



## Leader cognition: Approaches and findings

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### ABSTRACT

Although few scholars would dispute the point leaders must think, cognition has not, perhaps, received the attention it warrants in studies of leadership. The intent of the present special issue is to examine how cognition influences leader emergence and performance. In this introductory piece we argue that cognitive skills, often domain specific cognitive skills, strongly influence leader emergence and performance. The conditions that moderate the impact of these skills are also examined along with the ways in which cognitive capacities shape subsequent leader behavior. The implications of cognition for leader development and directions for future research are discussed.

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A superficial reading of the literature on leadership (Bass & Bass, 2009; Yukl, 2011) seems to point to a conclusion. Leaders do not need to think – they must act. In keeping with this assumption, theories of leadership, and the measures formulated based on these theories, have typically focused on follower perceptions of leader behavior (Dinh, Lord, & Hoffman, 2014). For example leader–member exchange (Graen, Novak, & Sommerkamp, 1982), transformational leadership (Bass & Avolio, 1990), servant leadership (Liden, Panaccio, Meuser, Hu, & Wayne, 2014), and ethical leadership (De Hoogh & Den Hartog, 2008) to mention a few examples, all represent behaviorally based theories of leadership.

Although it may be useful to understand and frame leadership in terms of behavior, this framing of leadership begs a number of questions. Are there different styles of leader behavior—charismatic, ideological, or pragmatic (Mumford, 2006)? Does leader behavior vary as a function of social context (Sparrowe, 2014) or organizational context (Carter & DeChurch, 2014)? And, where does leader behavior come from—identity (Day, Harrison, & Halpin, 2009), personality (Bono & Judge, 2004), or cognition (Mumford, Connelly, & Gaddis, 2003; Mumford, Zaccaro, Harding, Jacobs, & Fleishman, 2000)?

It is this last question to which the present special issue is devoted. More specifically, the present special issue is focused on how cognition influences leader emergence and performance. Cognition may be defined in many ways, however cognition ultimately refers to how people work with information in solving problems (Ericsson, 2003). As Zaccaro (2014) has noted, leaders must solve problems – albeit problems arising in a social or organizational context. As a result, there is ample reason to suspect that cognition would be critical to understanding the nature and significance of both leader emergence and leader performance (Mumford, Friedrich, Caughron, & Byrne, 2007).

### Cognition

Although the available evidence indicates that cognition is a critical force underlying leader emergence and performance (Connelly et al., 2000; Lord, De Vader, & Alliger, 1986), one must ask what exactly is implied by the term cognition. To begin, one must bear in

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mind that in incidents of leadership there is both a leader, or leaders, and a follower, or followers, and cognition occurs among both leaders (Drazin, Glynn, & Kazanjian, 1999) and followers (Lord & Maher, 1990). In the present special issue, our concern is not follower cognition. Rather, the focus of the present special issue is on the cognition of leaders.

Leader cognition, however, as is the case with cognition in general, is a complex phenomenon. Cognition is commonly held to require knowledge, or information (Kolodner, 1997), and knowledge has been shown to influence leader performance (Vessey, Barrett, & Mumford, 2011). Indeed, the case can be made that it is not just knowledge which is of concern but the ways people organize, store, and recall this knowledge (Connelly et al., 2000). This observation suggests that priming and salience effects, effects shaping knowledge recall, may be important in understanding leader emergence and performance. Indeed, Ligon, Hunter, and Mumford (2008) have provided evidence indicating that the information provided by prior life experiences, and recall of these life experiences, is critical to the emergence of leadership styles.

Cognition, however, is not simply a matter of knowledge, and recall of this knowledge, it also depends on people's capacity to work with this knowledge. One key capacity in this regard is general intelligence – commonly construed as the speed and depth of information processing (Tyler, 1964). Indeed, intelligence has proved to be a critical cause of performance in virtually all domains where people must solve problems (Schmidt & Hunter, 1998). And, because leaders must solve social or organizational problems (Mumford, Zaccaro, Harding, Jacobs, & Fleishman, 2000), there is reason to suspect that cognition would also influence leader emergence and performance.

