Conservation Biology

Essay

Black swans, cognition, and the power of learning from failure

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Abstract: *Failure carries undeniable stigma and is difficult to confront for individuals, teams, and organizations. Disciplines such as commercial and military aviation, medicine, and business have long histories of grappling with it, beginning with the recognition that failure is inevitable in every human endeavor. Although conservation may arguably be more complex, conservation professionals can draw on the research and experience of these other disciplines to institutionalize activities and attitudes that foster learning from failure, whether they are minor setbacks or major disasters. Understanding the role of individual cognitive biases, team psychological safety, and organizational willingness to support critical self-examination all contribute to creating a cultural shift in conservation to one that is open to the learning opportunity that failure provides. This new approach to managing failure is a necessary next step in the evolution of conservation effectiveness.*

Keywords: adaptive management, cognitive bias, conservation psychology, organizational learning, psychological safety, teams

Cisnes Negros, Cognición, y el Poder de Aprender a partir del Fracaso

Resumen: *El fracaso conlleva un estigma innegable y confrontarlo es difícil para los individuos, los equipos y las organizaciones. Las disciplinas como la aviación comercial y militar, la medicina y los negocios tienen una larga historia de lidiar con el fracaso, comenzando con el reconocimiento de que el fracaso es inevitable en cualquier empeño humano. Aunque la conservación discutiblemente pueda ser más compleja, los profesionales de la conservación pueden partir de la investigación y la experiencia de estas otras disciplinas para institucionalizar las actividades y actitudes que promueven el aprendizaje a partir del fracaso, ya sean contratiempos menores o desastres mayores. El entendimiento del papel de los sesgos cognitivos individuales, la seguridad psicológica en equipo, y la disposición organizacional para apoyar la auto-examinación crítica contribuyen a la creación de un cambio cultural en la conservación hasta llegar a una conservación abierta a las oportunidades de aprendizaje que proporciona el fracaso. Esta nueva estrategia para manejar el fracaso es el siguiente paso necesario para la evolución de la efectividad de la conservación.*

Palabras Clave: aprendizaje organizacional, equipos, manejo adaptativo, psicología de la conservación, seguridad psicológica, sesgo cognitivo

摘要: *失败无疑会带来耻辱, 对个人、团队和组织来说都是很难面对的。诸如商用和军用飞机制造业、医药及商业等领域都有与失败抗争的长期历史, 首先要认识到失败在每个人的努力中是不可避免的。虽说保护可能更*

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复杂, 但保护专业人员也可以借鉴这些领域的研究和经验以将活动和态度制度化, 这有助于从大大小小的失败中学习。理解个体认知偏差、团队心理安全, 以及支持自我批判性自醒的组织意愿, 都将有助于在保护中创造一种文化转变, 使之对那些由失败而来的学习机会持开放态度。这种处理失败的新方法是保护有效性演进的必不可少的下一步。 ***【翻译: 胡怡思; 审校: 魏辅文】***

关键词: 适应性管理, 认知偏差, 保护心理学, 组织学习, 心理安全, 团队

Introduction

Fallor ergo sum. I err, therefore I am. St. Augustine's simple words belie our actual relationship with accidents, errors, mistakes, violations, and failures. Despite the central role failure plays in every human endeavor, the words we use to describe our deviation from an ideal outcome carry emotional baggage and social stigma. We instinctively understand that experiencing setbacks offers powerful opportunities for learning and growth but also internalize messages from an early age that failure is something to be avoided, and therefore deny ourselves the chance to learn from such failures. This challenge of openness to the potential benefits of failure influences us both individually and how we collectively as a discipline view failure and success. If the goal of conservation is to learn to be increasingly effective at saving nature (Salafsky et al. 2002; Knight et al. 2006) and we accept that learning from failure and success offer different but equally valuable lessons (Hobbs 2009), then confronting failure and understanding its importance in conservation science and practice is critical and yet almost entirely under recognized and undervalued. This essay aims to challenge the current paradigm in conservation, expand on previous calls for a fundamental change to existing institutional frameworks (Allan & Curtis 2005), and propose a new approach to learning in conservation.

The complexity of conservation problems is surpassing the capacity of our approaches and institutions to solve them (Game et al. 2014). Paradoxically, conservation has adopted a success mindset. Success stories are more commonly reported than failures, yet evidence suggests that failure is a more common outcome whether openly discussed or not (Redford & Taber 2000; Webber et al. 2007). We position outcomes along a success spectrum, where activities not achieving stated objectives can be characterized as partial successes (e.g., Knight et al. 2008). We are highly reluctant to document and analyze failures, an important step toward a culture that recognizes failures as valuable learning opportunities (Redford & Taber 2000; Zedler 2007; Hobbs 2009). We focus on stories of hope and optimism to combat feelings of helplessness (Hobbs 2013; Ogden 2016) and to encourage continued societal support for our work. We adopt this success mindset at our peril, for it precludes the rigorous study of failure and the paradoxical success such study can bring.

