the process in favor of examining how performance below the aspiration triggers the outcome in the form of change. Taken together, these latter two points highlight that the extant literature often takes a very non-process view of the problemistic search process. Fourth, given strong assumptions about limited cognition and the myopic nature of search (Levinthal & March, 1993), problemistic search has been viewed, predominantly, as a source of exploitation (Greve, 2003c; Greve, 2007). Fifth, the assumption of an almost mechanistic link between the observation of a performance shortfall and the start of search, conflicts with predictions made by alternative theories that have received substantial empirical support (e.g. Staw, 1976; Staw, Sandelands, & Dutton, 1981). Finally, the theory focuses on a single, narrowly delineated outcome — changes that restore performance above aspirations (Greve, 2003c) — yet a diverse array of research and myriad examples suggest that search processes engender unintended, and potentially valuable, outputs (e.g. Miner, Bassoff, & Moorman, 2001).
Our review suggests that these issues can be traced to a continued (over) reliance on the initial (1963) conceptualization of the problemistic search process. Cyert and March’s conceptualization reflects their objective of providing a theoretical counterpoint to neoclassical economic theories of that era that assumed a unrealistically rational economic actor. Their conceptualization was thus constrained to a purposefully simple and highly mechanistic formulation. The research agenda we propose is premised on a revised conceptualization of problemistic search that takes two important steps. First, and foremost, we believe that the potential advancement of the literature must be premised on a more central role for cognition in the theory than is suggested by the traditional conceptualization. Other research, also in the Carnegie tradition, has made important strides by adding back a modicum of cognition to behavioral theory (e.g. Feldman & Pentland, 2003; Gavetti & Levinthal, 2000).

Second, to facilitate a more cognitive view of problemistic search, we believe that additional research emphasis on the process of problemistic search is warranted. Much of the research on problemistic search employs a variance theory approach (Mohr, 1982) that treats problemistic search as a black box, examining the attainment discrepancy that triggers the process and the outcome that restores performance, but often overlooking search itself. We believe that substantial theoretical and empirical progress could be made by disentangling the stages of the problemistic search process. To this end, we suggest the consideration of a revised process architecture characterized by two distinct search stages: problem definition search and solution search. Problem definition search is the process of identifying a causal diagnosis of the attainment discrepancy. Not only is problem definition likely to demand a more cognitive underpinning, the
outcome of problem definition search may act as a mental representation that guides subsequent solution search (e.g. Barr, Stimpert & Huff, 1992; Gavetti & Levinthal, 2000; Kiesler & Sproull, 1982).

By examining problemistic search from a process theory perspective, and adding back a modicum of cognition to the theory, we raise the possibility of a renewed and substantive research program on problemistic search as a centrally important, commonly observed organizational activity. Such a program may lead to a richer understanding of the functioning of problemistic search and facilitate distinguishing problemistic search from other search processes, such as slack search or institutionalized search (Chen & Miller, 2007; Cyert & March 1963; Greve 2003c) that may co-occur but are expected to differ in their characteristics. It may also shed light on how problemistic search may function as a master switch that engenders a broad range of behaviors, both exploitative and explorative (Greve, 2003a, 2003c, 2007), and in doing so, points to a multitude of ancillary outputs of problemistic search that may create value for the organization.

This paper is structured as follows. In the next section we review the extant research on problemistic search. We take a process approach, summarizing both theoretical developments and empirical tests in extant research in which problemistic search is a key theoretical mechanism. We use the literature review to identify critical gaps in our understanding of problemistic search. Building on this review and assessment, we highlight key elements of a research agenda that addresses these gaps.
2. EXTANT RESEARCH ON PROBLEMISTIC SEARCH

Following the publication of the behavioral theory of the firm, the concept of problemistic search has been widely adopted and diffused. In this section, we provide an in-depth review of the literature on problemistic search, summarizing theoretical developments and empirical tests. We begin below by briefly highlighting the original conceptualization in Cyert and March (1963). We then outline the methodology by which papers were chosen for inclusion in this review. We proceed to explicate the results of the review. To facilitate our discussion, we divide the literature into four broad areas of focus that follow the process of problemistic search as depicted in Figure 1: (a) triggers of problemistic search, (b) characteristics of solution search, (c) behavioral consequences that are the outcomes of problemistic search, and (d) stopping mechanisms of problemistic search.

<< Insert Figure 1 here >>

2.1. Original Conceptualization

In its original conceptualization by Cyert and March (1963), problemistic search is triggered by a performance shortfall relative to an aspiration, and represents the sequential process of comparing performance to aspiration, searching for behavioral alternatives when there is a shortfall, and terminating search when a behavioral alternative is identified that restores performance. Search in this conceptualization refers to activities geared toward identifying behavioral alternatives that have the potential to restore performance (i.e. solution search).
The original conceptualization of problemistic search was characterized with simplicity in mind. In its historical context, the simplicity of problemistic search was a reaction to behavioral assumptions in neoclassical economics that scholars in the Carnegie School viewed as unrealistic representations of the cognitive abilities of people and organizations (March & Simon, 1958; Simon, 1947). This simplicity was reflected across three key features of problemistic search. First, organizations employ a simple mapping between a performance shortfall relative to an aspiration and a problem, allowing the organization to move directly from the recognition of an attainment discrepancy (Lant & Montgomery, 1987) to solution search. A key insight in Cyert and March (1963), in this respect, was that an organization requires a motivation to search, and performance below aspiration provides this motivation. Second, organizations pursue a simple, narrowly delineated, and unambiguous objective through problemistic search: “mend performance shortfalls” (Greve, 2003a: 687). Although the existing literatures that have employed the idea of problemistic search are diverse, they are fairly consistent in theorizing about it. Organizations inherently use problemistic search as a means to engender organizational action and find solutions to the everyday challenges they face in a satisficing manner (Simon, 1955). Actions are evaluated on the basis of their ability to solve the problem, resolving the attainment discrepancy. Third, organizations are simple-minded in their search behavior. Problemistic search is typically viewed as occurring in the vicinity of current knowledge, practices, and expertise (Levinthal, 1997; Levinthal & March, 1993). Only when a solution cannot be found in the vicinity of the firm’s existing knowledge does the organization gradually move towards more distant search.
2.2. Methodology of Literature Review

To identify the relevant literature for this review we followed a structured process. We started with a broad search on google scholar using the terms "problemistic search cyert march". This search revealed approximately 2440 results (in October 2016). However, a large share of the papers in this set reference problemistic search ritualistically, employing the terminology without engaging with the substance of the concept, and often only contained singular mentions of problemistic search in the form of a side or subsidiary argument.¹

In order to ensure an appropriate scope and a consistent coverage of the relevant literature on problemistic search, we conducted several additional steps to develop a narrower group of core papers. First, to identify papers that are substantively related to problemistic search, we conducted five independent searches with distinct keyword combinations: (Cyert March “problemistic search”), (Cyert March satisfice OR satisficing), (Cyert March aspiration OR aspirations), (Cyert March “performance feedback”), and (Cyert March Search). Second, we restricted the search to nine leading journals in our field (Academy of Management Journal, Academy of Management Review, Administrative Science Quarterly, Management Science, Organization Science, Organization Studies, Journal of Management, Journal of Management Studies, Strategic Management Journal). Because the fifth keyword combination (Cyert March Search) produced overly broad results even with these restrictions, we applied additional criteria for the results from that last keyword combination. Specifically, we included a paper retrieved from searching “Cyert

¹ We decided to employ google scholar after testing and cross comparing google scholar with other search engines, including ISI Web of Knowledge and Ebsco Business Source Complete. Google scholar provided greater and more consistent search results because it matches keywords not only on title and abstract, but also, in many cases, the main text body.
March Search,” only if it either has more than 300 citation counts or was published after 2011. This step reduced the sample size to 594. Third, after examining the remaining articles, we excluded papers that discuss "problemistic search" as a marginal theme, or were well off topic. In other words, we excluded a paper if, even though it invokes the term “problemistic search,” the concepts of search and performance shortfall do not play a substantive role in the theory. When it comes to off-topic papers, for example, a considerable portion of our initial search results included papers mainly about operational procedures or routines. While these papers may include references to both “Cyert and March” and “search,” many of them did not engage with problemistic search and, thus, were excluded from our review sample. After executing this third step, the sample was reduced to 169 articles.

Finally, we examined the bibliographies of the papers in this subsample to identify relevant papers that may have been excluded. In doing so, we were able to add papers and book chapters on problemistic search that are important, but outside the subset of the nine leading journals. Moreover, using the bibliographies of this subsample of 169 articles enabled us to identify papers that, while not directly on problemistic search, are relevant to the problemistic search literature. Taken together, our final sample contains 205 core articles that form the basis of the literature review.\footnote{In addition to these articles that speak directly to problemistic search, we also discuss, where appropriate, articles that shed light on problemistic search, but are not in the literatures associated with the behavioral theory of the firm.} In addition to the formal literature search of leading journals, we also added on an ad-hoc basis papers that are related to, but not directly within the core stream of problemistic search. We complemented this further by additional literature from secondary journals, books and further publications, such as working papers that were cited in the focal work
of problemistic search. Therefore, the discussed literature includes as well numerous papers that are related to, but not directly within the core literature of problemistic search.

2.3. Triggering Mechanisms of Problemistic Search

A key domain of research on problemistic search focuses on the mechanism by which problemistic search is triggered. The explicit claim in the literature in the Carnegie school tradition, but also common across other bodies of management scholarship (e.g. Argyris & Schön, 1978; Chandler, 1962) is that “poor performance is actually necessary to catalyze the search for new practices in an organization” (Bolton, 1993: 59). We decompose research in this domain across two topics: an aspiration as a threshold of problemistic search and dimensions of aspirations. In doing so, we highlight the rather mechanistic, nearly automatic, view of the triggering of search when performance falls below an aspiration — a view that conflicts with predictions made by cognitively grounded theories such as threat rigidity and escalation of commitment that theorize instances when organizations do not respond to performance shortfalls (e.g. Staw, 1976; Staw et al., 1981). We also highlight conflicting results in the literature on social aspirations, which presage the need for an even greater understanding of the cognitive mechanisms underlying the determination of a social referent group.

2.3.1. Aspiration as a threshold of problemistic search

Cyert and March (1963) argued that problemistic search is triggered when a firm recognizes a gap between its actual performance and its performance aspiration — an attainment discrepancy. Thus, an aspiration is a goal or target that serves as a threshold against which
performance is evaluated, and it is the attainment discrepancy that is viewed as the problem. The premise is that, as Lant (1992: 624) argues, firms “act in order to enhance their degree of success in achieving their aspirations.” Thus, while an attainment discrepancy stimulates search for solutions, performance above the aspiration level induces the firm to maintain the status quo and avoid actions that might entail a risk of reducing performance (Bromiley, Miller, & Rau, 2001; March & Shapira, 1987). Winter (1971: 245), likewise, argues that “if existing rules are functioning well, the firm is unlikely to change them; if not, search for better rules will be stimulated.” The concept of an aspiration as a goal or target is not unique to the behavioral theory of the firm. It is built on the analogy to the individual level aspiration construct with its origin in psychology (e.g. Frank, 1935; Katona, 1953; Lewin, Dembo, & Festinger, 1944). For instance, Simon’s (1959: 263) argument that when “performance falls short of the level of aspiration, search behavior (particularly search for new alternatives of action) is induced,” is clearly built on earlier work in the psychology literature (e.g. Frank, 1935; Katona, 1953).

Empirical studies provide support for the claim that an aspiration is a performance threshold against which search is triggered. Studies suggest that lower-than-aspiration performance stimulates organizational effort to remedy the problem (e.g. Chen & Miller, 2007; Greve, 2008; McDonald & Westphal, 2003; Park, 2007), whereas firm performance comparable to or higher than the aspiration leads to strategic inaction (e.g. Audia, Locke, & Smith, 2000; Greve, 1998; Miller & Chen, 1994). For example, Chen and Miller (2007), using data of publicly traded U.S. companies from 1980 to 2001, find that R&D search intensity increases with the distance of firms’ past performance below an aspiration. Audia et al. (2000), in archival studies of the airline and trucking industries complemented by lab experiments, find that both individuals
and firms that experienced past success tend to show greater strategic persistence in the face of radical environmental change. Similarly, Greve (1998) studied the behavior of radio stations in 160 U.S. markets, finding that they decreased changes in genre formats and production when performance increased relative to the aspiration level.

While the underlying logic that performance below an aspiration acts as a trigger of search has substantial face validity and has received substantial empirical support, boundary conditions to this relationship that is conditions under which search is not triggered by an attainment discrepancy are a less well understood area of research. One line of research examining this question comes directly out of Cyert & March (1963), which theorized that organizations typically pursue multiple goals. Consequently, managerial attention to these goals may be a crucial moderator of problemistic search (Greve, 2008; Ocasio, 2011).