The speed and depth with which people process information, however, are not simply a matter of basic abilities, such as intelligence, and people's speed and depth of processing improve as a function of experience working in a domain. Experience working in a domain gives rise to specific skills – skills that emerge, in part, as a function of intelligence, and, in part, as a function of experience and active practice. What should be recognized here, however, is that these domain specific cognitive skills may be as important, if not more important, than general intelligence in accounting for leader emergence and performance when it is recognized that leadership emerges in social systems as a function of experience. Thus McKenna, Rooney, and Boal (2009) have argued that wisdom, social appraisal skills, may be important to understanding leader emergence and performance due to the distinctly social nature of the problems presented to leaders. This observation, however, broaches the question as to what other skills might contribute to leader emergence and performance.

Ability and skills, however, are of value in solving problems, including the problems presented to leaders, only when these capacities can be applied. The application of cognitive capacities in problem-solving has long been a focus of the literature on decision making (Hogarth, 1980). And, it seems clear that leaders must make decisions. The decision-making literature, however, has focused on situational variables, or individual variables, that result in better (optimal) or worse (sub-optimal) decisions in a specific context. In the case of leaders, however, these contingencies on the application of cognitive capacities may be far more complex when people are asked to address the type of problems commonly presented to leaders. Thus a number of variables ranging from stress (Fiedler & Garcia, 1987) to complexity of stakeholder concerns (Marion & Gonzales, 2013) may influence how leaders apply cognitive capacities.

The application of cognitive capacities is of interest for two reasons. The first reason is that how people apply their cognitive capacities will give rise to the type of behavior others see leaders exhibit. Cognition may shape the kind of visions leaders formulate and how these visions are articulated to key stakeholders (Strange & Mumford, 2005). Application of cognitive capacities may, moreover, shape how, and how well, leaders interact with followers giving rise to more, or less, effective patterns of leader member exchange.

The impact of applying cognition on leader behavior points to the second reason application of cognitive capacity is of interest to students of leadership. Understanding how leaders apply cognition, and the conditions shaping effective application of cognitive capacities in solving leadership problems, contributes to our ability to improve leader performance. Thus understanding how leaders apply cognitive capacity, and the variables shaping more, or less, effective application of these capacities, might allow us to “design” leadership jobs and develop work “aids” which would contribute to more effective leadership. More generally, understanding how people apply cognition might provide a basis for formulating more effective leadership development programs (Mumford, Marks, Connelly, Zaccaro, & Reiter-Palmon, 2000).

## Knowledge and ability

The first article in this special issue, an article by Combe and Carrington (2015-in this volume) examines one form of knowledge in relation to a critical situational influence. Prior studies (Mumford et al., 2007) have shown that leader cognition is particularly important to performance under conditions of crisis. Combe and Carrington (2015-in this volume) examine one form of knowledge, mental models (Rouse & Morris, 1986), held to be critical to crafting crisis resolution strategies. They examine agreement among the mental models of top management teams pre and post crisis. And, they found that shared mental models, shared mental models held to be critical to team performance (Day, Gronn, & Salas, 2004), emerge following crises. Thus crises may cause leaders to construct or organize knowledge in new, perhaps more appropriate, ways.

These findings are, of course, notable because they point to the salience of crises in the formation of leaders' knowledge structures. These findings, however, also suggest that as a result of crises leaders may come to understand prior experiences in different ways—imposing different organizing structures on past experience or case-based knowledge (Barrett, Vessey, & Mumford, 2011; Vessey et al., 2011). What remains unclear, however, is how crises interact with prior experience in shaping the shared mental models created by leadership teams.

Of course, one plausible answer to this question is that the shared mental models formulated in response to crises will depend on both team processes and the basic intelligence of team members. The role of intelligence in leadership has long been debated with

some studies (e.g. Lord et al., 1986) pointing to the importance of intelligence and other studies (e.g. Reichard et al., 2011) suggesting that intelligence is not strongly related to leadership. Of course, part of the issue here is exactly what is the criterion of concern—performance in the leadership role or occupancy of the leadership role. Daly, Egan, and O'Reilly (2015) used longitudinal data gathered in a sizeable sample, some 17,000 individuals, to examine the influence of intelligence on movement into leadership roles—a role occupancy criterion. It was found that intelligence was positively related to movement into leadership roles with the strength of these effects increasing as people reached maturity—thus timing may count in examining the relationship between intelligence and leadership. The Daly et al. (2015) study, however, makes two other noteworthy points. First, the impact of intelligence on attainment of leadership roles depends, in part, on education. Thus social systems value intelligence in leaders and condition role occupancy on intelligence. Second, this study indicates that self-regulation, a construct commonly assumed to be linked to wisdom and social judgment (Connelly et al., 2000; McKenna et al., 2009) also makes a unique, incremental contribution to prediction of movement into leadership roles.