The authors considered well-established disciplines with institutionalized approaches to address failure in complex systems and drew lessons from them to apply to conservation. We identified pragmatic ways of defining and conceptualizing failure; why failure offers a different and potentially more valuable learning opportunity than success; and a selection of cognitive biases that limit our ability to confront failure. Finally, we introduce the concept of psychological safety and describe its fundamental importance in creating a culture that can learn from failure.

Definitions of Failure

Failure can be defined simply as not achieving a stated objective or as a "deviation from expected and desired results" (Cannon and Edmondson 2001). In this regard, the term *failure* can be maddeningly imprecise and may encompass multiple outcomes across various scales and project phases muddied by different perspectives on what comprises failure (Edmondson 2012). In conservation defining failure is open to interpretation, can vary throughout a project's lifespan, and, as a label, can even be challenged as potentially not useful (Lamoreux et al. 2014).

Disciplines that learn to manage failure effectively determine what definitions best suit their organizational goals. Professionals in business, commercial and military aviation, and medicine have spent decades gathering data to refine definitions and conceptualize processes for managing and learning from failure, opting for utility rather than prescription to guide their definitions. For example, the business sector recognizes that fault and failure can be conflated (e.g., a purported human error may result, in fact, from a system failure). Therefore, conceptualizing failures across a spectrum from those resulting from the potentially useful exploratory testing of new approaches (i.e., praiseworthy) to those caused by conscious deviance from acceptable practice (i.e., blameworthy) provides organizations the ability to better understand and manage deviations from desired outcomes while maintaining high performance standards (Edmondson 2011) (Fig. 1).

In systems incorporating complex technology, such as commercial and military aviation, analysis of failure has evolved beyond reductionist binary definitions and simple blame-assigning exercises (Dekker et al.

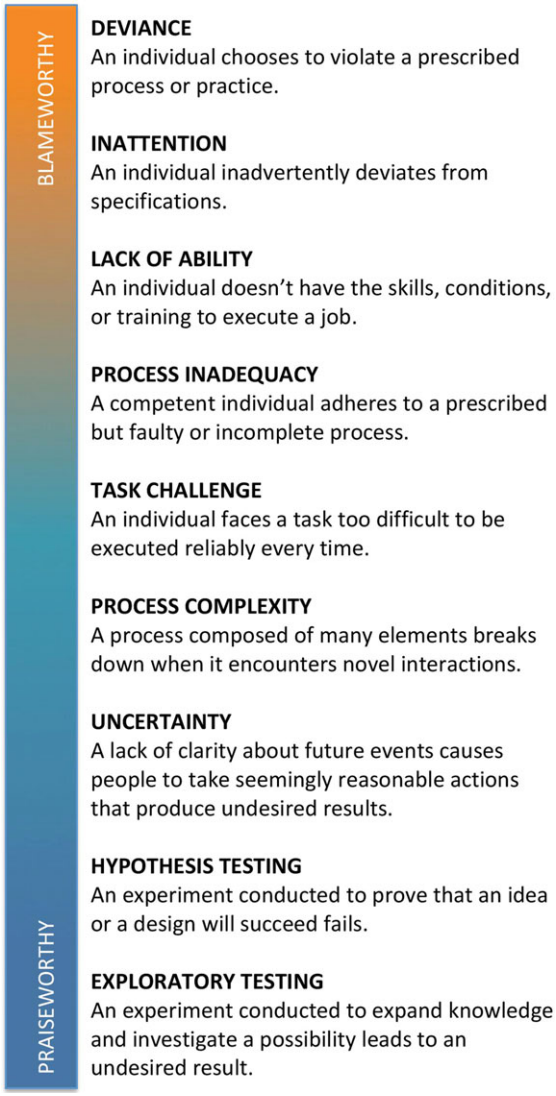

Figure 1. A spectrum of reasons for failure that can be applied to a nuanced exploration of a range of causality to facilitate understanding the relationship between failure and fault. Reprinted with permission from "Strategies for Learning from Failure" by Amy C. Edmondson. Harvard Business Review, April 2011. Copyright 2011 Harvard Business Publishing, all rights reserved.

2011). Aviation-safety investigators have operationalized Reason's (1990) "Swiss cheese" accident-causation model (Fig. 2) in recognition that failure is inevitable in complex systems (Helmreich & Merritt 2000; Hickey et al. 2015); failure rarely has a single cause (Reason 1995); human error is implicated in the majority of accidents involving technological systems (Duffey & Saull 2003); and attributions of blame drive errors underground and limit learning opportunities (Reason 2000). For example, accepting that human error may compromise all systems, commercial airline flight-crew training intentionally does not set goals for zero errors, but rather zero accidents, an achievable goal through the active process of mitigating human error when it occurs (United Airlines 2016) and one that shifts blame away from individuals. The training program teaches pilots specific, evidence-based actions to both reduce the number of errors they commit and to respond effectively when errors inevitably emerge. Errors (as distinct from violations) are not deemed blameworthy but rather a rich source of data to be mined for further refining error-mitigation systems and the operational models used to develop crew training.