Recognizing the potential importance of organizational attention, several scholars have empirically examined whether and how a shift of attention influences the triggering of search (Blettner, He, Hu, & Bettis, 2015; Chen & Miller, 2007; Li, Maggitti, Smith, Tesluk, & Katila, 2013; Washburn & Bromiley, 2012). Broadly, attention shifts in problemistic search can be categorized into three types: A shift of an attention focus to different reference performance levels regarding the same aspiration (e.g. Audia & Greve, 2006; Blettner et al., 2015; Chen & Miller, 2007; Desai, 2008; Greve, 2010; Iyer & Miller, 2008; Joseph & Gaba, 2015; Lehman & Hahn, 2012; Lehman, Hahn, Ramanujam, & Alge, 2011; Miller & Chen, 2004; Ref & Shapira, 2016), a shift of an attention focus from social to historical aspirations and vice versa (e.g. Blettner et al., 2015; Bromiley, 1991; Deephouse & Wiseman, 2000), and a shift across different goals (e.g.
Gaba & Joseph, 2013; Greve, 2008; Vissa, Greve, & Chen, 2010). For instance, Greve (2008: 476), presents evidence that “firms grow more when they are below the aspiration level for size, especially when performance goals are satisfied.” Blettner et al. (2015), studying the lifecycles of a sample of German magazine publishers, find that there are multiple reference points to which a firm can attend, and firms transition attention among different types of reference points over time. In contrast, in a study of R&D search behavior, Chen and Miller (2007) fail to find evidence of an attention shift to a survival aspiration when the firm was close to bankruptcy but rather find evidence for simultaneous attention to multiple reference points. These mixed results suggest that more research effort is needed to elucidate the role of managerial attention in the recognition of a performance-aspiration gap (Blettner et al., 2015).

Psychological factors may also limit the extent to which performance below an aspiration triggers search. Jordan and Audia (2012) theorize that managers have a self-enhancement motive in that they seek to view themselves in a positive light. As such, they may retrospectively distort the gap between performance and aspirations, reducing the likelihood that search is triggered. Jordan and Audia (2012) find that high levels of narcissism, accountability, and informational ambiguity can increase decision makers’ propensity to assess performance in a self-enhancing way. In a paper that includes both experimental and field studies, Audia and Brion (2007) show that when faced with two diverging performance measures, one above the aspiration level and the other below the aspiration, decision makers tend to give more importance to the favorable performance indicator. Likewise, Desai (2015: 1032), building on attribution theory, focuses on the “way in which decision makers interpret information about where failures occurred or who was involved.” In a study of surgery incidents at California hospitals, he finds that organizations
improve less effectively if failures can be traced back to smaller subunits or individuals. Moreover, in an experimental study, Audia, Brion, and Greve (2015) find that low-performing decision makers frequently choose organizations that have lower performers as a reference group for comparison, thus, inhibiting perception of the problem and propensity to make changes. In sum, these results suggest that both individual characteristics and the characteristics of the environment, such as ambiguous feedback (Rerup, 2006), may impact the triggering of problemistic search.

Yet another mechanism that may inhibit triggering of problemistic search is the role of differences across groups of individuals or corporate levels in an organization. Gaba and Joseph (2013) find “that corporate structure influences the relationship between performance below aspirations and business unit adaptation.” Likewise, Desai (2016: 860) examines how the existence of multiple groups of decision makers with divergent interests might impact learning from failure. In particular, he finds that “board characteristics moderate the relationship between performance feedback and organizational change.” Taken together, these studies point to conditions under which an attainment discrepancy may not trigger search.

In sum, while substantial progress has been made in linking performance below an aspiration to subsequent problemistic search as Cyert and March (1963) postulated, further progress in understanding of when performance below an aspiration does and does not trigger search has been constrained by the empirical challenges of distinguishing between search and its behavioral consequences. Later in this paper (section 2.5), we will discuss studies that examine an attainment discrepancy and then look for the subsequent behavioral consequences. These studies
typically black-box the search process. Thus, one cannot easily distinguish, for instance, whether the failure to observe a particular behavioral consequence (e.g. an acquisition after the recognition of an attainment discrepancy) was due to search not being triggered, or search not generating the particular behavioral consequence under observation.

2.3.2. Dimensions of aspirations

Given that aspirations are integral to the triggering of problemistic search, a rather large body of research has sought to examine aspiration formation. The literature on aspirations is large and has been subject to a number of recent reviews (Bromiley & Harris, 2014; Shinkle, 2012). As such, we focus our discussion selectively on elements related to problemistic search, leaving the interested reader to consult these prior reviews for a more detailed coverage on aspirations and their adaptation over time. We focus on two key dimensions of aspirations: the performance metric on which aspirations are based, and the construction of the referent, historical or social. In doing so, we highlight that in understanding the dimensions of aspirations, the extant literature has already begun to incorporate cognitive mechanisms by which aspirations are formed and become salient in the minds of managers.

Performance metrics of aspirations. The central feature of aspirations in the behavioral theory of the firm is that, with some exceptions (e.g. Bromiley, 1991; Chen, 2008; Lant & Shapira, 2008), they are based on experience rather than forward-looking or future-oriented calculations (Arrfelt, Wiseman, & Hult, 2013; Greve 2003c). For instance, Lant and Shapira (2008: 60) state that a “key assumption of the behavioral theory of the firm is that firms adjust
their behavior in response to their experience rather than acting on their expectations of future states of the world.”

While aspirations are, in Cyert and March (1963), broadly conceived as goals or targets, the literature has tended to focus somewhat more narrowly on financial performance as the aspiration. Financial and accounting measures of profitability are perhaps the most commonly studied bases for performance aspirations (Audia et al., 2000; Bromiley, 1991; Greve, 2003a, 2003b; Lant, Milliken, & Batra, 1992; Miller & Chen, 2004). These include dimensions such as return on sales (Audia et al., 2000), return on assets (Fleming & Bromiley, 2003; Greve, 2003a; Miller & Chen, 2004), and revenue (Mezias, Chen, & Murphy, 2002). Some studies have broadened the types of goals considered and investigated a broader range of goals including new product development performance (Tyler & Caner, 2016), innovation (Gaba & Bhattacharya, 2012), market share (Baum, Rowley, Shipilov, & Chuang, 2005; Greve, 1998), firm size and growth (Greve, 2008) and product quality (Parker, Krause & Covin 2015). Baum et al. (2005), for example, examine a sample of investment banks, adopting a market share aspiration because they observes that this metric is commonly employed by banks themselves. They also examine a status aspiration, calculated as a network centrality measure. Some aspirations may be more distant from performance. Greve (2008), for example, examines firm size, which is a basis for an aspiration that may become somewhat disconnected from financial performance.

*Historical and social basis of aspirations.* Cyert and March (1963: 115) identified three experience-based components of aspirations: “the organization’s past goal [prior aspirations], the organization’s past performance, and the past performance of other ‘comparable’ organizations.”
Following their framework, the literature has broadly distinguished two types of aspirations depending on the source of experience: historical aspirations based upon the organization’s past performance and social aspirations based upon the performance of comparable organizations. Theoretical frameworks are less well developed and empirical testing has provided more equivocal results regarding social aspirations than historical aspirations (Moliterno, Beck, Beckman, & Meyer 2014).

One natural way for firms to set an aspiration level is to appraise the history of one’s own performance. Past performance is an indicator of how well a firm can and should do in its environment. Reflecting this notion, prior research has specified a historical aspiration as an exponentially weighted average of the firm’s past performance (e.g. Lant, 1992; Levinthal & March, 1981; March, 1988). Experimental (Lant, 1992; Lant & Montgomery, 1987) and field studies (e.g. Mezias & Murphy, 1998) have provided early evidence that history of past performance contributes to the formation of aspirations. For example, in an experiment using a simulated management game, Lant (1992) examined the formation of team aspirations by observing executives participating in a strategy game. She compared an attainment discrepancy model, which builds on past performance with a rational expectation model, which takes into account all possible information. Her results suggest that a simple adjustment to past performance proposed in the attainment discrepancy model provides a better description of aspiration formation. Mezias and Murphy (1998) replicated the result of Lant (1992) using field data from 94 retail units of a large American financial services firm for ten quarters from 1995 to 1997. They found that the aspiration level is “sensitive to past performance” (Mezias & Murphy, 1998:18).
D7), reporting that performance in the previous period has a positive effect on the current aspiration level.

A substantial body of research supports the claim that performance below historical aspirations influences organizational behavior, presumably by triggering problemistic search (e.g. Audia & Greve, 2006; Baum et al., 2005; Chen & Miller, 2007; Greve, 1998; Harris & Bromiley, 2007; Hundley, Jacobson, & Park, 1996; Miller & Chen, 2004). For instance, a study comparing U.S. and Japanese firms finds that declining profit leads to increased R&D expenditures in Japanese firms, but to a fluctuating R&D intensity in U.S. firms (Hundley et al., 1996). In addition, Chen and Miller (2007) find that farther past performance falls below the historical aspiration level, the higher the firm’s spending on R&D search. These findings are consistent with the argument that performance below historical aspirations triggers problemistic search.

An alternative way a firm may set an aspiration level is to appraise the performance relative to that of other firms. If the focal firm’s performance is perceived to be lower than the performance level of other firms in the reference group, the focal firm is expected to recognize this performance gap as a problem, and, consequently, initiate problemistic search. Work on social aspirations has a classic psychological foundation. As Massini, Lewin, and Greve (2005) note, research on the "level of aspiration (Lewin et al., 1944) and social comparison theory (Festinger, 1954) suggests that individuals use a reference group that reflects the average performance of peers."

Despite the theoretical appeal of the concept of social aspirations, and the rich body of research (e.g. Baum et al., 2005; Greve, 1998; Harris & Bromiley, 2007; Iyer & Miller, 2008;
Ketchen & Palmer, 1999), empirical research on the link between social aspirations and subsequent organizational behavior in problemistic search has at times yielded mixed findings. While many studies find, consistent with problemistic search theory, that performance below the social aspiration stimulates more or riskier organizational changes (e.g. Baum et al., 2005; Harris & Bromiley, 2007; Ketchen & Palmer, 1999; Labianca, Fairbank, Andreviski, & Parzen, 2009; Shipilov, Li, & Greve, 2011), others find no effect (Audia & Greve, 2006; Desai, 2008; Lim & McCann, 2013) or an opposite relationship (e.g. Iyer & Miller, 2008). For example, Baum et al., (2005), in a sample of Canadian investment banks, finds that the propensity to select new partners increases as performance falls below the social aspiration level. In contrast, Iyer and Miller (2008: 815), in a study of acquisitions by U.S. manufacturing firms, find that “as performance relative to aspirations decreases, the probability of acquisitions increases.” Moreover, they find that firms performing above the social aspiration do not show a decrease in acquisition, again inconsistent with the problemistic search framework.

The mixed evidence on the role of social aspirations may result because of differences in how reference groups are specified across studies (Baum & Dahlin, 2007; Labianca et al., 2009; Short & Palmer, 2003). Many studies have regarded industry membership as the defining feature of reference groups (Greve, 2008), with social aspirations measured by average (e.g. Baum et al., 2005) or median (e.g. Iyer & Miller, 2008) industry performance. A more serious issue, one that goes beyond simple measurement, relates to the large number of dimensions on which a reference group might be constructed. Greve (1998) notes a broad array of variables, beyond industry, that may be important for determining the referent group: size, physical proximity, performance, products, markets, and production methods may all be relevant. For instance, Kuusela, Keil and
Maula (2017) used the within-group average performance of strategically similar peer companies, rather than the average performance of all industry participants, to construct firms’ social aspirations. Moreover, as Audia, Brion, and Greve (2015) argue by building on the psychological construct of self-enhancement motives, managers may select referent groups in a strategic manner such that they are able to view themselves in a favorable light.

The challenge of empirically studying social aspirations and problemistic search may be further compounded because firms may have multiple simultaneous referent groups. Moliterno et al. (2014) propose, and empirically show in a sample of German Bundesliga football teams, that two types of social reference points, group membership threshold and top performance threshold, may trigger the search for different types of solutions. Kacperczyk, Beckman, and Moliterno (2015) propose that social referent points may not only be external, but may also internal, among business units within a single firm. By analyzing investment patterns of mutual fund firms, they show that while internal comparison leads to change in riskiness of the investment portfolio, external comparison triggers change in investment portfolio but not necessarily risks in them.

Perhaps the most substantial theoretical issue related to social aspirations is the socially constructed nature of referent groups based on underlying managerial cognitive processes. Outside the behavioral theory of the firm literatures, a number of studies have examined how firms identify others as rivals, worthy of attention, and perhaps social comparison. Porac, Thomas, and Baden-Fuller (1989) examine the social construction of rivalry in a sample of Scottish knitwear producers. They argue that a cognitive process associated with managerial perception underlies how firms define their referent group of rivals. Fiegenbaum, Hart, and
Schendel (1996), builds on prospect theory as the theoretical foundation, focusing on the role of strategic groups that may serve as more effective comparison targets for the firms than the more general construct of industry. Panagiotou (2007), in a qualitative study of 26 UK travel agencies, finds that the firms are more likely to compare themselves to other organizations in a strategically similar group than the entire industry. Clark and Montgomery (1999), using a small sample of executives and MBA students, find that individuals focus on just a few firms with similar product, market, or production methods as competitors. In particular, participants identified just 6 other firms as competitors, of which 3 were identified as “main” competitors.

Further compounding the issue is that, while Cyert and March (1963: 123) formulate an additive model of historical and social aspirations into a single aspiration for each metric of interest, there is continued debate on how these two aspirations should be aggregated (Bromiley & Harris, 2014). Studies attempting to explicitly incorporate both historical and social aspirations have done so in a variety of manners. First, studies aggregate social and historical aspirations to a single scale, for instance, using a weighted average of the two (e.g. Greve, 2003b; Mezias et al., 2002). Bromiley and Washburn (2012) question this approach based on the empirical results in their study. Second, studies use distinct measures for social and historical aspirations and propose separate hypotheses for them (e.g. Baum & Dahlin, 2007; Baum et al., 2005; Greve, 1998). Finally, studies propose a theoretical mechanism by which firms switch attention between historical and social aspirations, suggesting that each aspiration type is associated with different underlying organizational processes. Such models frequently assume that organizations utilize different aspirations depending on their own performance level (e.g. Bromiley, 1991; Deephouse & Wiseman, 2000; Park, 2007; Washburn & Bromiley, 2012; Wiseman & Bromiley, 1996),
posing, for example, that organizations sequentially reallocate their attention from historical aspirations to social aspirations as their performance increases or vice versa. This may be important if responses to historical aspirations differ from responses to social aspirations (e.g. Kim, Finkelstein, & Halebian, 2015).