### Cognitive skills

These findings with regard to self-regulation point to the importance of domain specific cognitive skills in understanding leadership role occupancy, and potentially, leader performance. In fact, Zaccaro, La Port, and Jose (2013) have provided evidence that specific problem-solving skills, skills such as wisdom, are, in fact, strong, and stronger, predictors of leader performance than general intelligence. This point is reiterated in a study by Zaccaro et al. (2015).

They examined the impact of divergent thinking, thinking of alternative solutions, a skill held to contribute to creative thinking (Mumford, Medeiros, & Partlow, 2012), on the continuance of officers in the United States Army over a fifteen year period. Notably, retention of officers in the United States Army is likely, although not completely, dependent on performance in this “up or out” system. They found that divergent thinking was strongly ( $r = .42$ ), and positively, related to officer continuance — at least when divergent thinking was assessed with respect to domain relevant attributes (Mumford, Marks, Connelly, Zaccaro, & Johnson, 1998). Moreover, their findings indicate that assessments of other complex problem-solving skills, skills such as problem definition and idea evaluation, as applied in solving leadership problems, are also strongly positively ( $r = .41$ ) related to leader continuance. Thus in attempts to account for leadership and leader performance there is value, apparently great value, in looking at domain specific cognitive skills.

This observation, of course, broaches the question what other cognitive skills may prove important in accounting for leader performance? One such skill, forecasting, is discussed by Mumford, Steele, McIntosh, and Mulhearn (2015). Traditionally, the value of forecasting has been discounted based on the assumed inaccuracies in people's forecasts (Pant & Starbuck, 1990). However, when people have expertise and intend to act, implementation intentions, the accuracy of people's forecasts improves substantially (Daily & Mumford, 2006). More centrally, the evidence amassed by Mumford et al. (2015-in this volume) across a number of low-fidelity simulation studies, studies where participants assume leadership roles, indicated that forecasting skill is a powerful influence on both leader performance and the type of solutions constructed to leadership problems. Indeed forecasting, along with identification of key causes on which these forecasts are based (Marcy & Mumford, 2007, 2010) may represent important skills underlying performance in leadership roles.

However, at least one other skill appears to be of special importance. Marcy (2015-in this volume) in a historiometric study of one notable leader, Guy Debord, argues that both sensemaking and sensegiving skills may be important to performance in leadership roles. Indeed, he argues that sensebreaking, brought about through the reintegration of multiple mental models, may be critical to the cases of significant social change we hold to characterize our most eminent leaders historically—leaders such as Franklin Roosevelt and Nelson Mandela.

### Application capacities

Indeed one might argue that recent research has begun to allow us to identify the key cognitive skills, divergent thinking, idea evaluation, causal analysis, forecasting, planning, and wisdom or self-regulation, that make effective leadership performance possible. It is not, however, simply enough to possess these skills. It is also necessary for leaders to apply these skills in solving the problems presented to them by people and social systems.

One key consideration in this regard is attending to the problem. Leaders have many demands made on them and these varied demands reduce attentional capacity. Collins and Jackson (2015-in this volume) measured attentional capacity using an error task—mistakes made on a mathematical test. They found that attentional capacity, or effective self-regulation, positively mediated the impact of intelligence on proactive behavior on the part of first-line supervisors. Thus leaders must focus on, or attend to, problems if intelligence, or domain specific cognitive skills (e.g., divergent thinking, forecasting, planning), are to influence performance. This finding is of some importance because studies examining when, where, and how leaders allocate attention to different problems, and the impact of attentional allocation strategies on leader performance, are sorely lacking.