In some cases, *failure* may be most effectively defined as something one knows when one sees it, as, for example, with a catastrophic plane crash or a species going extinct. In other cases, conditional or multipart definitions of *failure* most usefully ensure the effective achievement of goals and learning. For example, military aviation may use conditional definitions of failure during warfare. The goal of complete destruction of an enemy's facility (defined as a target building being razed to the ground by aerial attack) may not be defined as a failure even if parts of the building are left standing. Upon review, a pragmatic assessment may be made of the outcome that combines evidence with expertise and experience (P. Catalano, personal communication). If the facility is deemed to no longer be functional, then the initial definition of failure is reassessed. Such pragmatic definitions result from acknowledging that failure is inevitable, the long-term outcome is ultimately of greatest importance, and the likelihood that you have enough data to make a 100% accurate assessment is inevitably zero. This is essentially a course correction based on new data, a critical step in learning from failure and ideally an integral part of conservation project assessments during all phases (Lamoreux et al. 2014).

Drawing on these ideas from other disciplines, a fundamental shift in the way failure is addressed in conservation is required, beginning with an acceptance of the inevitable nature of failure. This perspective is necessary to reduce the stigma of failure and to allow effective preimplementation risk assessment (Lamoreux et al. 2014) and postimplementation reflection and learning to occur, but is typically absent in discussion of conservation projects (Nie & Schultz 2012). This discomfort with failure is also evidenced by a strong aversion to uncertainty (Williams & Brown 2014) and the widespread tendency to reframe poor project outcomes in a more positive light when reporting to funding bodies or other stakeholders (if reported at all) (Allan & Curtis 2005; Webber et al. 2007). Whereas the aviation community has highly developed nonattribution reporting systems to publish and disseminate error information to drive continuous improvement (FAA 2002; Provera et al. 2010), conservation journals (with few exceptions [Hobbs 2009]) and other conservation outlets such as websites and newsletters remain reluctant to encourage the publication of failures at any scale, even unintended results (Doak et al. 2008).

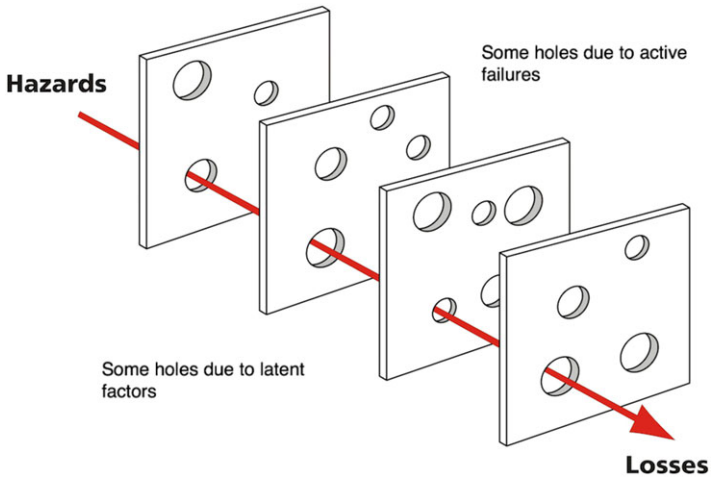

Figure 2. Reason's (2000) Swiss cheese model of human error of accident causation in complex systems, showing successive layers of defenses (such as automatic shutdowns, personnel training, and protocols) serving as barriers to failure, but with holes (active and latent errors, violations, mistakes, or adverse system conditions) that can line up under certain circumstances (typically due to human fallibility) allowing a failure to occur. Used with permission from David Mack, CC BY-SA 3.0, available from https://commons.wikimedia.org/w/index.php?curid=31679759.

The resulting silence amounts to tacit acceptance of a hypocrisy that there are no failures in conservation and eliminates one potential source of dynamic discussion and community-wide learning. The lessons from aviation indicate that far from demotivating professionals in mission-driven disciplines, operating in a culture that values learning from failure acknowledges the futility of this hypocrisy, reduces fear, and encourages transformative improvements (Provera et al. 2010).

Failure in conservation initiatives can occur at many points during a project. For example, teams may develop a comprehensive project plan but fail to gain the buy-in of key stakeholders, who subsequently refuse to cooperate. Even executing all phases of a project successfully does not guard against ultimate failure. A project to improve fish migration through the installation of fish ladders, for example, may be well planned, funded, and executed and have solid stakeholder buy-in, but ultimately it will fail if poor productivity in the ocean results in no migrating fish.

Failure versus Success and Searching for Black Swans

Our understanding of what constitutes failure is incomplete without a discussion of what it is not—specifically, success. Success has value. In both the peer-reviewed literature and popular media, success and how to measure and achieve it has been a major topic for many decades (Bass 1952; Pickle & Friedlander 1967; Peters & Waterman 1982). Success is a worthy goal for individuals and organizations; it provides motivation, increases satisfaction, and delivers monetary rewards. In conservation success is a requirement for continued funding for conservation projects and for continued public support, but it is also personally motivating in a mission-driven discipline.