In sum, the basic logic of aspirations as triggering problemistic search is compelling. While defining historical performance is relatively easy, referent groups of firms are socially constructed. Research on social aspirations highlights the limited ability of a behavioral logic of simple automaticity to explain the functioning of such aspirations. The extant literature has already begun to highlight the important role of cognitive mechanisms in selecting reference groups for social aspirations, and the complex dynamics of organizational attention to different social and historical aspirations.

2.4. Solution Search and its Characteristics

It stands to reason that a core focus of research on problemistic search should be on the characteristics of solution search. In fact, in their seminal work, Cyert and March (1963) argued that problemistic search is simple-minded in its causal models, biased by goals and experience, and, motivated by a performance shortfall. Accordingly, they theorized that, once triggered by the recognition of an attainment discrepancy, search for a solution that restores performance is predominantly local, conducted in the vicinity of the problem symptom and previously adopted actions, and intensified as the size of the performance shortfall increases (Cyert & March, 1963).
While the literature on the characteristics of search, as a general construct, is fairly large, the literature on the search for solutions triggered by, and oriented toward, the solution of a specific problem, that is, problemistic search, is more limited. Most research has occurred under the broader heading of organizational search (e.g. Levinthal, 1997; Rosenkopf & Almeida, 2003; Rosenkopf & Nerkar, 2001; Afuah & Tucci, 2012), which includes a range of search processes such as slack search (Cyert & March 1963; Chen 2008) and institutionalized search (Chen & Miller 2007; Greve, 2003c) that may have very different characteristics than problemistic search since they lack triggering by and orientation toward a problem (e.g. Levinthal & March 1981). In addition to confounding these alternative search processes, the extant empirical research has also often confounded search and its behavioral consequences and as a result our understanding of the characteristics of search within problemistic search remains somewhat underdeveloped. We thus draw inference about problemistic search based on a discussion of elements of this broader body of work focusing on the locus of search, online versus offline evaluation of search, the intensity of search and the dynamics of search rules. In doing so, we recognize substantial limitations in our understanding of problem driven search, in the extent to which it is local and exploitative, its prevalence relative to other types of organizational search, the extent to which it employs cognition in the evaluation of solution candidates, and more generally, how it differs from other types of search.

2.4.1. Locus of problemistic search

Cyert and March (1963) were relatively precise in their prediction that search triggered by an attainment discrepancy would be predominantly local in nature. For instance, firms
experiencing new product development rates below-aspiration level would be expected to start searching for solutions by tinkering with R&D related organizational practices (Tyler & Caner, 2016). Or, as March (1994: 28) suggests, “if sales fall in Texas, then they look for the problem and the solution in Texas.” As Jung and Lee (2016: 1729) summarize by describing a situation as firms “searching knowledge that is familiar (Fleming, 2001), or closely related to firms’ existing expertise (Katila & Ahuja, 2002), or searching for a solution that is in the neighborhood of current expertise (Rosenkopf & Nerkar, 2001).” Thus, search starts within familiar domains, modifying existing activities and routines, only proceeding to more distant domains if a solution cannot be found locally. Given the theorized reliance on local search, problemistic search has been characterized as path-dependent (Cyert & March, 1963; Ahuja & Katila, 2004), leading primarily to exploitation in the sense of incremental refinement of previously adopted organizational activities (March, 1991). However, as we will discuss, recent research on search highlights the mechanisms by which search in general, and by inference, problemistic search, may be less exploitative than previously thought.

Organizational search is theorized to be local based on a number of supporting rationales. First, local search exhibits distinct advantages relative to more distant search (e.g. Helfat, 1994; Laursen, 2012; Nelson & Winter, 1982). Organizations and their decision makers’ cognitive limitations make it difficult for the organization to become aware of and able to evaluate all alternatives that may be relevant for solving a problem (Simon, 1978b; Knudsen & Levinthal, 2007). Second, organizations possess a limited knowledge base. Given that learning is easier in domains where the organization holds knowledge or at least possesses related knowledge (Knudsen & Levinthal, 2007), search will be facilitated in the (local) areas where the organization
has current expertise (Helfat, 1994). Third, local search may be preferred since it may produce better performance, at least in the short run (Denrell & March 2001; Taylor and Greve 2006). Related to the latter point is that the cost of search can be expected to be lower when the organization searches locally because it avoids the substantial cost of communicating across knowledge domains (Carlile, 2002; Laursen, 2012). As an example of such cost one may think of the substantial cost in time and effort for developing common understanding and language when a physics scholar needs to communicate with a management scholar.

Perhaps because the theoretical logic supporting the localness of organizational search is so compelling, the empirical base of direct evidence in support of localness is somewhat slender. Key studies that lend support to the dominance of local search are Stuart and Podolny (1996), Martin and Mitchell (1998), and Katila and Ahuja (2002). Laursen (2012) provides a brief review of this work. In a lab study examining the nature of individual search on a rugged landscape, Billinger, Stieglitz, and Schumacher (2014: 93) observe that “Success narrows down search to the neighborhood of the status quo, whereas failure promotes gradually more exploratory search.”

Local search has a number of downsides. In particular, it is less likely to generate the requisite variety required to solve novel problems and to generate innovative solutions (Fleming & Sorenson, 2004; Katila, 2002). This is, in part, because local search tends to draw upon related knowledge in a manner that limits the extent of recombination (Fleming, 2001), and thus limits the ability to identify high quality solutions in complex environments (Levinthal, 1997; Puranam, Stieglitz, Osman, & Pillutla, 2015). That is, in environments characterized by rugged performance landscapes, possibilities for substantial performance improvement are less likely to reside in the
vicinity of current practices and routines, and thus, local search may not identify these superior positions, stalling at lower quality solutions (Levinthal, 1997).

These well recognized limitations of local search have spawned a rich literature, both theoretical (e.g. March, 1991; Levinthal & March, 1993; Gavetti & Levinthal, 2000) and empirical (e.g. Fleming & Sorenson, 2004; Katila & Ahuja, 2002; Rosenkopf & Almeida, 2003; Rosenkopf & Nerkar, 2001), that identifies mechanisms by which organizations can overcome a tendency towards local search. One stream of studies investigates the important role of variation among organizational members in enabling an organization to search a broader area of the solution landscape (e.g. Beckman, 2006; Rosenkopf & Almeida, 2003). A second stream investigates a variety of managerial approaches within the organization under the heading of ambidexterity (Gupta, Smith, & Shalley, 2006; Lavie, Stettner, & Tushman 2010; Raisch & Birkinshaw, 2008). A third stream investigates how drawing upon actors outside the organization’s boundaries may facilitate broader organizational search (Laursen, 2012; Laursen & Salter, 2006; Rotaheermel & Deeds, 2004; Schildt, Maula, & Keil, 2005; Wadhwa & Kotha, 2006). Theoretical work has complemented this research by pointing to a variety of mechanisms, often demanding higher level cognitive ability, that allow exploration of more distant locations in the search space (e.g. Ahuja & Katila, 2004; Baumann & Siggelkow, 2013; Csaszar & Siggelkow, 2010; Ethiraj, Levinthal, & Roy, 2008; Gavetti & Levinthal, 2000; Rivkin, 2000; Rivkin & Siggelkow, 2003; Siggelkow, 2002; Siggelkow & Rivkin, 2005).

The research on how firms may overcome localness in organizational search, along with a somewhat large literature highlighting the merits of broader search (e.g. Baum & Dahlin, 2007;
Dahlander, O’Mahony, & Gann, 2016), is at least suggestive of the possibility that problemistic search may be somewhat less exploitive than is suggested by the original conceptualization in Cyert and March (1963). Indeed, their lab study of individual search on a rugged landscape, Billinger et al. (2014: 93) see evidence to this effect, observing that “human participants were prone to over-exploration, since they broke off the search for local improvements too early.” Posen and Chen (2013), in a study of learning curves of U.S. commercial banks, find that firms tend to seek and learn from external knowledge when their performance is below their aspiration, with this effect more strong for entrants than incumbents. Moreover, search may be multidimensional. As such, organizations may focus on exploitation through local search along one dimension, such as relative to the firm’s knowledge base and routines (e.g. Helfat, 1994; Katila & Ahuja, 2002; Stuart & Podolny, 1996; Fleming & Sorenson, 2004), yet may explore more distantly along another dimension, such as relative to the firm boundary (e.g. Rosenkopf & Nerkar, 2001).

2.4.2. Online versus offline evaluation in problemistic search

In their conceptualization of problemistic search, Cyert and March (1963) specified search as the activity organizations engage in to create and consider solution candidates to address an attainment discrepancy. Their formulation of problemistic search was purposely devoid of a substantial cognitive component in order to create a counterposition to the overly rational view of contemporary economics. This has an important bearing on our understanding of how alternative solutions are evaluated as firms engage in search for solutions that resolve the attainment discrepancy. Research on organizational search, as a more general theoretical construct, includes
two very different types of performance evaluations: online and offline search (Lippman & McCall, 1976; Gavetti & Levinthal, 2000; Levinthal & Posen, 2007; Knudsen & Levinthal, 2007). The latter demands substantial cognitive capacity (Gavetti & Levinthal, 2000), and thus would appear to contrast with basic tenets of problemistic search.

Online search refers to search activities in which the organization, at least partially, implements an alternative as part of evaluating its merits of solution candidates (Gavetti & Levinthal, 2000). This may take the form of a series of revisions to an ongoing organizational process where the organization evaluates performance feedback at every step and adjusts the process according to that feedback (Levitt & March, 1988). Online evaluation may be necessitated by limited organizational cognition, but is feasible primarily when alternatives can be relatively easily implemented with limited costs, and when changes do not leave an irreversible legacy (Winter, Cattani, & Dorsch, 2007). While the advantage of online evaluation is that one learns about the merits of an alternative based upon real world outcomes, the merits of doing so may be reduced if the task environment is characterized by noisy feedback (March & Olsen, 1976), delayed feedback (Rahmandad, 2008; Rahmandad, Repenning, & Sterman, 2009), or when feedback can only be observed after a sequence of actions (Denrell, Fang, & Levinthal, 2004; Fang, 2012; Fang & Levinthal, 2009).

Offline search, in contrast, refers to search activities in which the organization explores alternative solution candidates without making changes to its existing activities. This may include, for instance, business planning, thought experiments, theoretical calculations, the creation of models, simulations, laboratory experiments, and organizational pilots (Winter et al.,
Effective, offline search requires substantial cognitive capabilities to correctly evaluate the merits of search alternatives (Gavetti & Levinthal, 2000). In offline search, a firm evaluates an alternative against its understanding of the world; a mental model that facilitates assessment of the likely implications of implementation (Gavetti & Levinthal, 2000; Martignoni, Menon, & Siggelkow, 2016; Csaszar & Levinthal, 2015). Offline search may allow the organization to consider a larger set of alternatives because costly implementation of an alternative will only occur if the offline evaluation is positive.

While the low-cognition theory of problemistic search offered by Cyert and March (1963) tends to rule out offline evaluation, we have little in the way of evidence to support the claim that problemistic search is predominantly characterized by online evaluation of alternatives. Most empirical studies considering performance feedback may be read as implicitly assuming that search is online (e.g. Audia & Greve, 2006; Greve, 1998; Harris & Bromiley, 2007; Iyer & Miller, 2008). In this case, behavioral changes implemented over time reflect the path of the search process itself. For pragmatic reasons, studies focus on externally visible strategic changes made by the organization — changes that have been implemented. Consider Greve’s (1998) study of radio format changes or Audia and Greve’s (2006) study of factory expansions in the shipbuilding industry; inference about problemistic search from observing such change must reflect one of two assumptions. The observed change may be an online evaluation during an ongoing process of search. Alternatively, the observed change reflects a solution that has been implemented after a prolonged period of offline search. To the extent that that latter is the case, or problemistic search involves both offline and online evaluation, then extant research may be ignoring the majority of early stage search activities that may have been evaluated offline and may not
lead to observed organizational change. Only a relatively small number of studies have attempted
to capture search that does not lead to organizational change, and thereby potentially incorporates
both online and offline evaluation in the search process. Such studies have looked at outcomes
including patent citations, (Katila & Ahuja, 2002), R&D expenditures (Chen, 2008; Chen &
Miller, 2007) and managers’ self-reports to questionnaires (Voss, Sirdeshmukh, & Voss, 2008; Li
et al., 2013).

Thus, important gaps exist, both in disentangling problemistic search from its behavioral
consequences such as change, and in understanding the conditions under which problemistic
search employs cognitive processes that facilitate offline evaluation. An overly restrictive
conceptualization of problemistic search as a process that involves minimal cognition has led to
research that has largely black-boxed elements of the search process that should be at the very
center of problemistic search. Even if the search for solutions to problems is mostly online,
organization surely engage in at least some ex ante offline evaluation of alternatives.
Consequently, research that focuses only on externally visible organizational changes may arrive
at incomplete or faulty conclusions given that it ignores a potentially important step in the search
process.