With allocation of attention people begin to acquire information bearing on a problem and apply their knowledge, skills, and abilities in solving this problem. In this regard, the study conducted by Serban et al. (2015) is of some importance. They used simulations, quasi-experimental, and experimental studies to examine the impact of intelligence on leader emergence. They examined how the density of network ties, ties providing information, influenced the application of cognitive ability with respect to nominations by team members that a particular individual was the team leader. They found that as the density of network ties increased cognitive ability had a stronger influence on leader emergence. Thus leaders must create strong, dense, social networks

to ensure that the information needed to apply cognitive capacities is, in fact, available—networks that may be built through positive leader–member exchange, charisma, and people's identification with the leader.

Attention and information, information that may be obtained from others, allow cognitive capacities to be applied by leaders in making decisions. Liu, Eubanks, and Chater (2015) examined leader decision making in the context of a single, real-world, decision. More specifically, they examined how leaders make succession decisions in family businesses examining one potential decision bias—nepotism. They showed that strong family ties act to bias these decisions. However, their findings also indicated that actively searching for information about external, non-family, candidates may ameliorate this bias. Notably, cognitive capacities such as self-regulation, divergent thinking, and forecasting may also help leaders ameliorate such decision biases. Unfortunately, at this juncture, evidence is not available indicating how cognitive skills act to influence decision biases.

## Behavior and development

It is commonly assumed that decisions result in behavior, or, at least, behavioral intentions. As noted earlier, leadership research has tended to focus on behavior. This observation is noteworthy because it broaches a new question. How do cognitive capacities, intelligence, knowledge, and domain specific cognitive skills act on, and interact with, leader behavior?

In one study along these lines, Dóci and Hofmans (2015) conducted an experimental study where participants were asked to assume the role of a CEO leading a meeting where decisions were to be made about office space. Task complexity was varied and perceptions of transformational leadership were assessed. It was found that perceptions of transformational leadership decreased as a function of task complexity—apparently because leaders lacked the resources, presumably cognitive resources, to evidence transformational leadership behavior. Thus one common critical form of leadership behavior, transformational behavior, depends on cognitive resources with greater cognitive resources being required as task complexity increases. Put more directly, effective leadership behavior may depend on leaders possessing requisite cognitive capacity—intelligence, knowledge, and skills.

In the case of real-world incidents of leadership, the complexity of the tasks at hand (Yukl, 2011) is such that substantial cognitive capacity may well be required. The significance of cognitive capacity, however, with respect to leader behavior may, in part, depend on the leader's ability to simplify their thinking when communicating direction to others. This point is underscored in the Partlow, Medeiros, and Mumford (2015) study. In this study, an experimental study, participants were asked to formulate a vision for leading an experimental secondary school. The quality, originality, and elegance of the resulting vision statements, along with their perceived utility and affective impact, were appraised. The complexity of relevant mental models presented was varied along with the number of schema present and neither participants were asked to forecast positive or negative outcomes prior to vision formation. It was found that the strongest vision statements were obtained when participants used relatively simple mental models in an attempt to minimize forecasted negative outcomes. Thus although leaders must be able to think complexly, and perhaps negatively, they must also be able to simplify their thoughts for followers. Although the need for simplification may seem obvious, we know little about how leaders go about simplifying their approach to problems.

Although the impact of cognitive capacities on leader behavior appears complex, the Dóci and Hofmans (2015) and the Partlow et al. (2015) studies indicate that cognition influences leader behavior. When these findings are considered in light of the observations of Daly et al. (2015) and Zaccaro et al. (2015) concerning the impact of cognitive capacities on a leader's ability to profit from educational or developmental opportunities, they suggest that developmental interventions focused on providing requisite knowledge and skills might prove especially valuable. In other words, cognitive interventions might provide a basis for developing leadership potential.

This possibility is addressed by Santos, Caetano, and Tavares (2015). In this study, a leadership training program was formulated for naval officers that focused on developing requisite cognitive capacities. For example, clarification skills, planning skills, and information search and structuring skills were trained in a twenty-day training program. Judges evaluated officer performance prior to and after training. It was found that this cognitively based training intervention resulted in gains not only in the relevant skills but more importantly in the effectiveness of the teams being led by program participants. Thus understanding leader cognition can result in tangible, practical, improvements in our ability to develop leadership potential.