Although the benefits of success are real, there are a number of limitations inherent in relying on measures of success to determine future courses of action (i.e., best practices); examining only successful outcomes to glean lessons; and failing to recognize the value of studying failure to gain a more profound understanding of problems (Provera et al. 2010). At the most basic level, organizations tend to over sample success and under sample failure (March & Levinthal 1993), a recipe scientists recognize as leading to biased interpretations of outcomes. A reliance on the examination of successful outcomes in the absence of a rigorous analysis of failures can lead to inaccurate causal attributions, an underestimation of the role of luck, and faulty predictions of future probabilities (Kahneman 2011). Ultimately, success breeds complacency and overconfidence, reinforces the status quo, generates a cultural milieu less tolerant of experimentation and change, and increases risk aversion (Sitkin 1992). Success suggests that corrective action is unnecessary and reduces the motivation to search for alternatives, a tendency compounded by the complacency-fostering pressure arising from assigning blame to those innovating but failing, rather than to those who fail to act (Sitkin 1992).

A perspective that is open to failure can prime us to stop and rethink our existing mental models (Biggs et al. 2011), leading to the notion that the information value of failure is higher than that provided by success. Studying and replicating success simply reinforces what is already known and discourages in-depth analysis (Gino & Pisano 2011), as well as confounding causal analysis. Philosopher and scientist Karl Popper's (1959) black swan thought experiment serves as a useful illustration of the value of a failure to confirm a hypothesis: We hypothesize, and so are attempting to falsify, the claim that all swans are white. Searching for, and consistently finding, white swans only demonstrates that we can continue to add to the existing body of evidence that white swans exist but reveals nothing about whether or not

all swans are white. Finding a black swan (the failure of the hypothesis) contains much greater informational value—we now know definitively that all swans are not white. Negative results are valuable because they provide information as to whether or not a hypothesis or theory is valid. When searching for the most effective approach for implementing conservation, it is essential that we seek information about what did not work and why with a vigor equal to that with which we catalog our successes.

When we implement a conservation activity, we are, consciously or not, testing a theory (Lee 1993). In seeking to understand outcomes that contradict conjectures, we are learning from our mistakes. Failure of our interventions simply reveals that the problem to be solved is difficult and requires more work—a "step forward that takes us nearer to the truth" (Popper 1963). Because failure is an exception that challenges our expectations, it serves as a clear signal that deeper analysis is warranted and can facilitate understanding of ambiguous outcomes (Sitkin 1992). For example, where models drive much of conservation decision making, unexpected or surprising results or unanticipated outcomes of interventions offer tremendous opportunities to learn (Anderson et al. 2017). However, just as models of effective cockpit crew coordination evolve in response to errors and new information, models in conservation must be subjected to revision after thorough error and outcome analysis.

Understanding the unique power of failure in learning how to execute conservation projects more effectively is a prerequisite for driving a cultural transformation in conservation. The experience of other disciplines suggests that an alternative to the success mindset is a willingness to locate errors of any scale at any level in an organization. This is a large part of what makes creating a culture that can learn from failure challenging and necessary in equal measure. However, before we can do so effectively, there is one barrier between understanding what failure is and what we should do about it, namely, us.

Deceived by Dissonance and Blinded by Bias

A failure transformation in conservation begins with an individual's willingness to learn from failure. Some of the blame for resistance to this task can be placed on universal susceptibility to one of the most important constructs in social psychology: cognitive dissonance (Festinger et al. 1956).

Dissonance refers to the discomfort people feel when they attempt to simultaneously hold two conflicting beliefs, opinions, attitudes, values, memories, or emotions. Dissonance is a motivating state: our drive to reduce it generates denial and self-justification, two major barriers to effectively discussing and learning from failure (Tavris & Aronson 2007). For example, when discussing with colleagues why a project failed, we find it uncomfortable to be challenged because we do not like to think of ourselves as deficient. Through this tendency toward ego preservation at the expense of confronting difficult truths, the ability to effectively learn from failure can be compromised.

Recognizing, defining, and classifying failure is also inextricably linked to, and often hampered by, cognitive biases that affect the way we make decisions and analyze outcomes. Biases are a predictable consequence of the cognitive process of using heuristics, or shortcuts, in decision making when time, information, or cognitive processing ability are constrained (Kahneman 2011).

Since the concept of cognitive biases emerged in the early 1970s to explain systematic deviations from the normative responses predicted by rational choice theory (Tversky & Kahneman 1974), the fields of aviation and medicine have drawn on these ideas to confront the challenge of learning from failure (Elia et al. 2016). For example, commercial airline flight crews are trained to identify biases that potentially affect their ability to function as a team, particularly under stress (United Airlines 2016). These biases exist in every sphere of human interaction, and although conservation has begun to investigate the role of biases in decision making (Iftekhar & Pannell 2015), it has yet to apply these concepts to a full examination of how failure should be identified, analyzed, and codified and how the resulting learning should be disseminated. The list of cognitive biases and heuristics affecting decision making, behavior, social interaction, and memory is extensive and continually evolving in light of new research. Several proposed classifications exist, with the most helpful enhancing understanding of how biases interact and affect the search for and processing of information, topics of particular relevance during team discussions of what went wrong (Fig. 3). Several are particularly salient for understanding our view of success and failure, as well as our willingness and ability to effectively learn from failure (Table 1).