2.4.3. Intensity of problemistic search

The intensity of search refers to the level of resources invested by firms to conduct
problemistic search. The extant literature highlights two factors that impact search intensity: the
size of the attainment discrepancy that determines the motivation to engage in problemistic
search, and the availability of resources that determines the feasibility of engaging in problemistic search.

Cyert and March (1963: 116) note that the intensity of search is dependent upon “the extent to which goals are achieved,” implying that search activities become more or less intense depending on how far performance deviates from the aspiration level. Thus, the greater the distance between current performance and the aspiration, the greater the intensity of problemistic search. To test this argument, Chen and Miller (2007) examine data on publicly traded U.S. manufacturing companies. They find that search intensity, measured by R&D expenditures, tends to increase as firms’ past performance falls further below the aspiration level. Chen (2008) finds similar result on search intensity, extending the theoretical logic to show that performance prospects also influence search intensity. The intensity of firms’ R&D activities increases when the firm anticipates failing to achieve its performance target.

One challenge in interpreting the finding on the intensity of search is that it is challenging to distinguish between search activities and their behavioral consequences. As we noted earlier, empirical research is often confined by data limitations to investigating the relationship between the size of an attainment discrepancy and the likelihood of a particular behavioral consequence, such as a series of strategic changes. While this may be reflective of the search process if evaluation is mostly online, to the extent that search has a substantial offline component, the assessment of the relationship between the size of the attainment discrepancy and the intensity of search may be misstated.
Moreover, empirical tests of the relationship between search intensity and the magnitude of the attainment discrepancy has been complicated by the fact that most empirical studies are unable to distinguish between distinct search types of processes. As Greve (2003c) notes, tests of the relationship between search intensity and the size of attainment discrepancy may confound problematic search with institutionalized search. Institutionalized search is routine search activity that is conducted even in the absence of particular triggers (Dosi, 1988; Patel & Pavitt, 1997). Chen and Miller (2007: 377) is one of the few studies (see also Antonelli, 1989; Gubbi, Aulakh, & Ray; 2015) that have made the distinction empirically. In support of institutionalized search, they hypothesize that search intensity will differ across firms and tends to be stable over time within firms. Based on a large longitudinal sample, they find support for the effect of attainment discrepancy on problematic search intensity. They also observe significant firm fixed-effects in R&D search intensity, which they interpret as reflecting “idiosyncratic search determinants for individual firms that persist over time.” Based on data from 298 firms in the Indian pharmaceutical industry, Gubbi et al. (2015) examine the impact of business group affiliation on the firm’s international market search behavior through exporting. They show that business group affiliation and the affiliate’s relative power within the affiliation have the inertial effects on the affiliated firm’s search propensity even after partialling out the impact of attainment discrepancy relative to historical and social aspiration levels. These findings suggest that studies not explicitly controlling for the institutionalized component of search may misidentify how the magnitude of an attainment discrepancy impacts the intensity of problematic search.
In addition, research has suggested alternative forms of relationship between the magnitude of an attainment discrepancy and the intensity of problemistic search. Specifically, March and Shapira (1987), drawing upon work on threat rigidity, argue that under severe threat such as bankruptcy, firms may shift attention away from the performance based aspiration to a survival aspiration, and search intensity will diminish. In line with this argument, Chen and Miller (2007) find that proximity to bankruptcy is negatively related to R&D intensity. Research has made efforts towards reconciling these alternative predictions by testing threat rigidity as an alternative or parallel response to problemistic search (e.g. Shimizu, 2007; Iyer & Miller, 2008) or by examining contingencies such as organizational power concentration, top management diversity, firm size, age, and experience that may moderate the relationship between the size of the attainment discrepancy and search intensity (e.g. March & Shapira, 1992; Mone, McKinley, & Barker, 1998; Audia & Greve, 2006; Desai, 2008). For example, Shimizu (2007) finds that divestiture decisions of the firms are jointly determined by problemistic search, prospect theory and threat rigidity. He showed, using a metric of performance relative to a social aspiration (average industry ROA), that the observed divestiture pattern is best explained by the sum of the extents of divestitures expected by three theories rather than solely by one theory. However, these attempts have fallen short of reconciling or theoretically integrating the underlying theoretical mechanisms.

The availability of resources may also impact search intensity. Two conflicting arguments exist regarding the role of such resources on the intensity of problemistic search. On the one hand, to engage in problemistic search, a firm must carve out resources, either by using unused
resources or by reducing the amount of resources invested in other activities. Search intensity may thus be constrained when resources are tied-up in current activities, while it may be strengthened when resources are more freely available (e.g. Greve 2003c; Pitelis, 2007).

On the other hand, Cyert and March (1963: 80) suggest that slack resources cause managers to be less responsive to failure to meet their performance aspirations, noting that “search will be much more intensive where organizational slack is small than where it is large.” Slack resources, particularly financial slack, may serve to buffer adverse contingencies (Levinthal & March, 1981; Milliken & Lant, 1991), and either inhibit the recognition of a problem, or diminish the extent to which a larger attainment discrepancy increases the intensity of search. Thus, while substantial research has emphasized the idea that slack resources may lead to more search (e.g. Bromiley, 1991; Chen 2008; Greve, 2003a; Greve, 2003b; Miller & Chen, 2007; Singh, 1986), it may also lead to a reduction in problemistic search. In a recent study, Kuusela et al. (2017) suggest that slack may rather guide search direction and suppress search among some potential solutions. Specifically, they find that the level of financial slack moderates the relationship between an attainment discrepancy and the nature and intensity of search.

2.4.4. Dynamics of search rules

Problemistic search is frequently described as a multi-period process where search and behavioral change may occur in several iterations with feedback loops, rather than as a one-shot event (Greve 2003c). During this process the rules governing search, its locus and intensity, may evolve and as a result, these rules can be understood to emerge endogenously during the problemistic search process.
A simple version of this adaptive search rule is reflected in Cyert and March’s (1963) claim that firms initially search locally yet may search more distantly if no solutions are found in the vicinity of the problem symptom or the existing activities suggested. As Augier and March (2008: 3) state, “the firm’s routines change through processes of organizational search, learning, and negotiation. As a result, the firm is seen as a system of rules [emphasis added] that change over time in response to experience, as that experience is interpreted in terms of the relation between performance and aspirations.” While our understanding of the dynamic processes of how search rules evolve during problemistic search is rather limited, and largely based on the broader search literature, prior research suggests that at least momentum, experiential learning, and attention shifts may play a role.

One of the simplest search rules that may emerge during the search process is that the path of prior search will continue during subsequent search due to momentum. When performance feedback regarding alternatives is difficult to collect or arrives only with substantial delay, an organization may simply continue its search path (Greve 2013). The argument is based on the idea that, as an organization conducts an activity, it develops cognitive frameworks that make the activity salient as a solution to a broader class of problems and organizational routines that support the activity thereby making the continuation of that activity more likely, largely independent of performance feedback (Amburgey & Miner 1992). In line with this argument, Amburgey and Miner (1992) argue and find in a study of mergers of Fortune 500 firms that, as firms engage in acquisitions as solutions to strategic problems, they develop momentum (i.e. repeat the same activity) and increasingly view acquisitions as the solution to an ever broadening
class of problems. Similarly, using U.S. air carrier industry data, Kelly and Amburgey (1991) show that the probability of changes in a certain strategy increases with the focal firm’s prior experience with such changes.

In addition to simply following the direction of past behavior, firms may adjust their search direction through experiential learning. In other words the very process of problemistic search is subject to experiential learning. Greve (2003c: 14) argues that both “search rules and the decision rules are evaluated based on their success in finding solutions and implementing them" and changed if evaluated to be unsuccessful. Thus, firms may engage in an experiential learning process during search in which the direction of search is based on which alternatives have provided positive or negative outcomes (e.g. March, 1996; Posen & Levinthal, 2012). Likewise, Greve (2003c) argues that search rules of problemistic search arise from past experience. “Experiential learning works by connecting current problems with memories of similar problems that were solved in the past. [...] problemistic search is directed by past organizational experience in finding solutions” (Greve 2003c: 88). Even when faced with different attainment discrepancies or environmental pressures, it is expected that those solutions that the firm has recently applied elsewhere will be considered before the firm searches for new solutions.

Rules governing search may also be shaped by shifts in organizational attention in a process similar to that discussed regarding the triggering of search. Shifts of attentional focus across reference points, different aspirations or even different goals may affect the direction and locus of problemistic search (Keil & Martignoni, 2017) and its intensity (e.g. Chen & Miller, 2007; Iyer & Miller, 2008; Lehman et al., 2011). However, we have little empirical evidence of
the process how such attention shifts affect the search process and therefore many open questions remain (Bromiley & Harris, 2014). As a rare exception, Lehman and Hahn (2012) offer at least indirect evidence that problemistic search may influence the transition of attention between aspiration focus and survival focus. They argue that not only the level of performance but also the trajectory of performance can affect attention focus. Specifically, they argue and find that organizations experiencing improving performance, will shift attention to attainment discrepancies whereas those experiencing declining performance will increasingly attend to the survival threat.

2.5. Behavioral Consequences of Problemistic Search

The behavioral consequences of problemistic search that restore performance have been one of the most intensely studied topics in research in the domain of the Behavioral theory of the firm. The extant literature has linked problemistic search to a broad range of different types of organizational change, for example, acquisitions and divestitures, but also risk-taking, and the rules and routines that govern search itself. We detail these issues in our discussion that follows, highlighting strategic change and risk taking as the central behavioral consequences of problemistic search.

In our review of this body of research, we highlight two salient features of the literature. First, the extant literature does not clearly distinguish change as a consequence of search, from change that is part of the process of search itself. As we noted in the prior section, research often black-boxes the process of search that leads from an attainment discrepancy to behavioral consequences. Second, while search is assumed to be inherently exploitative, some of the
behavioral consequences of problemistic search seem almost exploratory (e.g. R&D, distant tie formation, risk-taking). Research, however, has paid less attention to the circumstances under which these very different responses are invoked. Finally, research focuses on the behavioral consequences that serve to directly resolve the attainment discrepancy. It thereby ignores ancillary outcomes that may be identified during problemistic search yet adopted by the organization for other purposes than addressing the focal attainment discrepancy.

2.5.1. Strategic change

Since Manns and March (1978) presented the first empirical test of problemistic search, the extant literature includes a substantial body of research that examines strategic change that results from performance below aspirations. The basic empirical design is a regression of performance relative to an aspiration on a measures reflecting strategic change; a wide range of such change measures have been studied. The implementation of this research design is facilitated by relative ease with which objective data for performance shortfalls and a large number of externally observable actions that reflect strategic change can be collected for large samples of firms. However despite the substantial body of literature, several important gaps remain in our understanding of strategic change in response to attainment discrepancies, specifically regarding the lack of observation of search itself as distinct from the behavioral consequences of search in the form of a change, and the whether changes are indeed mostly exploitative in nature.

Prior studies have investigated several distinct groups of behavioral consequences that reflect strategic change. The breadth of dependent variables studied is quite large and diverse including Miller and Bromiley’s (1990) examination of changes in financial structure and Harris
and Bromiley’s (2007) examination of organizational misconduct that is triggered by performance below aspiration. However, most salient across the literature are changes associated with strategic orientation, market position, and R&D.

A small group of studies examines how an attainment discrepancy triggers broad change in firms’ strategic orientation (e.g. Audia et al., 2000; Greve, 2003b; Grinyer & McKiernan, 1990; Kang & Shivdasani, 1997; Lant et al., 1992; Miller & Chen, 1994). For instance, Lant et al. (1992) find that poor past performance leads to changes in domains encompassing organizational structure, control systems, power distribution, and functional backgrounds of the top management team. Likewise, using data from the U.S. airline industry, Miller and Chen (1994) show that positive past performance increases firms’ competitive inertia, which they define as rigidity in pricing, advertising, new product or service introductions, and market scope. Likewise, based on data from Japanese shipbuilding companies, Greve (2003b) finds that high performance relative to aspirations induces firms to reduce their investment in production assets, a change that he interprets to reflect search and risk-taking in manufacturing.

A broader group of studies examines more narrow action domains that reflect strategic change. One domain often examined by researchers is strategic change in market positions (e.g. Greve, 1998; Hayward & Shimizu, 2006; Palmer & Wiseman, 1999; Shimizu, 2007) and subsequent expansion modes (e.g. Baum et al., 2005; Iyer & Miller, 2008). For example, Greve (1998) shows that performance shortfalls relative to the aspirations significantly increase the probability of change in the target market position of radio stations, which operate in highly differentiated markets in terms of audience tastes. Palmer and Wiseman (1999) suggest that an
attainment discrepancy increases effort to reposition through diversification. Shimizu (2007) examines the opposite strategic direction — strategic decisions to change the market position by divesting formerly acquired business units. He finds that failure to improve performance increases the likelihood of divestitures.

Firms’ R&D activity is another area frequently studied as a behavioral consequence of performance below aspirations and problemistic search (e.g. Antonelli, 1989; Bolton, 1993; Bromiley & Washburn, 2011; Chen & Miller, 2007; Palmer & Wiseman, 1999). For instance, using data from 74 U.S. high technology firms, Bolton (1993) finds that firms experiencing substandard performance are more likely to be an early joiner of an R&D consortium, arguably out of their higher need to adopt innovative changes. Similarly, Chen and Miller (2007) report that R&D expenditures increase with the distance of firms’ performance below aspirations, unless the firms’ performance level is close to bankruptcy. However, Bromiley and Washburn (2011) find a negative relationship between attainment discrepancy and R&D spending of 1,366 firms. Specifically, they interpret this finding to suggest that firms’ need for cost reduction might dominate problem solving motivations below aspirations.