## Conclusions

Perhaps the most clear cut conclusion that can be drawn from the various studies of leader cognition presented in the present volume is that leader cognition is complex. Yes, leader cognition depends, in part, on intelligence. However, the ways in which intelligence affects leadership may be quite complex—permitting movement into leadership roles and allowing people to profit from developmental experiences. Intelligence, however, is clearly not the whole story.

Leaders must acquire expertise (Vessey et al., 2011). Not only must leaders acquire experience they must develop a number of complex cognitive skills for working with this experience. In fact, the various studies presented in the present volume point to the importance of a number of complex, higher-order, cognitive skills that may contribute to leadership—including divergent thinking, causal analysis, forecasting, sensemaking, sensebreaking, planning, and wisdom or self-regulation. Although this list of cognitive skills is likely incomplete, the findings obtained in the studies presented in the present volume indicate that they may represent critical cognitive capacities underlying leadership performance across a number of domains.

Not only have the studies presented in the present volume helped us to identify critical cognitive skills, skills of known importance to leader performance (Zaccaro et al., 2013), they also have an important practical implication. Typically, these specific cognitive skills were found to be strongly related to leader performance *over* substantial periods of time across a *range* of criteria. This observation is

noteworthy because it suggests leader assessment and selection systems should focus on these skills. Thus, we might ask potential leaders to forecast the effects of policy changes, or, alternatively, formulate program plans, in our attempts to appraise leader potential.

In addition, however, understanding leader cognition provides a basis not only for the design of assessment systems, it provides a basis for formulating new types of training and leader development systems. The findings of Santos et al. (2015) clearly point to the value of training interventions intended to develop requisite cognitive skills. Presumably, career experiences and feedback systems might also be designed to help leaders develop these skills. Moreover, leader development and feedback systems might be formulated to provide leaders with the knowledge and expertise that provide the basis for application of these skills.

In addition to the implications of the studies presented in this volume for traditional assessment, selection, and developmental interventions, these studies point to a number of new ways we might seek to enhance leadership potential and leader performance. For example, the Serban et al. (2015) study points to the value of developing network structures that would provide leaders with the information needed to apply cognitive capacity. Other work suggests the potential value of designing information systems that would cause leaders to attend to relevant critical concepts. Still other studies point to the value of providing leaders with viable models for understanding relevant problems (Combe & Carrington, 2015-in this volume). Thus understanding leader cognition may make possible a new wave of interventions intended to enhance leader performance.

In fact, one key attribute of the studies presented in the present volume is that they point to a variety of methods that might be used to address these issues. Traditionally cognitive studies were based on either the experimental or psychometric paradigms. And, indeed these approaches appear in the present volume (e.g., Combe & Carrington, 2015; Partlow et al., 2015; Zaccaro et al., 2015). The studies presented in the present volume, however, suggest that a number of other methods might also be used to study leader cognition including historic methods (Marcy, 2015) and educational interventions (Santos et al., 2015) and simulations (Liu et al., 2015).

Research using these and other potential methods, however, is not only important for pragmatic reasons, it is also of potentially great importance substantively. Traditionally we have not believed that leaders must be creative (Mumford & Connelly, 1992). The Zaccaro et al. (2015-in this volume) study, however, points to the potential importance of considering the fundamentally creative nature of leadership (Mumford & Gustafson, 1988). Similarly, it is plausible that we might seek to understand leader performance in terms of attentional allocation. And, the Collins and Jackson (2015-in this volume) study clearly points to the value of such an approach.

Not only do the various studies on leader cognition presented in the present volume suggest some promising new theoretical approaches, they also point to the need to take a new look at many extant leadership theories. The Dóci and Hofmans (2015-in this volume) study suggests that transformational leadership may not work on complex, high-value, endeavors such as advanced research and development efforts (Mumford, Scott, Gaddis, & Strange, 2002). Along related lines, the Serban et al. (2015-in this volume) study suggests that leader-member exchange theory might need to be reconstructed with respect to network models at least when the leader is the focal concern.