Among the biases that affect our ability to constructively engage with failure, the need to create a coherent story (described by the *narrative fallacy*), coupled with retrospective biases (such as the *hindsight* and *outcome biases*), and the search for confirming evidence (courtesy of the ubiquitous *confirmation bias)* combine to promote the belief that good decisions invariably lead to good outcomes. However, luck plays a large role in outcomes, particularly in contexts of uncertainty, and confounds attributions of causality (Kahneman 2011). All these cognitive traps lead us to think we understand the past better than we actually do and to therefore believe our ability to predict future events is greater than it actually is. Absent awareness and active management of these influences, any postmortem analysis will be insufficient and opportunities to learn from failure will be minimal.

Just as airlines have updated their operational training models to incorporate these psychological factors,

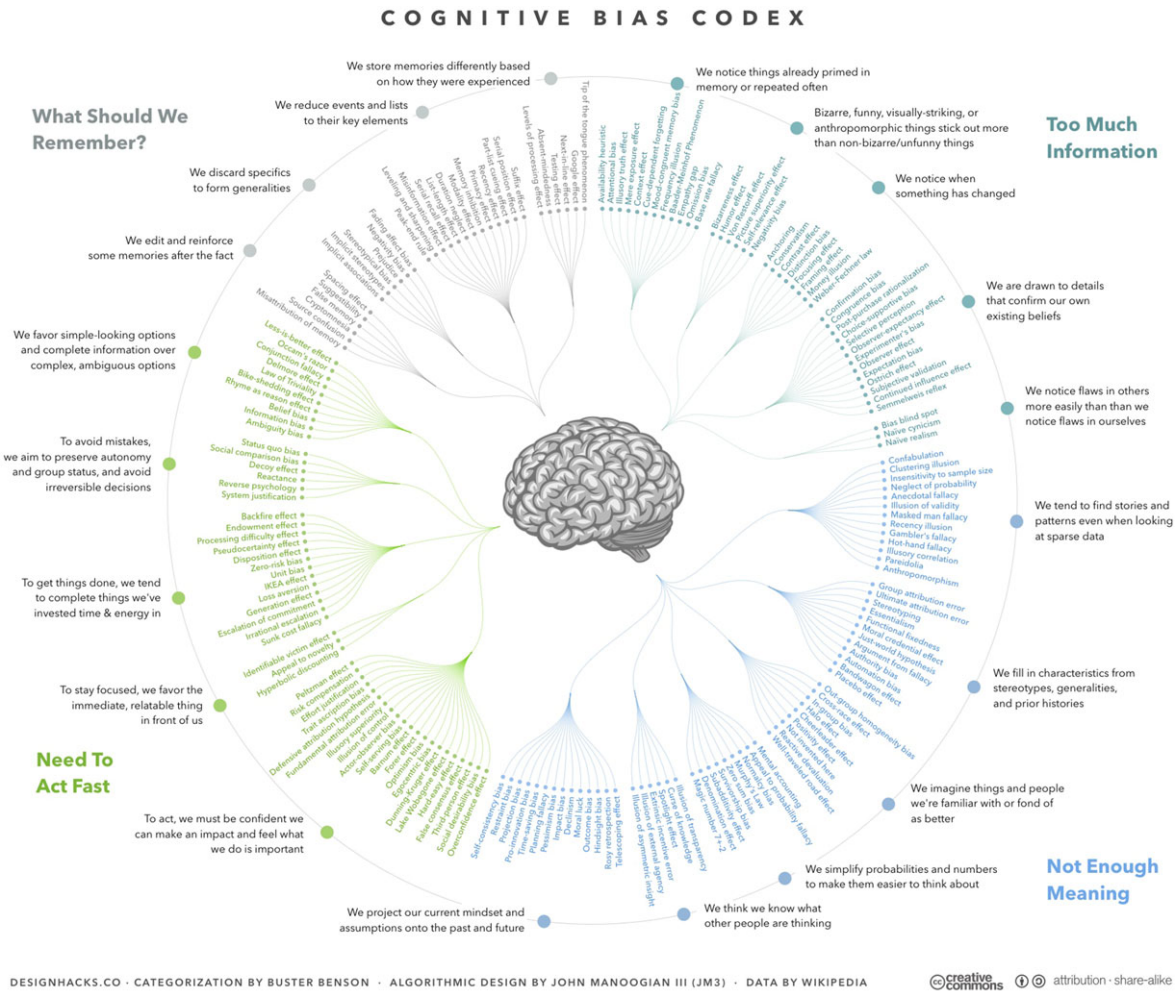

Figure 3. An example of a classification scheme of cognitive biases that affect many aspects of human thought processes, from how one approaches decision making to how one evaluates outcomes. This graphical scheme links biases with their underlying cognitive driver and enhances understanding of how biases affect the search for and processing of information and meaning. Graphic art design: John Manoogian III (jm3). Organizational model content: Buster Benson. Used with permission. Available from https://betterhumans.coach.me/cognitive-bias-cheat-sheet-55a472476b18.

conservation professionals could also benefit from acknowledging the ubiquity of these cognitive pitfalls and accounting for their effects (a topic the authors are currently exploring). Two opportunities to do this are questioning preconceptions about ecological systems so as to be open to surprises and avoid confirmation bias in constructing models (Lindenmayer et al. 2010) and creating a checklist for conservation-planning teams to examine the role of these biases in project planning and execution.