Despite the large number of studies and substantial progress, important gaps remain. Most central, following our discussion in Section 2.4.2, is that the process of search is rarely examined in studies that examine the correlation between an attainment discrepancy and observed strategic change. An implication of black-boxing the search process is that extant research tends to leave unanswered the question of why a generic performance shortfall at the organizational level (e.g. sales or ROA) leads to one specific type of change rather than another (e.g. M&A rather than
R&D investment), and issue that has been raised previously in the literature (e.g. Argote & Greve, 2007; Greve, 2008; Kuusela et al., 2017). A recent paper by Kuusela et al. (2017) suggests one way in which to make progress. They theorize and find that a performance shortfall relative to an ROA aspiration might trigger one of two different types of strategic change, an acquisition or divestiture, depending on the level of slack resources. Another approach, not yet developed in the literature on problemistic search, would be to consider the role of cognition. For instance, prior research, outside of the literature on problemistic search, suggests that cognitive biases affect the choice of alliances and acquisitions (Tyler & Steensma 1998; Duhaime & Schwenk, 1985). It seems likely that cognitive biases and differences in information processing may explain variation in the strategic changes that result as a response to performance shortfall.

A second gap relates to the oft stated assumption that problemistic search is predominantly exploitative. While most research does not explicitly examine this assumption, a closer examination of the behaviors identified in response to performance shortfalls suggest that many could be classified as, to some extent, exploratory. For instance, research and development may be geared to both exploration and exploitation. While some studies suggest that R&D in response to performance shortfalls is mostly exploitation focused (Greve, 2007), others find that firms may explore, for instance through R&D alliances, in the face of performance below aspirations (Tyler & Caner, 2016). Likewise, Baum et al. (2005) examine a sample of banking syndicates, finding that investment banks increasingly leverage non-local ties when performance is below aspirations, a type of behavior that is certainly somewhat more exploratory in nature. Moreover, to the extent that exploration is riskier than exploitation (March, 1991), work on
risk-taking in response to a performance shortfall, which we discuss next, can perhaps be seen at least as weak evidence for exploration.

Finally, research on problemistic search tends to assume that only strategic change oriented to resolving the focal problem is likely to covary with the attainment discrepancy of interest. However, we know from research on innovation (e.g. Austin, Devin, & Sullivan, 2012; Cohen & Levinthal, 1994; Miner et al., 2001) that search may generate ancillary outcomes that are not geared towards the focal task but may prove valuable in other contexts and therefore may be adopted by the organization. Thus, it seems likely that search in response to performance shortfalls may generate a number of solutions that are not being adopted for the focal attainment discrepancy, yet may be adopted to address different or later problems.

2.5.2. Risk taking

The original conceptualization of problemistic search did not explicitly theorize changes in risk taking as a behavioral consequence of an attainment discrepancy (Argote & Greve, 2007). Only much later, in work by March and Shapira did risk taking behavior come to be associated with problemistic search (March & Shapira, 1987; March & Shapira, 1992; Shapira, 1995).

A body of research has since found that a failure to meet aspirations generally induces decision makers to accept higher risks (e.g. Boyle & Shapira, 2012; Bromiley, 1991; Fiegenbaum, 1990; Fiegenbaum & Thomas, 1988; Gooding, Goel, & Wiseman, 1996; Greve, 2003a; Lant et al., 1992; Miller & Leiblein, 1996). For example, using data on nearly 500 firms, Miller and Bromiley (1990: 756) conclude that “performance reduced subsequent income stream uncertainty for high performers and increased income stream risk for low performers.” Bromiley (1991) finds
that poor performance increases risk taking measured by variance in analysts’ forecasts of the focal firm’s income. Wiseman and Bromiley (1996) compare the prediction from problemistic search theory with the theory from work on organizational decline (e.g. McKinley, 1993) that theorizes that declining firms will shun risk, opting instead for efficiency. Based on data from 344 manufacturing firms in 19 industries, measuring risk taking by variance in analyst forecasts, they find that performance shortfalls are positively associated with risk measured by income stream uncertainty. They conclude that “firms facing decline fall into a trap of taking unprofitable risks that ultimately exacerbates the decline” (p.524). Palmer and Wiseman (1999) examine two distinct metrics of risk taking, organizational risk taking as measured by variance in ROA and managerial risk taking measured by diversification. They find that both types of risk taking are correlated with an attainment discrepancy (measured as prior year ROA and ROE relative to the industry average).

While studies in the Carnegie tradition have typically hypothesized a positive relationship between an attainment discrepancy and risk taking, research drawing upon threat rigidity arguments suggest that, at least for large discrepancies, organizations should respond with reduced risk taking (Audia & Greve 2006). To reconcile these perspectives, some studies have argued that the relation between problemistic search and subsequent changes in risk-taking depends on contextual factors (e.g. Audia & Greve 2006, Greve 2011). Other studies have pointed to multiple reference points, arguing that when attainment falls far below the traditional aspiration, and nears the extinction point, the relationship changes, and further performance declines lead to a reduction in risk taking (Hu, Blettner, & Bettis, 2011). For instance, studies have found that organizations close to bankruptcy may attempt to reduce risk rather than increase
it, to reduce threats to survival (Miller & Bromiley, 1990; Miller & Chen, 2004). In addition, Audia and Greve (2006) and Greve (2011) find that while large firms do engage in risky behavior in the face of performance shortfalls, small firms respond to the attainment discrepancy with decreased risk-taking as their survival is more likely to be threatened by a large attainment discrepancy.

A challenge in interpreting evidence on the relation between an attainment discrepancy and risk taking is that observed risk in empirical studies may be the result of change in risk that is purposefully chosen in response to an attainment discrepancy, or a byproduct of strategic changes induced by problemistic search as it has often been argued that change itself is risky (e.g. Levinthal and Posen, 2007). For instance, changes induced by problemistic search might have little impact on risk if they mainly involve the imitation of well-established routines or incremental adaptations (Massini et al., 2005; Schwab, 2007), but other changes, such as acquisitions, may be risk inducing. In empirical studies, change is difficult to disentangle from risk taking. For example, increases in R&D intensity or R&D spending have been frequently used as proxies for risk taking (e.g. Barker & Mueller, 2002; Chen & Miller, 2007; Devers, McNamara, Wiseman, & Arrfelt, 2008; Hoskisson, Hitt, & Hill, 1993; Miller & Bromiley, 1990). However, such measures may be poor indicators of risk taking, rather reflecting organizational changes. In fact, Bromiley, Rau, and Zhang (2017) show that R&D spending lacks a clear connection with measures of organizational risk. Similarly, McAlister, Srinivasan, and Kim (2007) argue that R&D expenditures will create intangible assets that buffer risks in the market, reflected in the index of systematic risk in the firm’s stock, and in line with their prediction find a negative relationship between R&D intensity and risk using panel data on 644 publicly traded firms.
firms. This issue is, moreover, related to the question previously discussed, on the extent to which problemistic search is predominantly exploitative, as risk taking is more often viewed a dimension of exploration (March, 1991).

In recent work, Kacperczyk et al. (2015: 229) have argued that change and risk should be further disentangled, suggesting that the two “arise under different conditions and reflect distinct causal processes.” They posit that change is derived by problemistic search, an organization-level response in the framework of behavioral theory of the firm. Risk, in contrast, is adjusted in accordance with the principle of loss aversion as described in prospect theory (Kahneman & Tversky, 1979; Tversky & Kahneman, 1992), an individual-level determinant. Building on this recognition, Kacperczyk et al. (2015) hypothesized and found that internal social comparison across units within a firm induces individual concerns and, subsequently, affects risk, whereas a performance shortfall relative to competing firms in the external reference group is considered as a firm-level problem, and, consequently, leads to change.

2.6. Stopping Mechanisms of Problemistic Search

In considering problemistic search from a process perspective, the question of what stops problemistic search is as important as the question of what triggers it. However, while the triggering mechanisms of search have been subject to substantial scholarly work, the mechanisms that stop search have received much less theoretical and empirical attention.

Cyert and March (1963: 121) argue that “problemistic search is stimulated by a problem [and] depressed by a problem solution.” A solution, in this view, indicates a change that restores
performance above the aspiration level that initially triggered search. Thus, stopping is inherently driven by satisficing (Simon, 1956) — the first behavioral change that resolves the attainment discrepancy is sufficient to cause search to stop. Our discussion below highlights three broad mechanisms that may lead to stopping: performance improvement, aspiration degradation, and attentional shifts. For each of these stopping mechanisms, empirical evidence is limited. Indeed, it is often the case that we must draw inferences indirectly from work on the triggering of search. Yet starting and stopping of search need not be symmetric; an observation related to Greve’s (1999: 606) statement that “success breeds complacency more quickly than failure spurs action.” Additional research is needed to more fully identify the mechanisms theorized and make progress towards a more complete understanding of the process of problemistic search.

2.6.1. Performance improvement

In Cyert and March’s (1963) conceptualization, the most basic mechanism that inhibits further problemistic search is performance improvement from below to above an aspiration. As March (1994: 28) notes “failure increases search, and success decreases search. [...] search continues as long as achievement is below the target and ends when the target is exceeded.”

While the underlying logic is simple, stopping mechanisms have received only limited empirical evaluation. One notable exception is work on the individual level by Caplin, Dean, and Martin (2011). In a series of choice experiments, they show that individuals search for alternatives when performance from their prior choice is below the aspiration level, but stop searching if they achieve performance above the aspiration.
In an organizational context, however, evidence is at best circumstantial. Some insight into the implications of performance improvement for the stopping of problemistic search may nonetheless be derived indirectly by combining the direct evidence on two related ideas: (1) problemistic search leads to performance improvement, and (2) higher performing organizations engage in less (or no) problemistic search.

In support of the first argument, studies have investigated the performance consequences of problemistic search (e.g. Audia et al., 2000; Bromiley, 1991; Greve, 2003a, 2008; Posen & Chen, 2013; Wiseman & Bromiley, 1996) and generally find support for the idea that problemistic search improve subsequent performance. For instance, Wiseman and Bromiley (1996) find evidence that supports the claim that attainment discrepancy and subsequent search have a positive influence on future performance. Based on data from 344 companies in 19 industries, they report a positive impact of attainment discrepancy on firms’ subsequent return on sales. A small set of studies is more skeptical about the performance consequences of problemistic search, finding, for instance, reversion to the mean (Greve 1999, 2003c) or even performance decline in some instances (Olivia & Sterman, 2001).

In support of the second argument, empirical studies generally support that claim that higher performing firms engage in less problemistic search (e.g. Fiegenbaum, 1990; Gaba & Bhattacharya, 2012; Greve 1998, 2007; Park, 2007). For example, using U.S. radio market data, Greve (1998) shows that recent performance improvement leads to a lower probability of subsequent strategic change. Similarly, Fiegenbaum (1990) finds that managers become more reluctant to take risk and make changes when firm performance is perceived to be above the
predetermined target. However, Audia and Greve (2006) report a finding that could be interpreted as contradictory: when performance of a sample of 11 Japanese shipbuilding companies was below the aspiration level, a further performance decrease led to less risk-taking measured by rates of manufacturing facility expansion.

This circumstantial evidence in favor of stopping of search when performance exceeds the aspiration stands in contrast with the predictions of other theories. For instance, momentum theory would suggest that search or organizational change continues, once initiated, even if the attainment discrepancy is resolved. Momentum theory has received empirical support in the domains of organizational acquisitions (e.g. Amburgey & Miner 1992; Baum, Li, & Usher 2000), alliances (Park, Martin, Lee, & Mezias, 2017), and more broadly organizational change (See e.g. Beck, Brüderl, & Woywode, 2008 for a review), though more recently the empirical evidence used to support momentum theory has been criticized on methodological grounds (Beck et al., 2008).

2.6.2. Aspiration degradation

While our discussion of performance improvement assumes that the organization uses the same aspiration for starting and stopping, in some situations, an organization may exert substantial effort in problemistic search without identifying a solution that can restore performance to an acceptable level (Simon, 1962). In such a situation, a firm may adjust the aspiration downward, instead of continuing search for a solution that meets the initial aspiration level (Cyert & March, 1963). March (1994: 31) notes that “aspirations change over time, and they change endogenously,” and “when performance is below the target, ... the target is lowered.”
From this perspective, it is possible that problemistic search is stopped without any performance increase if sufficient aspiration degradation takes place.

Little empirical evidence exists to examine whether repeated inability of search to identify a satisfactory solution indeed inhibits search via aspiration degradation. A substantial body of research empirically examines aspiration adaptation (e.g. Greve, 2002; Lant, 1992; Mezias et al., 2002) relative to past experience, with decreasing historical performance leading to decreasing aspirations. However, the aspiration degradation claim is somewhat different. It takes a process perspective: a cycle of sequential search and change activities before the search cycle eventually terminates (March 1994). Aspiration degradation occurs because search is ineffective rather than because of declining historical performance.