These observations are noteworthy because they indicate that cognitive approaches may give rise not only to new theories of leadership, they may also give rise to some significant changes in our current conceptions of leadership. At one level, this conclusion is not surprising. Leadership theory has largely been based on superficial observations of leader behavior (Yukl, 2011). In science, when one digs deeper, new ways of understanding superficial observations often emerge (Kuhn, 1970). Thus studies of leader cognition may result in some significant advances in leadership theory. When potential theoretical gains are considered in light of the practical value of this research with respect to leader assessment and development, it points to the value of a focus on cognition in studies of leadership. We hope that the present special issue will provide an impetus for further research along these lines.

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## References

- Barrett, J. D., Vessey, W. B., & Mumford, M. D. (2011). Getting leaders to think: Effects of training, threat, and pressure on performance. *The Leadership Quarterly*, 22, 729–750.
- Bass, B. M., & Avolio, B. J. (1990). The implications of transactional and transformational leadership for individual, team, and organizational development. In W. Pasmore, & R. W. Woodman (Eds.), *Research in organizational change and development* (pp. 231–272). Greenwich, Connecticut: JAI Press.
- Bass, B. M., & Bass, R. (2009). *The Bass handbook of leadership: Theory, research, and management applications*. New York: Free Press.
- Bono, J. E., & Judge, T. A. (2004). Personality and transformational and transactional leadership: A meta-analysis. *Journal of Applied Psychology*, 89, 901–910.
- Carter, D. R., & DeChurch, L. A. (2014). Leadership in multiteam systems: A network perspective. In D. V. Day (Ed.), *The Oxford handbook of leadership and organizations* (pp. 482–502). New York, NY: Oxford University Press.
- Collins, M., & Jackson, M. (2015). A process model of self-regulation and leadership: How attentional resource capacity and negative emotions influence constructive and destructive leadership. *The Leadership Quarterly*, 26, 386–401 (in this volume).
- Combe, I., & Carrington, D. (2015). Leaders' sensemaking under crises: Emerging cognitive consensus overtime within management teams. *The Leadership Quarterly*, 26, 307–322 (in this volume).
- Connelly, M. S., Gilbert, J. A., Zaccaro, S. J., Threlfall, K., Marks, M. A., & Mumford, M. D. (2000). Exploring the relationship of leadership skills and knowledge to leader performance. *The Leadership Quarterly*, 11, 65–86.
- Daily, L. R., & Mumford, M. D. (2006). Evaluative aspects of creative thought: Errors in appraising the implications of new ideas. *Creativity Research Journal*, 18, 367–384.
- Daly, M., Egan, M., & O'Reilly, F. (2015). Childhood general cognitive ability predicts leadership role occupancy across life: Evidence from 17,000 cohort study participants. *The Leadership Quarterly*, 26, 323–341 (in this volume).
- Day, D. V., Gronn, P., & Salas, E. (2004). Leadership capacity in teams. *The Leadership Quarterly*, 15, 857–880.