Learning from Failure

Researchers who study organizational failure have identified a number of significant barriers to effective learning from failures. For example, although managers may genuinely want to improve their organizations' ability to learn from failure, they typically believe that failure is invariably bad and that learning from it is a simple process consisting largely of reflecting on an error and trying not to repeat it. Furthermore, even if all failures are not the result of wrongdoing, most end with an allocation of blame (Edmondson 2011). As a consequence of these attitudes, any lessons that failure could provide are squandered. Creating a fundamental change in the way failure is managed requires a shift in organizational culture and individual mindsets, coupled with the creation of systemic processes to detect and respond to failure, such that we can undertake the interpersonal work of confronting failure as well as the conceptual work of figuring out what went wrong (Schulz 2010).

In conservation practice, managers can take on a leadership role within teams to create a culture in which individuals and groups can learn from failure. Critical steps in this process include acknowledging that failure

is inevitable in complex systems; identifying, discussing, and analyzing failures to explore underlying causes; seeking and accepting feedback; proactively and productively managing conflict and disagreement; and widely disseminating lessons learned (Barach & Small 2000; Helmreich 2000; Cannon & Edmondson 2001; Tucker & Edmondson 2001). These processes go beyond error identification to determine underlying causes and challenge the policies, norms, and objectives of an organization. Edmondson (2012) calls this strategy creating a "learning approach to failure." When leaders adopt this orientation, team members understand that dissent is not just tolerated but seen as a necessary component of learning and recognize the value in exploring different perspectives and ideas. Conservation project team leaders can also use exploratory responses to challenge existing assumptions, embrace ambiguity, combat confirmation bias by proactively gathering disconfirming information, and search for opportunities to experiment (Edmondson 2012; Hirak et al. 2012).

For their part, those who teach conservation can ensure their students understand the cognitive biases and institutional dynamics that make it so difficult to learn from failure. Case studies of mistakes made by senior conservationists and personal reflection can be used to prompt students' understanding of the importance of building on failure to improve practice.

The power of leaders in foundations and other funding organizations in generating a wider cultural transformation cannot be overstated. Their first priority should be to set a tone that accepts the inevitability of occasional failure and then ensure that grantees report on their failures and how they learned from them. Providing support so that groups of related grantees can meet to share failure and learning is a powerful way to begin a culture change. However, waiting for this transformation is not an excuse for team leaders to avoid undertaking learning from failure behaviors. For example, a small U.S.-based regional conservancy, despite facing a similar funding environment and sense of urgency as other conservation organizations, currently undertakes activities such as experimenting and acknowledging the inevitability of failure, surfacing errors in group discussions, seeking feedback within and outside the organization, and reflecting on and documenting outcomes (A.C., personal observation).

A learning approach to failure is especially critical given not only the complex context of conservation but also the types of teams in which conservation professionals often participate. We may find ourselves in interdisciplinary research teams, integrated conservation and development teams, restoration-education project teams, or even teams of instructors. Given these realities, it is even more important for team leaders to set a tone that failure is worthy of being examined, that team members contributions are not just valued but desired, and that it is safe to share difficult conversations. Individuals can embrace the notion that there is value in discussing failure, which begins with admitting when failure has happened and resisting the temptation to generate excuses, blame others, or recast it as a success. Instead of relying on a "success mindset" to replicate past wins and avoid deep examination of failures, we can adopt a "growth mindset" (Dweck 2006) that views failure as learning opportunities. Once we can discuss failure openly, we create the opportunity for others to offer solutions we could not imagine alone (Tavris & Aronson 2007).

The Importance of Psychological Safety

If the willingness of individuals to discuss errors and express ideas to generate solutions is critical to learning from failure, psychological safety provides the foundation for mobilizing these activities. Psychological safety describes the degree to which people feel comfortable taking interpersonal risks in a group setting (Edmondson 1999). This group-level construct is foundational to organizational change and is characterized by an environment of trust and respect that enables people working in groups to take perceived risks in expressing personal opinions and alternative views. In a psychologically safe workplace, people do not fear asking for help, making mistakes, or being labeled as ignorant, incompetent, negative, or disruptive for speaking up (Edmondson 2012).

Psychological safety underpins the widely emulated no-rank practice of military aviation debriefs, where pilots are trained from their first postflight debrief to seek and give direct, useful, fact-based feedback regardless of rank, status, or ego, a process honed and institutionalized from failure's lessons written in blood (S. Kartvedt, personal communication; McGreevy & Otten 2007). Teams in medicine and business are working to adopt similar systems in recognition of psychological safety's critical role in learning from failure (Carmeli 2007; Hirak et al. 2012; Edmondson & Lei 2014). For example, to investigate traits of successful teams, Google analyzed more than 250 attributes of over 180 teams; psychological safety emerged as the only clear commonality and by far the most important of the team dynamics identified (Rozovsky 2015; Duhigg 2016). The two behaviors exhibited by high-performing teams included "conversational turn-taking" (providing every team member an opportunity to speak up) and "social sensitivity" (i.e., empathy), both of which are key functions of psychological safety (Edmondson 1999; Woolley et al. 2010; Duhigg 2016).