2.6.3. Attentional shifts

The behavioral theory of the firm points to yet another mechanism through which search may be stopped — the transition of managerial attention. As we discussed before, managers’ attention may shift between different reference points (e.g. Audia & Greve, 2006; Blettner et al., 2015; Chen & Miller, 2007; Desai, 2008; Greve, 2010; Iyer & Miller, 2008; Joseph & Gaba, 2015; Lehman & Hahn, 2012; Lehman et al., 2011; Miller & Chen, 2004; Ref & Shapira, 2016), different aspirations (e.g. Bromiley, 1991; Deephouse & Wiseman, 2000; Blettner et al., 2015), and different goals (e.g. Gaba & Joseph, 2013; Greve, 2008; Vissa et al., 2010). Such an attentional shift to a different objective may cause a firm to stop searching for a solution to solve the previously attended problem. In other words, if decision makers’ attention is relocated to a
different goal, the performance shortfall that triggered search in the past might cease to operate as a driver of problemistic search.

At this point no studies exist that have tested the direct effect of attention shifts on the stopping of search. Indirect support for this idea, however can be derived from the effects of shifts in attention on the triggering of search and the intensity of search, which we discussed in the respective sections. However, additional research would be needed to test if the arguments regarding attention extend as well to the stopping of search.

Taken together, a major gap in the literature exists on the circumstances and mechanisms that lead to the stopping of problemistic search. For a full understanding of the process of problemistic search, substantial research effort is needed to directly examine the search process, rather than the behavioral consequences (e.g. alliances), and test the predictions that derive from the conceptualization of problemistic search and further develop and refine its theoretical apparatus.

3. TOWARD A RESEARCH AGENDA - RENEWING PROBLEMISTIC SEARCH THEORY

Our review of the extant literature examined problemistic search from a process perspective. In this section, our objective is two-fold. We begin by recognizing several key issues with work on problemistic search. The issues we highlight are, in particular, related to the current theoretical conceptualization. We then proceed to suggest a research agenda that addresses these
issues in a manner that, we hope, will revitalize research, and enable further progress in our understanding of how firms respond to performance feedback.

3.1. Issues in the Extant Literature

In our review of the literature, we made salient several issues related to the conceptualization of problemistic search that, we believe, have held back theoretical and empirical progress. We highlight these issues across five somewhat discrete categories, although many of these issues are integrally related.

First, and perhaps most important, the traditional conceptualization of problemistic search assumes a high degree of automaticity and overly routinized processes of search. Problemistic search has been viewed as a standard, frequently employed, and somewhat mechanistic facet of organizational behavior (Cyert & March, 1963). This is not surprising, given its roots in the behavioral theory of the firm — the automaticity in the theory reflects a purposeful, parsimonious, polar opposite rebuttal to the overly rationalistic micro-economic conceptualization of organizations in the early 1960s. Yet it may be equally unrealistic as an assumption for organizational behavior. Gavetti, Greve, Levinthal, & Ocasio, (2012: 9), in their review of work on behavioral theory, recognize that important “decisions often result from deliberate attempts to anticipate future environments.”³ Feldman and Pentland (2003), for example, argue convincingly that the routinized view of organizational behavior emerging from the Carnegie School over-emphasizes the structural aspects of behavior. Indeed, even routinized behaviors may

³ Emphasis added.
emerge from agentic, cognitively rich, learning behavior that is adaptive in response to the environment (Aggarwal, Posen, & Workiewicz, 2017).

Second, the traditional conceptualization of problemistic search tends to focus primarily on solution search (Cyert & March, 1963). Indeed, as our review highlights, scholars have extensively studied the characteristics of solution search. Implicit in a narrow focus on solution search is at least one of two assumptions: First, a performance shortfall relative to aspiration has a clear mapping to a particular latent problem, or the problem is sufficient well-structured that search is likely to be effective even without further consideration of the problem (Von Hippel & Tyre, 1995). Second, cognition is so limited that a firm must blindly look for solutions without any meaningful consideration of the underlying problem. While one or both assumptions may sometimes be valid, a large body of research on managerial problem solving provides substantial evidence that firms do indeed engage in a cognitively intensive process of problem definition (Lyles, 1981; Mintzberg, Raisinghani, & Théorêt, 1976; Nutt, 1993), and makes compelling claims about the centrality of problem definition in the context of strategy making (Nickerson & Zenger, 2004; Baer, Dirks, & Nickerson, 2013; Hsieh, Nickerson, & Zenger, 2007; Leiblein & Macher, 2009; Macher & Boerner, 2012; Nickerson, Yen, & Mahoney, 2012; Felin & Zenger, 2016). Yet to date, the process and challenges associated with defining the problem have been broadly overlooked in the literature on problemistic search.

Third, the extant problemistic search literature tends to conjoin distinct elements of the problemistic search process: search, its behavioral consequences, and the stopping of search. While the original conceptualization of problemistic search defines these as distinct elements of
the process (the organization searches for solutions, adopts a solution which it hopes will mend the performance shortfall, and stops search when performance is restored), the literature has been empirically constrained in a manner that makes distinguishing these elements challenging. For instance, when we study strategic reorientation (Lant et al., 1992), divestiture (Shimizu, 2007), or market repositioning (Greve, 1998) after an attainment discrepancy, are we observing the search process itself or are we observing the behavioral consequences of search? When we observe that investment in R&D increases as a function of an attainment discrepancy, are we observing the input of R&D dollars to the search process or is this investment in R&D the consequence of a search process which might have considered as alternative courses of action, investment in marketing or production efficiency? When we observe changes in market position following an attainment discrepancy, can we assume that these restore performance and search stops? To date, while we have substantial empirical evidence regarding the behavioral consequences of problemistic search, we have much less empirical evidence to support the theoretical claims about the process of search itself and one may argue that we have only the very beginning of a process theory of problemistic search.

Fourth, the conceptualization of problemistic search focuses on its myopic nature, and as a consequence, the literature tends to consider it primarily as a driver of exploitation (Levinthal & March, 1993). Problemistic search is typically viewed as exploitative, occurring in the vicinity of current knowledge, practices, and expertise (Levinthal, 1997; March & Simon, 1958). Levinthal and March (1981: 309) summarize this conception of problemistic search, noting that it “emphasizes relatively immediate refinements in the existing technology, greater efficiency, and discoveries in the near neighborhood of the present activities.” This assumption of highly myopic
behavior is, from a historical perspective, predicated on the classic behavioral theory assumption of limited cognitive and information processing capacity. Not only is this assumption somewhat at odds with recent scholarship (per our earlier discussion), it is also at odds with the broad variety of behaviors predicted in the extant literature, including R&D or risk taking, that may be much more exploratory, and more generally, the broader literature on search that has recently emphasized a variety of mechanisms to extend search beyond the vicinity of existing knowledge, routines, and activities (Laursen, 2012).

Fifth, the conceptualization of problemistic search that assumes an almost mechanistic link between performance shortfalls and search, *conflicts with predictions made by other theories* that also have received substantial empirical support. With respect to triggering (starting) problemistic search, consider escalation of commitment (e.g. Sleesman, Conlon, McNamara, & Miles, 2012; Staw, 1976) and threat rigidity (Chen & Miller, 2007; D'Aunno & Sutton, 1992; Shimizu, 2007; Staw et al., 1981) theory. They make predictions that oppose those of problemistic search, with performance shortfalls reinforcing current behavior. For example, using data from the shipping industry, Greve (2010) finds that small and large firms show distinct responses to performance shortfalls; only the largest firms showed problemistic search in the face of performance decline while most firms became more rigid when threatened by performance shortfalls. Since these theories come out of work on individual and organizational psychology, they do so by taking a more cognitive approach to responses to performance feedback. With respect to stopping of problemistic search, consider momentum theory (Miller & Friesen, 1980; Amburgey & Miner, 1992; Kelly & Amburgey, 1991) that argues that firms tend to repeat the same activity largely independent of performance feedback or even despite negative performance
feedback. Thus, once triggered, search may not cease even though the triggering performance shortfall is resolved.

Finally, problemistic search is typically conceptualized as having a single, narrowly delineated outcome — to identify organizational changes that restore performance above aspirations (Greve, 2003c). Yet a diverse array of research related to the domain of problemistic search recognizes that search processes engender also unintended outputs that organizations may capitalize upon outside of the focal problemistic search process. A prominent example is in the domain of studies on innovation (e.g. Cohen & Levinthal, 1994; Miner et al., 2001; Mintzberg & McHugh, 1985). The classic example is 3M’s PostIt sticky notes (Mokyr, 1990), where the firm reused a failed adhesive solution in a novel application. The extant theory on problemistic search does not deny the existence of these unintended outcomes, but neither can it systematically account for them. In part, the challenge is that leveraging these unintended outcomes requires richer cognitive assumptions that facilitate storage, retrieval, and application of these unintended outcomes. As a result, we have a limited understanding of the factors that allow an organization to leverage unintended byproducts from problemistic search while still solving the triggering problem.

In sum, the issues we raise are predicated on two overarching critiques: First, the extant literature on problemistic search relies on an overly automatic view of organizational action that is somewhat at odds with recent effort throughout the literatures building on the behavioral theory of the firm that has sought to add back in a modicum of cognition. Second, the research on problemistic search has focused on variance theorizing (Mohr, 1982) often blackboxing the
detailed process of problemistic search. As we consider a theoretical role for more agentic cognitive actors and move towards a more detailed process view of problemistic search, we see issues, but more importantly, opportunities to advance our understanding of problemistic search. These opportunities are reflected at multiple points in the process model, ranging from the identification of a problem, to triggering search, behavioral consequences, and stopping search.

3.2. Cognition and Process in Problemistic Search

To support the advancement of research on problemistic search, we use our comprehensive review of prior studies to recognize the need for process theorizing and for a more central role for cognition than is suggested by the traditional conceptualization. The extant literature on problemistic search has been strongly premised on a routine-based mechanism that suggests substantial automaticity. While this provides a very parsimonious theoretical foundation for the key features of problemistic search, it comes at the expense of obscuring important elements of the process of problemistic search and limits insight that the theory can provide into managerial and organizational action.

We believe that progress in the literature will be facilitated by relaxing some of the simplified organizational apparatus and the constraints imposed by its initial conceptualization in Cyert and March (1963), and exploring in more detail the process of problemistic search. Recent research in the Carnegie tradition has made important strides by adding back a modicum of managerial cognition to behavioral theory. For instance, research on aspirations has begun to examine the role of shifts in managerial attention between reference points, aspirations and goals in explaining when organizations respond to attainment discrepancies and when not (e.g. Blettner
et al., 2015). Porac and Tschang (2013) go further in arguing that the time has come to do away with the small brains image of managers. Relaxing this assumption allows us to recognize that managers may have substantial latitude in their actions even in routinized settings (Feldman & Pentland, 2003), and that these actions are underpinned by cognitive processes, both at the managerial and organizational level (e.g. Walsh, 1995). Indeed, while extant research has not greatly expanded upon it, in outlining the theoretical foundations of problemistic search, Cyert and March (1963: 121) clearly recognize information-processing underpinnings in arguing that the “way in which the environment is viewed and the communications about the environment that are processed through the organization reflect variations in training, experience, and goals of the participants in the organization.”

Yet, by attending to cognition, we do not imply the need for, or development of, an individual level, psychological theory of problemistic search. We propose an eclectic approach that allows organizational information processing to draw upon managerial cognition, just as Feldman and Pentland (2003) propose that individual agency plays an important role in organizational routines. In this sense, cognition, though an inherently individual construct, shapes collective/organizational information processing. This notion is not new in organization theory. Weick and Roberts (1993, p. 358) recognized the literature’s “preoccupation with individual cognition has left organizational theorists ill-equipped to do much more with the so-called cognitive revolution than apply it to organizational concerns, one brain at a time.” Weick’s (1969) notion of sensemaking, in which organizations try to make sense of their environment, is perhaps the most salient response to this challenge. In doing so, Weick builds on Simon’s (1978a) view that the organization is an information processing system. While Weick’s view highlights
interpretation rather than computation, individual cognition is central — the “decisions that an individual makes as a member of an organization are quite distinct from his personal decisions” (Barnard, 1938: 77).

This notion of cognition at the macro level is now widespread in work in the Carnegie tradition. For instance, the merit of recent work on microfoundations (Barney & Felin, 2013; Felin, Foss, & Ployhart, 2015; Foss & Pedersen, 2014; Winter, 2013) “resides not in studying individuals’ behaviors per se, but rather from identifying how individual behaviors interact and aggregate to generate macro-level phenomena” (Aggarwal, Posen, & Workiewicz, 2017). Gavetti and Warglien (2015), for example, discuss “collective interpretation” as the collective cognitive act of giving meaning. A broad variety of work highlights organizations’ mental representations of their environment (e.g. Csaszar & Levinthal, 2015; Martignoni, Menon, & Siggelkow, 2016). These representations are knowledge structures that both reflect the current outcome of ongoing information processing and interpretive efforts, and facilitate subsequent information processing, interpretation, and decision making. Research on organizational adaptation suggests that cognitive representations play an important role in guiding search (Eggers & Kaplan, 2009; Gavetti & Levinthal, 2000) and the evaluation of alternatives (Knudsen & Levinthal, 2007; Rerup, 2006).

To consider the research directions that result from reconceptualizing the theory of problemistic search to take the process of problemistic search more seriously and to include more room for cognition and information processing, we proceed in five steps. We begin by examining the possibility that the current model of problemistic search, which focuses on solution search, under-accounts for the search for problem definitions. As we argue, this definition search may
itself involve a greater cognitive component than does solution search, and that the outcome of problem definition search itself serves as a cognitive representation of the solution space. Next, we discuss how a more cognitive perspective may enable research to disentangle the remaining stages of problemistic search thereby leading to a more complete understanding of the process of problemistic search. We then discuss how a more complete process model and the addition of cognition may inform research regarding the locus of problemistic search. This is followed by a discussion of how cognition may enable problemistic search to incorporate explanations for alternative behaviors, triggering and stopping of search, not predicted by the overly routinized model. We conclude by examining how a more cognitive approach to problemistic search facilitates endogenizing the creation and utilization of ancillary outputs from search.