- Day, D. V., Harrison, M. M., & Halpin, S. M. (2009). *An integrative approach to leader development*. New York, NY: Psychology Press.
- De Hoogh, A. H., & Den Hartog, D. N. (2008). Ethical and despotic leadership, relationships with leader's social responsibility, top management team effectiveness and subordinates' optimism: A multi-method study. *The Leadership Quarterly*, 19, 297–311.
- Dinh, J. E., Lord, R. G., & Hoffman, E. (2014). Leadership perception and information processing: Influences of symbolic, connectionist, emotion, and embodied architectures. In D. V. Day (Ed.), *The Oxford handbook of leadership and organizations*. New York, NY: Oxford University Press.
- Dóci, E., & Hofmans, J. (2015). Task complexity and transformational leadership: The mediating role of leaders' state core self-evaluations. *The Leadership Quarterly*, 26, 436–447 (in this volume).
- Drazin, R., Glynn, M. A., & Kazanjian, R. K. (1999). Multilevel theorizing about creativity in organizations: A sense making perspective. *Academy of Management Review*, 24, 286–329.
- Ericsson, K. A. (2003). The search for general abilities and basic capacities. In R. J. Sternberg, & E. L. Grigorenko (Eds.), *The psychology of abilities, competencies, and expertise* (pp. 93–125). Cambridge: Cambridge University Press.
- Fiedler, F. E., & Garcia, J. E. (1987). *New approaches to effective leadership: Cognitive resources and organizational performance*. John Wiley & Sons.
- Graen, G., Novak, M. A., & Sommerkamp, P. (1982). The effects of leader-member exchange and job design on productivity and satisfaction: Testing a dual attachment model. *Organizational Behavior and Human Performance*, 30, 109–131.
- Hogarth, H. (1980). Learning from experience and suboptimal rules in decision making. In T. Wallsten (Ed.), *Cognitive processes in choice and behavior*. Hillsdale, NJ: Erlbaum.
- Kolodner, J. L. (1997). Educational implications of analogy: A view from case-based reasoning. *American Psychologist*, 52, 57–66.
- Kuhn, T. S. (1970). *The structure of scientific revolutions*. Chicago: Chicago University Press.
- Liden, R. C., Panaccio, A., Meuser, J. D., Hu, J., & Wayne, S. J. (2014). Servant leadership: Antecedents, processes, and outcomes. In D. V. Day (Ed.), *The Oxford handbook of leadership and organizations* (pp. 357–379). Oxford: Oxford University Press.
- Ligon, G. S., Hunter, S. T., & Mumford, M. D. (2008). Development of outstanding leadership: A life narrative approach. *The Leadership Quarterly*, 19, 312–334.
- Liu, C., Eubanks, D. L., & Chater, N. (2015). The weakness of strong ties: Sampling bias, social ties, and nepotism in family business succession. *The Leadership Quarterly*, 26, 419–435 (in this volume).
- Lord, R. G., De Vader, C. L., & Alliger, G. M. (1986). A meta-analysis of the relation between personality traits and leadership perceptions: An application of validity generalization procedures. *Journal of Applied Psychology*, 71, 402.
- Lord, R. G., & Maher, K. J. (1990). Alternative information-processing models and their implications for theory, research, and practice. *Academy of Management Review*, 15, 9–28.
- Marcy, R. T. (2015). Breaking mental models as a form of creative destruction: The role of leader cognition in radical social innovations. *The Leadership Quarterly*, 26, 370–385 (in this volume).
- Marcy, R. T., & Mumford, M. D. (2007). Social innovation: Enhancing creative performance through causal analysis. *Creativity Research Journal*, 19, 123–140.
- Marcy, R. T., & Mumford, M. D. (2010). Leader cognition: Improving leader performance through causal analysis. *The Leadership Quarterly*, 21, 1–19.
- Marion, R., & Gonzales, L. D. (2013). *Leadership in education: Organizational theory for the practitioner*. Waveland Press.
- McKenna, B., Rooney, D., & Boal, K. B. (2009). Wisdom principles as a meta-theoretical basis for evaluating leadership. *The Leadership Quarterly*, 20, 177–190.
- Mumford, M. D. (2006). *Pathways to outstanding leadership: A comparative analysis of charismatic, ideological and pragmatic leaders*. Mahwah, NJ: Erlbaum.
- Mumford, M. D., & Connelly, M. S. (1992). Leaders as creators: Leader performance and problem solving in ill-defined domains. *The Leadership Quarterly*, 2, 289–315.
- Mumford, M. D., Connelly, M. S., & Gaddis, B. (2003). How creative leaders think: Experimental findings and cases. *The Leadership Quarterly*, 14, 411–432.