Creating a safe space for team members to share ideas and give constructively critical feedback is essential for effectively collaborating, reducing the negative impacts of organizational hierarchy, surfacing errors to those who can enact change, and identifying novel opportunities for improvement (Milliken et al. 2003).

Table 1. Synthesis of selected, ubiquitous cognitive biases that can affect the effective management of failure.

Cognitive trap	*Impact on managing failure*	*Management strategies**
Confirmation bias (Lord et al. 1979; Nickerson 1998; Kahneman et al. 2011)		
Tendency to selectively seek out, interpret, and give more weight to information that supports existing perceptions, opinions, or theories	Knowledge progresses by seeking contradictory information and can be found by examining the failures of hypotheses. Refusal to believe or reducing the importance of evidence contrary to expectations stymies this effort.	Cultivate critics (devil's advocates) and listen to the arguments of people who disagree. Insist on full exploration of pros and cons of hypothesis or consensus recommendation, as well as at least 2 alternatives (possibly generated by another team), and search actively for information disproving main hypothesis.
Naïve realism (Ichheiser 1949; Ross 1977; Ross & Ward 1996; Pronin et al. 2004; Nasie et al. 2014)		
Tendency to assume one's own worldview is the real one and if others do not agree they must be ignorant, unreasonable, irrational, or wrong	When one's view is unexpectedly challenged by disagreement, one forms negative opinions about the intelligence and open-mindedness of the person voicing dissent. Miscommunication, misunderstanding, and antagonism result from both failing to appreciate differing perspectives as valid and from failing to find similarities where they do exist.	Try to resist making snap judgments and attempting to figure out who is right. Make a genuine effort to see the other person's point of view. Recognize there can be, and likely are, multiple valid realities.
Bias blind spot (Pronin et al. 2002; Ehrlinger et al. 2005)		
Tendency to believe once one has become aware of biases that everyone else is subject to them except oneself	Believing oneself is immune to biases but that others are subject to them can create a culture of blame when exploring reasons for project failure.	Accept susceptibility to biases, even when they are not self-evident. Embrace meaningful feedback as the foundation for learning and resist the tendency to rationalize the criticism.
Loss aversion (Kahneman & Tversky 1979; Thaler 1999)		
Tendency for people to strongly prefer avoiding losses to acquiring gains (i.e., losses loom larger than gains), particularly when uncertainty is high	This bias may lead one to be more risk averse than is rational and therefore miss opportunities to explore alternatives. Consequently, one experiences greater regret for action than inaction, which tends to reinforce the status quo.	Conduct a premortem or prospective hindsight exercise before the project begins to identify reasons failure might occur and try to envision the worst possible outcome. Consider whether and how those risks can be mitigated.
Sunk cost fallacy (Kahneman & Tversky 1979; Arkes & Blumer 1985; Simonson & Nye 1992; Kahneman et al. 2011)		
Tendency to focus on costs that have already been incurred and that cannot be recouped when considering future courses of action (i.e., throwing good money after bad)	Learning from mistakes and making better decisions going forward requires evaluation of options based on a current frame of reference, not one anchored to a past starting point. Allowing failing projects to continue past the point that they should be cut off prevents accurate assessment of success and failure.	All alternative continuing courses of action should be evaluated based only on their future costs and benefits. Visualize evaluating the project as a new manager with no personal involvement in choosing this course of action. Consider whether you would invest in it.

Continued

Table 1. Continued.

Cognitive trap	*Impact on managing failure*	*Management strategies**
Fundamental attribution error (FAE) (Miller 1976; Ross 1977; Edmondson 2012; Fiske & Taylor 2017)		
Describes propensity to blame bad outcomes on another person's personal shortcomings rather than situational factors that may have been beyond this person's control	This bias can hamper one's ability to fully investigate one's own role in mistakes and failures, as well as negatively affect interpretation of other group members' behavior. Attributing failure to another person's personal shortcomings (even when not shared openly) increases mistrust and destroys open communication.	Foster an environment of trust and openness so that each team member can be heard and understood. Encourage each team member to voice concerns, and recognize that reasonable people may disagree and have experiences that can lead to equally valid opinions.
Self-serving bias (Miller & Ross 1975; Arkin et al. 1980; Fiske & Taylor 2017)		
Tendency to attribute one's failures to external factors and one's successes to personal abilities	This bias can lead one to deny responsibility for failure, blame others too readily, and ultimately negatively affect team dynamics. This bias can also lead to overconfidence in one's own abilities or judgment.	Learning from our mistakes begins with recognizing them in the first place. Accept that failure is not always someone else's fault.
Overconfidence (Lichtenstein & Fischhoff 1977; Koriat et al. 1980; Plous 1993; Kahneman 2011)		
Tendency for people to overestimate their own skills and abilities, believe themselves to be better than others, and to view their decisions with excessive certainty	Although a certain level of confidence is healthy, overconfidence can lead to one taking more credit than is warranted, disregarding conflicting opinions without due evaluation, rejecting evidence that does not support one's opinions, and disregarding the role of luck in outcomes. Under the influence of this bias, one tends to take credit for success but avoid responsibility for failures, inhibiting effective discussion of project outcomes.	Strategies that consider opposing or contradictory evidence can mitigate this bias effectively. Ensure that a full discussion of pros and cons of the decision takes place, with particular emphasis on considering why the decision might be wrong. The premortem or prospective-hindsight strategy of envisioning the decision resulting in failure and then generating reasons for that failure may also provide some defense against this bias by legitimizing doubts that may have been suppressed as the group converged on a course of action.
Hindsight bias (Fischhoff 1975; Slovic & Fischhoff 1977; Pezzo & Pezzo 2007; Roese & Vohs 2012)		
Belief that an event is more predictable after the outcome is known than it was before the outcome became known (i.e., one knew it all along).	This bias causes one to see the path to failure or success as inevitable and results in a flawed assessment of the past during postevent analysis. It can lead to overlooking causes for failure and thus to repeating the same errors in future projects. It also contributes to selective causal attribution that tends to minimize personal responsibility.	The consider-the-opposite strategy encourages reflection and explicit discussion of how outcomes that did not occur could have occurred and can reduce hindsight bias.