3.3. Extending the Process Model of Problemistic Search

As a first step to take the process of problemistic search serious and add back a modicum of cognition, we propose an extension of the problemistic search process that focuses on defining the problem. The process model of problemistic search, that has remained largely unchanged since the foundational work in Cyert and March (1963), focuses on the search for solutions assuming that the organization knows the underlying problem based upon the performance shortfall. A potentially important component of the process of problemistic search, not addressed by the current conceptualization, is that a firm is not presented with a problem. Rather, it is presented with a symptom of a latent problem, performance below aspiration. Thus, problem definition is the process of causal diagnosis of the attainment discrepancy. The distinction between symptom and problem is best explained with the help of an example: consider a patient
suffering from chest pain. The patient visits a doctor. The doctor’s first step, prior to identifying a treatment (solution), is to diagnose the underlying condition — that is, define the problem. For instance, a patient’s chest pain (symptom) may be caused by one of three underlying problems: heart attack, indigestion, or muscle strain. The treatment alternatives (solutions) for each of these latent conditions are fundamentally different, and the set treatment alternatives that may address one condition may worsen another. While search for a solution can, in some instances, commence without rich consideration of the problem, it is clear that this is likely to be the exception rather than the rule. Organizations can and do engage in mindful, cognitively intensive, efforts to define the problem.

We are not the first to point to the important role of problem definition. Einstein famously argued that, in the context of a scientific problem, “the formulation of a problem is often more essential than its solution” (Einstein & Infeld, 1938: 92). Problem definition activities are not absent in management theory. Most notable is the recent body of research in strategy that argues for the centrality of managerial action oriented towards the identification of high value problems (Baer et al., 2013; Hsieh et al., 2007; Leiblein & Macher, 2009; Macher & Boerner, 2012; Nickerson et al., 2012; Nickerson & Zenger, 2004; Felin & Zenger, 2016). Like problemistic search itself, this work is built on a theoretical foundation of bounded rationality. An older body of research, focusing on decision-making by top executives, reflects a similar argument about the importance of problem-solving in organizations (Kilmann & Mitroff, 1979; Lyles, 1981; Mintzberg et al., 1976; Nutt, 1993). Mintzberg et al. (1976: 274), for example, argue that problem definition, which they refer to as “problem diagnosis,” “is probably the single most important routine, since it determines in large part, however implicitly, the subsequent course of action.”
This work takes a normative stance on problem solving, arguing for problem definition as a distinct stage in the problem solving process (e.g. Mitroff & Featheringham, 1976; Ramaprasad & Mitroff, 1984; Simon, 1978; Smith 1988; Smith, 1989). Even Cyert and March (1963: 121), highlight a very simple model of problem definition that recognizes the distinction between symptoms and problems when they note that a firm may “search in the neighborhood of the problem symptom” — although their brief discussion has largely been overlooked in the extant literature which has focused on solution search. An important direction of research on problemistic search may therefore be to integrate existing insights on problem definition into the conceptualization of and research on problemistic search.

A practical approach to take problem definition seriously in future research, one that is consistent with the logic of the behavioral theory of the firm, may be to reconceptualize problemistic search as consisting of two distinct search stages. An attainment discrepancy acts as a symptom that triggers problem definition search and the conclusion of this first stage, the start of second stage, solution search, commences, with solution search terminating when the attainment discrepancy is resolved. For Cyert and March, the search in the neighborhood of the symptom is quite routinized, although it seems reasonable that if we are willing to consider a modicum of cognition in solution search (e.g. Gavetti and Levinthal, 2000) then we should also be willing to do the same with problem definition. In conceptualizing the problem definition process as one of search, one can take seriously both the bounded nature of human cognition in the process of problem definition search and also the implications for the problem definition as a cognitive representation employed in solution search.
To the extent that we conceive of problem definition activities as a process of search governed, in the usual Carnegie school manner, by bounded rationality and satisficing, then research is needed to understand the nature of aspirations and stopping rules in problem definition search, and how they adapt with experience. A simple approach would be to think about online evaluation (Gavetti & Levinthal, 2000) where each problem definition is directly tested by engaging in solution search. This would be consistent with Cyert and March’s (1963: 122) example: “if the problem is the failure to attain the sales goal, the search begins in the sales department and with the sales program. Failing there, it might reasonably proceed to the problem of price and product quality and then to production costs.” That is, each potential problem definition is tested directly through the commencement of solution search, and only when solution search fails to find a satisfactory solution does the firm return to problem definition search, cycling through the two search processes until the attainment discrepancy is resolved.

An extension of this logic would point to the need for more cognitively intensive offline evaluation. Following the general search logic articulated by Gavetti and Levinthal (2000: 115), a firm may evaluate alternative problem definitions using, for example, their “simplified cognitive representation” in the form of their “understanding of the world and the probable consequences of engaging in the proposed behavior.” Related research on problem definition suggests that the aspiration associated with satisficing in problem definition search may be the comprehensiveness of the problem definition search process itself, where “comprehensiveness is defined as the extent to which alternative, relevant problem formulations are identified with respect to an initial symptom or web of symptoms” (Baer et al., 2013: 199). Thus, the problem definition aspiration may be associated with the number of potential problem definitions evaluated offline, before the
one considered best is put into action with the start of solution search. When comprehensiveness is low, then problem definition search would be very limited and problem definition and solution search would be tightly integrated. As the comprehensiveness increases, however, problem definition search becomes a more distinct stage. How exactly cognitive limitations and bias on the one hand and environmental factors such as complexity, novelty, turbulence or causal ambiguity of the problem may affect problem definition search would seem important subjects for future research.

3.4. Disentangling the Stages of Problemistic Search

For a deeper understanding of the process of problemistic search, research would benefit from disentangling the distinct elements of problemistic search that prior research has identified yet often empirically confounded, in particular: solution search, its behavioral consequences, and stopping of search. Disentangling these stages of the problemistic search process is related to assumptions about cognition in the problemistic search process and the nature of evaluation of alternative solutions. Our literature review highlighted two polar cases, online evaluation of alternatives during search and offline evaluation of alternatives (Gavetti & Levinthal, 2000). The distinction between offline and online search and evaluation lead to different interpretations of empirical results. Take for instance the example of divestitures (Shimizu, 2007). A divestiture may be the behavioral consequence of an offline search process in which the organization considered a variety of alternative courses of actions and finally chose a divestiture as the (only) course of action that has the potential to restore performance. In this case, one would expect search to stop after the divestiture. The divestiture may also be viewed as online search with
uncertain outcomes and the organization may engage in several other actions to mend the performance shortfall or at least if the divestiture does not mend the performance shortfall engage in other behaviors (e.g. alliances, restructurings, acquisitions) to mend the performance shortfall. In this interpretation, divestitures may not necessarily be associated with the stopping of search. It seems likely, of course, that organizations use a mix of offline and online evaluation in practice, and thus, what we observe in empirical studies is at best ambiguous. Careful research would be needed that is designed to distinguish between these processes and provide more in depth insight into the decision making during problemistic search.

Our argument for disentangling the stages of search also points to the need to empirically distinguish problemistic search from other search processes. Specifically, the conceptualization of problemistic search is built on the idea that search ceases once the performance has been restored. In contrast, slack search or institutionalized search, two alternative search processes that have been theorized within the behavioral theory of the firm (Chen & Miller, 2007; Cyert & March 1963; Greve 2003c), start or continue when performance is above aspiration. With performance below aspirations, current research is often unable to distinguish if the organization is engaging problemistic search or institutionalized search. With performance above aspirations the situation is even more dire as the evidence frequently makes it impossible to distinguish if problemistic search continues, institutional search takes place, or the organization has started slack search. Disentangling these different search processes is important since theory predicts different search behavior across these processes. For instance, whereas problemistic search is expected to occur mostly locally and focused upon a single organizational problem, institutionalized search may tackle multiple problems and slack search may not only cover multiple problems but also may
occur generally more distantly from existing activities. Thus, research on when organizations stop search and when not would seem to have the potential to help us to better distinguish problemistic search from other search processes (e.g. institutionalized search) that may occur simultaneously and may compete for attention and resources of decision makers.

Disentangling the stages of problemistic search points to several additional research opportunities. First, the importance of offline search implied in our argument, suggests the need for in-depth research on how decision-makers in organizations search for alternative solutions. How are alternatives generated? How are they being evaluated? A second opportunity for research lies in the directionality of strategic change in response to performance below aspiration. Current theorizing on organizational search in response to performance below aspiration often assumes little directionality other than that search occurs in the vicinity of existing activities. While some research has pointed to contingencies that may shape the directionality of search (Kuusela et al., 2017), our understanding of the factors that may shape search direction is in its infancy. Assuming at least some degree of offline search would suggest that attentional structures and cognitive biases may influence the directionality of search and the alternatives chosen from search.

3.5. Locus of Problemistic Search

The conceptualization of problemistic search as myopic and largely exploitative (e.g. Levinthal and March, 1981) is somewhat at odds with the view of problemistic search as a "master switch’ that controls a range of organizational responses to problems” (Greve, 2003c: 76). While the former does not necessarily negate the latter, reconciling these two views is a
potentially lucrative research direction. While extant research recognizes that problemistic search can in fact give rise to exploration (see Laursen, 2012 for a recent discussion), it does so mostly through conceptualizing a mechanism that dates to Cyert and March (1963), who suggest that search starts locally, and extends in breadth only if local alternatives are unable to resolve the attainment discrepancy. This view, however, is predicated on the assumption of limited cognitive and information processing capacity and does not take into consideration distinct problem definition search as a potentially distinct stage of problemistic search. Relaxing these assumptions therefore may open up alternative avenues by which to understand the locus of search.

Problemistic search may be more exploratory in the space of potential solutions, if the organization has a mental representation of the environment that facilitates more distant research (see for example, Gavetti & Levinthal, 2000). A critical question is then the source of these representations. While mental representations may be exogenous to the current problemistic search event, for example, from prior experience with related performance deficits or analogy (Gavetti, Levinthal, & Rivkin, 2005), a potentially promising line of research would involve focusing on how a problem definition, which results from first-stage problem-definition search, functions as a mental representation of the space over which solution search occurs.

Understood as a causal diagnosis of the attainment discrepancy, the problem definition identifies the elements of the attainment discrepancy that should be included, what are the relationships among these elements, and how these selections may impact solution search (Smith, 1989). In this view, a problem definition has many of the features of a mental representation (e.g. Barr et al., 1992; Gavetti & Levinthal, 2000; Kiesler & Sproull, 1982) that enables predictions
about reality (Holland, Holyoak, Nisbett, & Thagard, 1986) and may guide solution search. Problem definitions may take several forms. For instance, they may take the form of a lower dimensional map of the space of possible solutions, thereby guiding the organization to start search in more attractive regions of the solution space (Gavetti & Levinthal, 2000). They may also take the form of a representation of the problem structure thereby identifying directions for local search that have higher potential (Keil & Martignoni, 2017), bounding the range of solutions considered during solution search by ruling out solutions inconsistent with the problem definition. Indeed, Csaszar and Levinthals’s (2015) recent two-stage model of search can be interpreted in a manner consistent with this logic.

This conceptualization of the role of the problem definition implies solution search behavior that may be potentially quite different from the local search generally associated with problemistic search in the behavioral theory of the firm. For instance, a problem definition that rules out the space of alternative solutions focal to currently employed activities will engender broader exploration, and even exploration that precedes exploitation. Distant solution search may precede local search when problem definition search identifies a relatively narrowly defined location in the solution search space — distant from the current position (existing routines and solutions) of the firm. Under what conditions are organizations able to develop problem definitions that enable organizations to directly move to exploration and under what circumstance local search dominates as the traditional conceptualization suggests remains an important subject for future research.
The distinction between problem definition search and solution search also opens up novel research opportunities regarding the dimensionality of distance in problemistic search. Cyert and March (1963) defined localness based upon the distance of solution search from the problem symptom and from prior solutions. While the subsequent literature is not always fully explicit, it seems to us that it has typically thought about exploration on the basis of the distance from current solutions (Katila & Ahuja 2002; Benner & Tushman 2002; Rosenkopf & Nerkar, 2001). In his seminal study on exploration and exploitation, March (1991: 71) defines exploitation to include “things captured by terms such as refinement, choice, production, efficiency, selection, implementation, execution,” and exploration to include things such as “search, variation, risk taking, experimentation, play, flexibility, discovery, innovation.” We tend to think of these “things” in terms of solution search, because the solutions are a much more tangible realization of the somewhat more intangible and often latent problem they solve.