- Mumford, M. D., Friedrich, T. L., Caughron, J. J., & Byrne, C. L. (2007). Leader cognition in real-world settings: How do leaders think about crises? *The Leadership Quarterly*, 18, 515–543.
- Mumford, M. D., & Gustafson, S. B. (1988). Creativity syndrome: Integration, application, and innovation. *Psychological Bulletin*, 103, 27–43.
- Mumford, M. D., Marks, M. A., Connelly, M. S., Zaccaro, S. J., & Johnson, J. F. (1998). Domain-based scoring in divergent-thinking tests: Validation evidence in an occupational sample. *Creativity Research Journal*, 11, 151–163.
- Mumford, M. D., Marks, M. A., Connelly, M. S., Zaccaro, S. J., & Reiter-Palmon, R. (2000). Development of leadership skills: Experience and timing. *The Leadership Quarterly*, 11, 87–114.
- Mumford, M. D., Medeiros, K. E., & Partlow, P. J. (2012). Creative thinking: Processes, strategies, and knowledge. *The Journal of Creative Behavior*, 46, 30–47.
- Mumford, M. D., Scott, G. M., Gaddis, B., & Strange, J. M. (2002). Leading creative people: Orchestrating expertise and relationships. *The Leadership Quarterly*, 13, 705–750.
- Mumford, N. D., Steele, L., McIntosh, T., & Mulhearn, T. (2015). Forecasting and leader performance: Objective cognition in a socio-organizational context. *The Leadership Quarterly*, 26, 359–369 (in this volume).
- Mumford, M. D., Zaccaro, S. J., Harding, F. D., Jacobs, T. O., & Fleishman, E. A. (2000). Leadership skills for a changing world: Solving complex social problems. *The Leadership Quarterly*, 11, 11–36.
- Pant, P. N., & Starbuck, W. H. (1990). Innocents in the forest: Forecasting and research methods. *Journal of Management*, 16, 433–460.
- Partlow, P. J., Medeiros, K. E., & Mumford, M. D. (2015). Leader cognition in vision formation: Simplicity and negativity. *The Leadership Quarterly*, 26, 448–469 (in this volume).
- Reichard, R. J., Riggio, R. E., Guerin, D. W., Oliver, P. H., Gottfried, A. W., & Gottfried, A. E. (2011). A longitudinal analysis of relationships between adolescent personality and intelligence with adult leader emergence and transformational leadership. *The Leadership Quarterly*, 22, 471–481.
- Rouse, W. B., & Morris, N. M. (1986). On looking into the black box: Prospects and limits in the search for mental models. *Psychological Bulletin*, 100, 349.
- Santos, J. P., Caetano, A., & Tavares, S. M. (2015). Is training leaders in functional leadership a useful tool for improving the performance of leadership functions and team effectiveness? *The Leadership Quarterly*, 26, 470–484 (in this volume).
- Schmidt, F. L., & Hunter, J. E. (1998). The validity and utility of selection methods in personnel psychology: Practical and theoretical implications of 85 years of research findings. *Psychological Bulletin*, 124, 262–274.
- Serban, A., Yammarino, F. J., Dionne, S., Kahai, S. S., Hao, C., McHugh, K. A., et al. (2015). Leadership emergence in face-to-face and virtual teams: A multi-level model with agent-based simulations, quasi-experimental and experimental tests. *The Leadership Quarterly*, 26, 402–418 (in this volume).
- Sparrowe, R. T. (2014). Leadership and social networks: Initiating a different dialog. In D. V. Day (Ed.), *The Oxford handbook of leadership and organizations* (pp. 434–454). Oxford, England: Oxford University Press.
- Strange, J. M., & Mumford, M. D. (2005). The origins of vision: Effects of reflection, models and analysis. *The Leadership Quarterly*, 16, 121–148.
- Tyler, L. E. (1964). *The psychology of human differences*. Englewood Cliffs, NJ: Prentice Hall.
- Vessey, W. B., Barrett, J., & Mumford, M. D. (2011). Leader cognition under threat: "Just the facts". *The Leadership Quarterly*, 22, 710–728.
- Yukl, G. A. (2011). *Leadership in organizations*. Englewood Cliffs, NJ: Prentice-Hall.
- Zaccaro, S. J. (2014). Leadership memes: From ancient history and literature to twenty-first century theory and research. In D. V. Day (Ed.), *The Oxford handbook of leadership and organizations* (pp. 13–39). New York, NY: Oxford University Press.
- Zaccaro, S. J., Connelly, M. S., Repchick, K. M., Daza, A. I., Young, M. C., & Kilcullen, R. N. (2015). The influence of higher order cognitive capacities on leader organizational continuance and retention: The mediating role of developmental experiences. *The Leadership Quarterly*, 26, 342–358 (in this volume).
- Zaccaro, S. J., La Port, K., & Jose, I. (2013). Attributes of successful leaders: A performance requirements approach. In M. Rumsey (Ed.), *The Oxford handbook of leadership* (pp. 11–36). Oxford, England: Oxford University Press.