Continued

Table 1. Continued.

Cognitive trap	*Impact on managing failure*	*Management strategies**
Outcome bias (Baron & Hershey 1988; Lefgren et al. 2015)		
Tendency to overweight outcome information in assessing the quality of decisions that led to that outcome; hindsight bias judges what the decision maker should have known, whereas outcome bias judges what the decision maker should have done	This bias tends to confuse the evaluation of decisions with the evaluation of the outcome, such that decision makers can be judged more harshly than is warranted by the information that was available at the time the decision was made. Punishment for bad outcomes may be applied regardless of decision quality, leading to fear of failure. If applied to oneself, one may become overconfident in one's decision-making abilities if the outcome is good or overly self-critical if the outcome is poor, regardless of the quality of one's decisions. Applying this to others can lead to incorrect attributions of blame. Ultimately, future courses of action can be too optimistic or not appropriately revised after fortuitous successful outcomes or too pessimistic and radically altered after failed outcomes, regardless of decision quality.	It can be useful to analyze the decision from the decision-maker's point of view at the time the decision was made. Recording assessments of decisions as they are made and before the final outcome is achieved is also helpful in postevent analysis.
Narrative fallacy or what you see is all there is (WYSIATI) (Taleb 2007; Kahneman 2011; Kahneman et al. 2011)		
The tendency to link an unrelated series of events together into a logical story by imposing a pattern of causality on what one observes	Because the human mind tends to create a coherent narrative based on available information and fills in any missing pieces, one cannot see what evidence is lacking. This can lead to post hoc rationalizations and results in flawed assumptions about causality that lead us to think we understand the past well enough to predict the future. Therefore one may be liable to take successful outcomes as prescriptions for future actions and to exaggerate the role of skill and underestimate the role of luck.	Accept that success should not be viewed as a how-to manual; rather, it should serve as a source of inspiration and alternatives. Actively search for gaps in evidence or knowledge by imagining making the decision at a point in the future and asking yourself what information you would want and whether you can get it.
Bounded awareness (Chugh & Bazerman 2007; Grant & Quiggin 2013)		
Tendency to systematically overlook critical, easily accessible, and relevant information	During group discussions about project outcome, this bias can result in limiting analysis to information that is easily accessible, rather than that which is most relevant to the situation at hand. Thus, both the implications and probabilities of future events are circumscribed by this informational limitation. This bias causes individual group members to discuss shared information more often than individual information, negating a major strength of group discussion.	Recognize that bounded awareness is a normal psychological limitation, and accept that overlooking crucial information is likely. Cultivate psychological safety to encourage contributions from all team members. Leverage the benefit of multiple perspectives by ensuring team members are aware that unshared information has value.

**Debiasing is very difficult. Just being aware of biases is no guarantee that one is necessarily immune to their influence; thus, getting an outsider perspective is critical. Trust and openness within teams (key elements of psychological safety) is of particular importance.*

Conclusion

Success in achieving conservation goals paradoxically requires a new approach to managing failure because unanticipated failure is inevitable as we seek solutions to challenging problems in a complex world. The difference between success and failure can often be attributed to the timely identification, analysis, and mitigation of errors (Mittelstaedt 2005), which can be difficult to confront in light of our cognitive biases, aversion to failure, and our inability to perfectly predict the future. Creating and implementing strategies to enable individuals, teams, and our entire discipline to effectively manage failure is essential. Just as aviation training and business and medical schools have moved beyond simply examining technical causes of failure and are now teaching awareness of cognitive biases and the psychology of decision making, conservation professionals too can benefit immensely from an awareness of these phenomena. Adopting a new mindset (both individually and in teams) that is open to learning from failure is possible, and the authors' future research will examine this failure-opportunity orientation in conservation professionals. Ultimately, the lesson from other disciplines is that until the benefit of embracing learning from failure outweighs the costs, conservation will continue to squander these learning opportunities and remain less effective than it otherwise might be.

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