Taking the problem and problem definition search as the starting point, we may define exploration based upon the novelty of the problem being defined and its distance from prior problem definitions. This idea is in line with arguments in work that takes the “problem” as the critical unit (Baer et al., 2013; Hsieh et al., 2007; Leiblein & Macher, 2009; Macher & Boerner, 2012; Nickerson et al., 2012; Nickerson & Zenger, 2004; Felin & Zenger, 2015). We interpret this literature as suggesting that a central dimension of novelty in organizations reflects the novelty of the problem being solved. An organization that allocates attention and effort to solving local problems generates less novelty on the problem-dimension than an organization that seeks to solve distant problems.
Distinguishing between problem distance and solution distance may allow us to gain novel insight into how organizations manage the balance between exploration and exploitation and achieve ambidexterity in the context of problemistic search (Tushman & O’Reilly, 1996; Raisch, Birkinshaw, Probst, & Tushman, 2009; Lavie et al., 2010). Research on organizational ambidexterity often suggests the need for a separation of activities geared towards exploitation from those geared towards exploration: temporally (Boumgarden, Nickerson, & Zenger, 2012; Brown & Eisenhardt, 1997), structurally (He & Wong, 2004; Tushman & O'Reilly, 1996), or functionally (Lavie & Rosenkopf, 2006; Lavie et al., 2010).

Separating exploration and exploitation in problemistic search based on problem novelty and solution novelty may thus allow for novel forms of ambidexterity. Solutions may be familiar or novel, and problems might be too. Thus, problemistic search may reflect exploitation on both dimensions (pure exploitative search), or exploration on both dimensions (pure explorative search). Solutions may be familiar or novel, and problems might be too. Thus, problemistic search may reflect exploitation on both dimensions (pure exploitative search), or exploration on both dimensions (pure explorative search). In contrast, we might observe mixed forms of ambidexterity that balance between exploration and exploitation across the problem-solution pair that constitutes ambidexterity. We might also observe exploration on the basis of the problem, but exploitation on the basis of the solution, or vice versa. This form of within-domain ambidexterity may have distinct advantages because combining existing solution knowledge with novel problems or vice versa may pose lower cognitive demands upon the organization than exploring on both dimensions and yet may have the potential to solve more challenging problems or create more novelty than exploiting on both dimensions. At the same time, this form of ambidexterity
may pose unique challenges and tensions, for instance, when the organization tries explore very
different solutions with an existing problem definition since recurring organizational problems
may over time be mirrored in organizational structures (Conway, 1968; Henderson & Clark,
1990; Baldwin & Clark, 2000) and such structures may be incompatible with very novel
solutions.

Taken together, adding problem definition and problem novelty to derive new
conceptualizations of ambidexterity may provide additional insight into how organizations
manage the tradeoff between exploration and exploitation during search. However, substantial
additional research is needed to increase our understanding in if and how organizations balance
exploration and exploitation across problem definition and solution search.

3.6. Integrating alternative behaviors to problemistic search

An interesting question, historically outside the domain of research on problemistic
search, is: when do organizations respond to a performance shortfall with other behaviors than
searching for solutions? Problemistic search theory suggests a rather mechanistic link between a
performance shortfall and subsequent search. However, other theories make quite different
predictions, both in terms of the starting of search after the recognition of a performance shortfall,
and the stopping of search when a solution is found. Research that addresses these discrepancies
may add substantially to our understanding of organizational responses to performance feedback.

Extant theory makes predictions that oppose those associated with the triggering of
problemistic search. Escalation of commitment theory (e.g. Staw, 1976; Sleesman, Conlon,
McNamara, & Miles, 2012) suggests that organizations may escalate their commitment to the
current course of action when performance below aspiration leads to perceived identity threats (Brockner, Houser, Birnbaum, Lloyd, Deitcher, Nathanson, & Rubin, 1986), threats to the perception of self-efficacy (Zhang & Baumeister, 2006), or the need to self-justify behavior (Staw, 1976). Threat rigidity (Chen & Miller, 2007; D'Aunno & Sutton, 1992; Shimizu, 2007; Staw et al., 1981) theory suggests that in the face of threats organizations may restrict information processing, centralize, reduce costs and constrict decision making (Staw et al., 1981; D’Aunno & Sutton, 1992) resulting in continued and reinforced past behavior, instead of reacting to threats by search, risk taking and organizational change as problemistic search theory would predict.

Whereas threat rigidity and escalation of commitment theories have a fundamentally psychological underpinning, problemistic search emphasizes a somewhat mechanistic effort to reduce an attainment discrepancy. One approach to extending research is to seek to understand the conditions under which the mechanistic problemistic search theory versus the psychological threat-rigidity or escalation dominates. Such work may follow a well worn path by proposing contingencies, in the spirit of prior work that has looked at distance from bankruptcy, organizational power concentration, top management diversity, firm size, age, and experience (Chattopadhyay, Glick, & Huber, 2001; Ferrier, Fhionnlaoich, Smith, & Grimm, 2002; March & Shapira, 1992; Sitkin & Pablo, 1992; Mone, McKinley, & Barker, 1998; Audia & Greve, 2006; Desai, 2008).

A second approach to extending research, potentially more promising, may be to integrate the psychological mechanisms underlying threat rigidity and escalation of commitment arguments into the conceptualization of problemistic search. The factors that underlie escalation shape the
cognition of decision makers and the organizational information processing underlying problemistic search. The limited efforts in that direction that currently exist (e.g. Audia & Brion, 2007; Jordan & Audia, 2012), clearly suggest that psychological factors such as self-enhancement (Jordan & Audia, 2012) may shape decision making related to problemistic search and thereby create boundary conditions for the occurrence of problemistic search. Understanding and integrating these alternative responses and the theoretical mechanisms that drive them further highlights the importance of characterizing the attentional and cognitive processes that regulate the processing of performance feedback relative to aspiration (e.g. Blettner et al., 2015; Chen & Miller, 2007; Jordan & Audia, 2012; March & Shapira, 1992). Moreover, recognition of the role of cognition in problemistic search may form a basis for deeper connections between the competing theories of responses to performance shortfalls. For instance, problem definition search as a cognitively intensive process may provide substantial latitude for managerial agency, and leaves ample room to integrate the largely psychological (and therefore cognitive) mechanisms that underlie threat rigidity theory and escalation of commitment.

There exists a similar need to integrate theory that makes alternative behavioral predictions regarding the stopping of search when an attainment discrepancy is resolved. As we argued in our review, the prediction of behavioral theory that search ceases once a solution has been identified that mends the performance shortfall, not only remains largely untested but alternative predictions have been developed and tested in momentum theory (e.g. Miller & Friesen, 1980; Amburgey & Miner, 1992; Kelly & Amburgey, 1991). The contrasting predictions of problemistic search literature and momentum theory suggest that contingencies may exist that regulate when performance feedback is taken into consideration for stopping problemistic search.
Recent work by Greve (2013), for example, suggests that the organization’s ability to process performance feedback may play an important role. However, empirical research testing this argument and identifying contingencies that may shape the stopping behavior has been largely absent and would strike us as an important area for future research.

3.7. Ancillary Outputs of Problemistic Search

Somewhat unexplored in the extant literature on problemistic search are the mechanisms underlying the broad diversity of outcome that result from the process. The literature tends to focus on a single, narrowly delineated outcome — often organizational changes that restore performance above aspirations (Greve, 2003c). Yet search oriented toward one objective leads to collateral knowledge that may serve some very different objective (e.g. Andriani, Ali & Mastrogiorgio, 2017; Cohen & Levinthal, 1994; Miner et al., 2001; Mintzberg & McHugh, 1985). These ancillary outputs do not solve the triggering problem, nevertheless, they may be a significant source of potential value in future, unanticipated, or alternative utilizations.

Ancillary outputs may be problem definition candidates that did not explain the focal symptom, or solution candidates that did not solve the focal problem. While the most well-known example is 3M’s PostIt sticky notes (Mokyr, 1990), there are many other examples. For instance, the microwave oven was an unintended byproduct of defense contractor Raytheon’s efforts to solve problems during the design of WWII radar systems. Similarly, pharmaceutical firms maintain libraries of molecules they have previously investigated, and search these molecule libraries for solutions to a given problem (Andriani et al., 2017; Nightingale, 2000).
Recognizing that problemistic search may engender outputs that do not solve the triggering problem but may still be valuable, raises important questions for research on problemistic search related to how firms manage the set of outcomes of problemistic search. Future research may examine factors that regulate the unintended outputs of problemistic search, the ability of firms to recognize, commercialize, and profit from these unintended outcomes. Such research must surely acknowledge and allow for richer cognitive assumptions than extant conceptualizations of problemistic search do to explain storage, retrieval, and application of these unintended outcomes. Without cognition and attention, organizations and their decision makers are neither able to recognize and capture these outputs, nor use them for future problems. Cognition and attention will need to be combined with organizational routines that facilitate capturing these outcomes. Indeed, there may be considerable heterogeneity across organizations in their ability to capture ancillary value from problemistic search while achieving the focal value associated with solving the triggering problem. This heterogeneity may arise from differences across firms in the attentional and cognitive prerequisites to recognize ancillary outputs, and the set of organizational routines needed to leverage ancillary outputs.

To leverage problem definition and solution candidates that were not useful for the focal problem, the organization must notice their potential value and retain them. Organizational attention in problemistic search naturally attends to the focal output associated with solving the triggering problem and therefore such ancillary outputs may go unnoticed as research on attention and cognitive filtering suggests (e.g. Fiol and Huff 1992; Zajac & Bazerman 1991). Thus, future
research may investigate what organizational mechanisms and structures may be needed to steer attention (Ocasio, 1997) towards unused problem definitions and solution candidates.

Organizations will also need the cognitive prerequisites to process the information related to unused problem definition and solution candidates. Research on cognition (Cohen & Levinthal, 1990; Shane, 2000; Gruber, Harhoff, & Hoisl, 2013) suggests that prior experience in a specific context may affect the ability to understand the potential value of problem definitions and solutions in that context. For instance, Shane (2000) showed that the application of a specific technology to a customer need was dependent upon the entrepreneur’s educational background and industry experience. Thus, over and above noticing the ancillary outputs of problemistic search, the organization will likely need a means to evaluate uses of these outputs.

Research would be warranted into routines related to storage, transfer, adaptation, and integration of ancillary outputs that may be needed to capture ancillary value from unused problem definitions and unused solutions. For instance, without storage and maintenance, problem definitions and solutions may be forgotten or lost when personnel leave the firm (de Holan & Phillips, 2004; David & Brachet, 2011). Routines to transfer the unused problem definition and solution candidates to different locations in the organization may be required and may need to be designed to fit the characteristics of the knowledge underlying the problem or solution (Kogut & Zander, 1992). If unused problem definition and solution candidates are stored and transferred, routines may be necessary to adapt, integrate, and recombine the ancillary output to the new context (e.g. Garud & Nayyar, 1994; Jensen & Szulanski, 2004).
Finally, integrating ancillary outputs in theories of problemistic search also points to solution-driven search as a complementary process to problemistic search. Although the possibility of a search process that starts from an existing (potentially unused) solution and progresses towards identifying problems that the solution may fit was mentioned in the original work by Cyert and March (1963), and may be quite common in entrepreneurial contexts (Shane 2000), it has not been incorporated into our understanding of problemistic search. Research into the features of solution-driven search seems warranted as it is likely to differ substantially from more traditional search processes that start with a problem and proceed to a solution. For instance, we have relatively little insight into the cognitive challenge of characterizing solutions before a problem is known. Such research may also benefit from comparing solution-driven search with the somewhat related concepts in the garbage can model (Cohen et al., 1972).

4. CONCLUSIONS

In this article, we have reviewed the literature on problemistic search. Emerging from our review is a call for research on problemistic search that recognizes a more central role for cognition and a stronger emphasis on process theorizing.

The original conceptualization of problemistic search, like much of the conceptual toolkit of the behavioral theory of the firm (Cyert & March, 1963), emerged in response to the unrealistically rational view of organizations in classical economics. Although its simplicity in process, automaticity, and reliance on minimal behavioral assumptions gave rise to a successful body of management research on performance feedback, this simplicity has, over time, become a limitation. While the traditional conceptualization of problemistic search provides a parsimonious
theoretical foundation, it comes at the expense of obscuring important elements of the process of problemistic search and limits insight that the theory can provide into managerial and organizational action.

Our reading of the extant literature highlights a clear path forward to revitalizing work on problemistic search. We believe that progress in the literature will be facilitated by extending some of the simplified organizational apparatus and relaxing some of the constraints imposed by its initial conceptualization. In particular, we see the need for research to take a more process oriented approach and for a more central role for cognition than is suggested by the traditional conceptualization. As we highlighted, much progress in the broader literature on the behavioral theory of the firm has been facilitated by adding a modicum of cognition to domains of the theory that were heretofore viewed as highly automatic. Indeed, cognition has already begun to seep into work on problemistic search via ideas such as attention. Our call for more process oriented theorizing reflects the observation that the literature often black-boxes search in the discussion of problemistic search for empirical reasons, studying its antecedents and consequences without a rich connection to search itself. Moreover, we believe that recognizing the potential for a two stage search process, problem definition search followed by solution search, is central to any reconceptualization of the theory of problemistic search — the outcome of definition search itself may act as a mental map of the solution landscape.

To jump start a revitalized research agenda on problemistic search we identified several implications of addressing these two central shortcomings. Through the extensions along the process of problemistic search that we identified and the new emphasis on cognition, we hope to
maintain the relevance of the construct to theoretical and empirical research. While our article leads to a number of areas for future research, we believe that it only scratches the surface of the implications of the role of cognition in the process of problemistic search and we hope that future research will continue to build on this renewed conceptualization.
5. REFERENCES


6. FIGURES

Figure 1: Process of Problemistic Search

- Search Triggers
- Solution Search
- Behavioral Consequences of Solutions Search
- Stopping
Figure 2: The relationship between the exploration and exploitation distinction and focal and ancillary output

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